

APPENDIX E

Numerical Estimates of Hydropower-Related Losses

I. Introduction

Any estimate of total losses of salmon and steelhead is limited by the lack and quality of data. A definitive judgment is impossible. Data are scarce for the era prior to 1850, the period before major development of the basin severely reduced fish runs. More recent data are more plentiful, but often are not comparable. For example, increased logging is known to have had a detrimental effect on salmon and steelhead habitat, but there is no definitive way to translate board feet or acres logged into fish lost. As a result, the data can be interpreted reasonably in several different ways.

Following are methods for numerically estimating the contribution of hydropower development and operation to losses of Columbia Basin salmon and steelhead. The focus is on the contribution of the hydropower system to losses of salmon and steelhead and their habitat and not on the precise contribution of each individual hydropower project in that system. In several parts of the discussion, there are references to the approximate contributions of groups of projects to salmon and steelhead losses. These are included only for the purpose of estimating system hydropower-related losses, not to determine particular responsibilities within that system for mitigating the losses.

II. Staff Numerical Estimates of Hydropower-Related Losses

The best way to estimate hydropower-related losses would be an approach that computed mortalities, by species and stock, from operation of each of the 136 hydropower projects in the basin annually since their development. These estimates would also compute the amount of production precluded by each project's blockage and inundation of habitat. Although probably the most accurate approach, this type of estimate is not possible because the extensive, specific data necessary to estimate hydropower-related losses in this manner is not now, and never will be, available.

The specific data necessary to assess losses caused by hydropower operation and development as comprehensively as noted above include the list of criteria that follows. This information would be needed for each stock of salmon and steelhead in the basin because life-history factors, such as migration timing, spawning timing and duration of freshwater rearing, differ

among species and stocks. Information for each of the 136 hydropower dams would have to be assembled because each dam inundated varying amounts of habitat at different times, and each dam has affected the upstream and downstream migration of fish differently. Also, the information listed would have to be collected for all years since construction was initiated, because the effect of the dams and the size of the fish runs have fluctuated over time. Information requirements would be:

1. The numbers of smolts by stock produced above each hydropower dam from the date construction was initiated.
2. The rate of smolt mortality (direct and reservoir) by stock caused by each hydropower dam in the basin for every year since construction was initiated. (This would change as turbines were added.)
3. The ocean survival for each stock for every year since hydropower dam construction was initiated. (This is variable depending on each age class and on the availability of food. Individuals of the same stock may spend anywhere from one to five years rearing in the ocean.)
4. The rate of adult mortality by stock caused by each hydropower dam in the basin for each year since construction was initiated. (This also would change as turbines were added.)
5. The amount of salmon and steelhead habitat inundated or blocked by each dam and the effect of each dam on salmon and steelhead production directly below the site.
6. The amount of each dam's mortality rate attributable to hydropower, as opposed to irrigation, navigation, recreation or other specified purposes. (This also may have changed over time.)

If the above information were available, an annual accounting could be made for hydropower-caused losses for all hydropower dams in the Columbia Basin. The simple fact is that most of this information is not available because it was not collected at the time the losses occurred and currently is not being collected. Fish counts generally were not made until relatively recently. For example, adult fish counts were not made before Rock Island Dam and Bonneville Dam began operation in 1933 and 1938, respectively. Further, fish counts are only one indication of adult-run size. Estimates of numbers of fish caught below the dam, where the count is made, are necessary to represent the entire run size. Tools and methods for determining origin of fish caught in the ocean were not developed until the 1960s. Estimates of dam mortalities are available only for recent years and only for some of the 13 mainstem projects.

In short, the information needed to do this type of estimate of hydropower-related losses cannot be reconstructed with any degree of confidence. A simplified alternative clearly is necessary.

As a result, the Council staff developed two simplified alternatives. The first method estimates hydropower-related losses of about 7 million to 8 million fish. This approach primarily depends on assumptions about the state of salmon and steelhead when the hydropower projects were built and on the hypothetical capability of those fish to recover if it were not for the impacts of the hydropower system. One could assume that the runs could have recovered substantially to their 1850s levels if it were not for hydropower. Or one could assume that the runs were damaged and

incapable of substantial recovery even without hydropower, but capable of significant partial recovery without hydropower. The second alternative method developed by the Council staff estimates a hydropower-caused loss of about 5 million to 11 million fish. This alternative uses the total loss caused by all developmental effects to determine hydropower-related losses.

A. Alternative 1

As identified above, specific information for all years and stocks is not available. However, use of a simplified version of this approach is possible. The following types of assumptions are integral to calculating an estimated hydropower contribution using this approach:

1. Most hydropower operational mortalities occur as fish pass through the mainstem Columbia and Snake river projects and associated reservoirs. Therefore, it may be appropriate for these purposes to assume that all operational mortalities are caused by mainstem projects.
2. Maximum reservoir survival is generally estimated to be about 90 percent; average bypass efficiency is generally estimated to be about 50 percent; survival of bypassed fish is generally estimated to be about 98 percent; and survival of fish that travel through turbines is generally estimated to be about 85 percent. These estimates are from studies by the fish and wildlife agencies and hydropower project operators. These estimates were used by the Council's Mainstem Passage Advisory Committee to estimate downstream migrant survival. Using these figures, an optimistic per dam survival rate would be about 82 percent. Because present knowledge shows that reservoir survival decreases sharply as flows decrease, a survival rate of 80 percent is probably more appropriate. (See Attachment 1, Table 1.)
3. The Council's Mainstem Passage Advisory Committee estimates upstream passage survival per dam at 95 percent. This information appears to be the best available. (See Attachment 1, Table 1.)
4. Ocean survival is variable depending on the number of years the fish spends in the ocean. Some fish of the same stock (for example, fall chinook) spend from one to five years in the ocean. Because the proportion of the stock that spends varying times in the ocean itself varies by species, stock and years, an overall average survival is used here. The only estimates available for this factor are 2 percent for spring chinook; 4 percent for summer chinook; 8 percent for coho; and 10 percent for sockeye and steelhead. Fall chinook are assumed to have the same survival rate as summer chinook for purposes of this issue paper because they have similar life histories and ocean migrations.
5. Most of the production that has been blocked occurred in areas above Grand Coulee and Hells Canyon dams. Therefore, for these purposes, it may be appropriate to account only for losses caused by blockage in these two areas.
6. Because blocked areas are permanently precluded by dams from producing salmon and steelhead, it may be appropriate to assume that all blocked-area loss is caused by dams.

1./ Testimony of D.W. Chapman in hearings before the Federal Energy Regulatory Commission on Rock Island Dam (Summer 1985). The Council staff is aware of no other overall estimates on this subject.

7. For purposes of this analysis, the congressional "repayment allocation" is used as the estimate of the percentage of dam loss attributable to hydropower for federal projects because this represents the amount of the project that is being paid for by hydropower ratepayers. Non-federal projects are not assigned repayment allocations, and the percent of loss attributable to hydropower is assumed to be different for different areas as explained below:
- a. The operational loss at the 13 mainstem Snake and Columbia river dams is assumed to be 89 percent of dam loss. This is the average of the repayment allocation for the federal dams and assumes 100 percent hydropower purpose for non-federal projects. (See Attachment 1, Table 5.)
 - b. Above Grand Coulee Dam, the hydropower contribution for lost habitat is assumed to be equal to the repayment allocation for Grand Coulee Dam, which is 92 percent. (See Attachment 1, Table 5.)
 - c. Above Hells Canyon Dam, the hydropower contribution for lost habitat is assumed to be 50 percent. This number cannot be estimated in a simplified manner because most of the projects in this area are non-federal, and the percentage of each of the dam's purposes is not clearly defined. The 50 percent figure assumes that the mainstem Snake dams above Hells Canyon are primarily operated for hydropower production and the numerous large tributary dams are primarily non-hydropower in purpose. This does not mean that hydropower dams do not exist on the tributaries and that the only purpose of mainstem dams is hydropower. It merely describes the primary purposes of the dams in a simplified fashion. As mentioned above, this estimate is for the purpose of determining the system contribution and not the precise contribution of each operator.

Using those assumptions, the basic calculation for hydropower contributions from operations is as follows:

- Step 1. Average numbers of smolts produced in the area behind each mainstem Columbia and Snake river dam (the 13 dams below Chief Joseph and Hells Canyon dams)

X

Average survival of smolts at each mainstem
Columbia and Snake river dam while migrating
from the production areas to the ocean

X

Average overall ocean survival per species
(or per race for chinook)

X

Average survival of adults migrating from the
ocean to the production areas

=

Adults with dams

Step 2. Average numbers of smolts produced for the area behind each mainstem Columbia and Snake river dam (the 13 dams below Chief Joseph and Hells Canyon dams)

X

Average overall ocean survival per species
(or per race for chinook)

=

Adults without dams

Step 3. Adults without dams - adults with dams = dam loss

Step 4. Dam loss x average percent of hydropower purpose of dams

=

Salmon and steelhead loss attributable to hydropower system

Note: To compute blocked area hydropower contribution, only step 4 is necessary because all loss in the blocked areas is assumed to be dam-caused.

Recognizing the limitations of data, this approach appears to be the most technically based possible and uses the best scientific information available.

The most important factor in calculating hydropower-related losses using this approach is the fish run selected as a basis to calculate the average number of smolts produced for steps 1 and 2. Two alternative theories have been identified for this purpose: a) runs were damaged (by non-hydropower impacts) but were capable of substantial recovery to 1850s size if it were not for hydropower development and operations, or b) runs were damaged and incapable of substantial recovery to 1850s size, even without hydropower development and operations, but were capable of significant partial recovery without hydropower development and operation. Two levels of partial but significant recovery without hydropower operation and development can be identified as: 1) current run size without mainstem operational mortalities and without total production losses in blocked areas, or 2) current potential production of habitat now available plus hatchery production (lost potential) without mainstem operational mortalities and without total production losses in blocked areas. This potential may be greater, but the staff is aware of no certain means of determining whether it is or how much greater it might be.

Rationale and estimated hydropower contribution calculated for each of these bases follow.

1. Alternative 1a - Capable of Substantial Recovery if it were not for Hydropower Development and Operation

The theory underlying this approach is that non-hydropower development effects (e.g., irrigation, fishing, logging, mining, grazing, agriculture, urbanization, pollution and other effects) are largely reversible so hydropower caused all the mortalities that would occur if predevelopment run sizes existed. This is akin to saying the fish runs have been damaged, but they would be capable of complete, or nearly complete recovery, if it were not for hydropower development and operation. For example, the effects of irrigation diversions, poor logging practices and overgrazing in riparian zones may in time be reduced to an insignificant level, virtually eliminating their impact on salmon and steelhead runs.

The run size base used here is the average predevelopment run size of about 13 million fish. (The average of between 10 million and 16 million; see *Compilation of Information on Salmon and Steelhead Losses in the Columbia River Basin*, Chapter 2.) This run size base gives an estimate of hydropower-related losses of about 8 million salmon and steelhead. (See Attachment 1, Table 6.) The fish distribution used for this method is the predevelopment distribution identified in the losses report. (See Attachment 1, Table 2.)

1. Alternative 1b - Capable of Partial Recovery if it were not for Hydropower Development and Operation (Current Run)

The underlying theory to this approach is that the current run is what is actually occurring in the basin after all the development types have had their effects (destruction and rehabilitation of habitat and artificial production); therefore it reflects what has actually happened. This is akin to saying that the fish runs would be capable of partial recovery if it were not for hydropower development and operation.

The run that has partially recovered is defined here as the current run size of about 2.5 million fish (see *Compilation of Information on Salmon and Steelhead Losses in the Columbia River Basin*, Chapter 2) for operational loss and as the loss identified in Alternative 1a for blocked-area loss. This base provides an estimate of hydropower-related losses of about 7 million salmon and steelhead. (See Attachment 1, Table 7.) The distribution used for operational loss is the 1975 distribution. (See Attachment 1, Table 3.)

1. Alternative 1c - Capable of Partial Recovery if it were not for Hydropower Development and Operation (Current Potential Production)

The theory behind this approach is that the production potential of the habitat in the basin was limited after predevelopment times by activities such as irrigation, logging, mining, grazing and others. The effects of fishing are not considered in this approach, but current efforts by the fish managers are indicative that fishing may not currently limit production. (See *Program Technical Appendix 2*, Chapter 5.) This approach also is akin to saying that the fish runs' potential have been damaged but would be capable of partial recovery if it were not for hydropower development and operation.

The potential run that has partially recovered is defined here as the current potential production of the basin. In addition to natural potential, current hatchery releases are included as compensation for lost potential to determine operational loss. The hydropower-related losses computed in Alternative 1a are used for blocked areas. Natural potential is distributed according to the distribution identified in the Council's production planning data base, and hatchery potential is distributed by 1985 release sites. (See Attachment 1, Table 4.) It should be noted that the

Council's production potential data base, although complete for the most part, does not have estimates for minor production areas (areas where it may be possible to produce some fish, but where none are currently produced). This would tend to make this estimate conservative. Also, the addition of hatchery production may make the estimate a little high because some of the hatcheries' production may be compensation for blocked-area loss. This basis provides an estimated loss from hydropower of about 7 million salmon and steelhead. (See Attachment 1, Table 8.)

B. Alternative 2

The Alternative 1 approaches are complicated by the number of assumptions needed. Another approach would be to limit the number of assumptions to a minimum.

The equation for such an approach could be expressed as follows:

$$\begin{array}{r}
 \text{Total loss} \\
 \times \\
 \text{Percent hydropower purpose of dams} \\
 = \\
 \text{Hydropower-related losses}
 \end{array}$$

The most difficult factor to identify in this equation is the percentage of hydropower purpose of dams. If it is assumed that one-third of the loss is attributable to each of the three areas that either currently or at one time produced salmon and steelhead, i.e., 1) the area currently accessible to salmon and steelhead, 2) the area above Grand Coulee Dam, and 3) the area above Hells Canyon Dam, then the average of the percents of the hydropower purpose identified in Alternative 1 is applicable here. This average is about 77 percent $([89\% + 92\% + 50\%] / 3 = 77\%)$. The resulting hydropower contribution range is then about 5 million to 11 million fish. (See Attachment 1, Table 9.)

Calculation of hydropower-related losses using this method is based on the premise that the predevelopment run size is the proper basis for this determination. This premise can be characterized as saying that the fish runs have been damaged, but that they would be capable of substantial recovery if it were not for hydropower development and operation. The estimated range for hydropower-related losses would be lower if the loss were based on a theory that runs have been damaged but are only capable of partial recovery. A loss based on this theory is not available.

III. Variations of the Council Staff Estimates

Alternative calculations for hydropower-related losses are possible by applying changes in assumptions and methods. All the alternatives suggested result in an estimate of hydropower-related losses within the 5 million to 11 million adult salmon and steelhead range estimated by the Council staff.

Although no commentators suggested that several variations be applied to calculate an alternative estimate, the staff recognizes that this might yield a hydropower-related losses estimate outside of the 5 million to 11 million range. The staff believes an estimate based on several variations is unreasonable because it would yield estimates outside the range that are either conservatively low or liberally high. In other words, the staff believes the range of 5 million to 11 million adult salmon and steelhead encompasses the most reasonable range for hydropower-related losses based on the available data. Suggested variations of the staff estimates were as follows:

1. A hydropower-related losses range can be calculated for the Alternative 1 predevelopment (substantial recovery if it were not for hydropower) run size basis. The point estimate is about 8 million. The estimated range around this point is about 6 million to 10 million. (See Attachment 1, Tables 10 and 11.)
2. In the issue paper, blocked-area, hydropower-related losses are calculated only using a predevelopment (substantial recovery if it were not for hydropower) basis. Hydropower-related losses can be calculated for the blocked areas using a current run size and a current potential run size (both are partial recovery if it were not for hydropower) basis if the assumption is that the percentage of production above and below the blocked areas is the same proportionally now as prior to 1850. These yield estimates of about 5 million, instead of 7 million, for a current run size basis, and 6 million, instead of 7 million, for a current potential run size basis. (See Attachment 1, Tables 12 and 13, respectively.)
3. It has been suggested that the percentage of dam use for hydropower should be calculated using "benefits" allocations, instead of repayment allocations. (See Attachment 1, Table 5.) Using benefits allocation, the estimated hydropower-related losses for the Alternative 1 calculations is about 7 million for a predevelopment run size (substantial recovery if it were not for hydropower) basis; about 6 million for a current run size (partial recovery if it were not for hydropower) basis; and about 6 million for a current potential run size (partial recovery if it were not for hydropower) basis. (See Attachment 1, Tables 14, 15, and 16, respectively.) The range for the Alternative 2 calculation is reduced at the upper end to 10 million. The lower end of the range remains about 5 million. (See Attachment 1, Table 17.)
4. If it is assumed that 100 percent of the operational dam loss is hydropower-caused because, in theory the system could be operated for fish passage if it were not for hydropower, then the Alternative 1 estimates of hydropower-related losses are about 8 million for a predevelopment run size (substantial recovery if it were not for hydropower), 7 million for a current run size (partial recovery if it were not for hydropower) basis, and 7 million for a current potential run size (partial recovery if it were not for hydropower) basis. (See Attachment 1, Tables 18, 19, and 20, respectively.) The Alternative 2 range estimate is 6 million to 11 million using this assumption. (See Attachment 1, Table 21.)
5. If some upstream and downstream migrant natural mortality is assumed in the "without dams" calculations for Alternative 1, then the estimated loss is about 6 million for a predevelopment run size (substantial recovery if it were not for hydropower) basis; about 6 million for a current run size (partial recovery if it were not for hydropower) basis; and about 6 million for a current potential run size (partial recovery if it were not for hydropower) basis. (See Attachment 1, Tables 22, 23, and 24, respectively.)

6. It was suggested that the summer chinook blocked-area distribution in the Alternative 1 estimate using a predevelopment run size (substantial recovery if it were not for hydropower) basis should be different. The distribution in the staff estimate is 16.6 percent above Chief Joseph Dam and 34.2 percent above Hells Canyon Dam. The suggested modification is that there was no summer chinook production above Hells Canyon Dam and 50.8 percent above Chief Joseph Dam. This change does not alter the hydropower-related losses estimate of about 8 million adult salmon and steelhead. (See Attachment 1, Table 25.)
7. It was suggested that the hydropower contribution for fall chinook loss above Hells Canyon Dam should be 100 percent in Alternative 1 calculations, because these fish are only affected by mainstem projects. This alternative does not change the estimates. (See Attachment 1, Tables 26, 27, and 28.)
8. It was suggested that a figure for delayed mortality should be added to the Alternative 1 calculations of hydropower-caused loss. Delayed mortalities are mortalities below the hydropower system (in the estuary and ocean) caused by a lowered survival rate from stress incurred on the fish by the hydropower system. In order to account for delayed mortality, a portion of the natural mortality in the estuary and ocean must be assigned to the hydropower system. Because delayed mortality has not been measured, estimates of its magnitude are speculative. Regardless, hydropower-related losses remain within the estimated range of 5 million to 11 million adult salmon and steelhead even if a plausible range of 0 percent to 25 percent delayed mortality is added to the Alternative 1 estimates.
9. It was suggested that the actual upstream and downstream mortality percentage for each dam be used for the Alternative 1 calculations instead of an average. Exact mortality rates are not known for most dams in the basin. The average mortalities used in the calculations are based on the best information available and represent the most accepted numbers used in the scientific community to assess mortality at Columbia Basin dams. Because the mortalities identified at each dam are an overall average, it should be noted that the hydropower-related losses cannot be assigned to specific projects or areas of the basin.
10. It was suggested that the percentage of dams used for hydropower purposes should be applied to each dam's losses instead of an average to the overall loss. This does not change the numbers calculated; it merely assigns different portions of the systemwide hydropower-related losses to specific projects and areas of the basin. As stated above, the mortalities identified at each dam are an overall average and cannot be assigned to specific projects or areas of the basin.

Attachment 1

Tables for Numerical Estimates of Hydropower-Related Losses

TABLE 1

CUMULATIVE AVERAGE MAINSTEM DAM
SALMON AND STEELHEAD SURVIVAL RATE¹
FOR THE COLUMBIA RIVER BASIN

<u>Number of Dams</u>	<u>Cumulative Downstream Survival Rate (average 80% per dam)</u>	<u>Cumulative Upstream Survival Rate (average 95% per dam)</u>
0	100	100
1	80	95
2	64	90
3	51	86
4	41	81
5	33	77
6	26	74
7	21	70
8	17	66
9	13	63

¹ See Compilation of Information on Salmon and Steelhead Losses in the Columbia River Basin, Chapter 5, Section 5.3.

TABLE 2

PREDEVELOPMENT (PRE-1850) DISTRIBUTION
OF SALMON AND STEELHEAD PRODUCTION
IN THE COLUMBIA RIVER BASIN¹

<u>Areas of Production</u> ³	<u>Percentage of Production by Species</u> ²					
	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u> ⁴
Below Bonneville Dam	15.1	0.0	24.8	43.7	17.1	0.0
Between 1 and 2 Dams	0.9	0.0	1.0	4.9	2.2	0.0
Between 2 and 3 Dams	3.3	0.0	0.4	0.0	4.1	0.1
Between 3 and 4 Dams	4.5	0.0	0.4	0.0	5.2	0.0
Between 4 and 5 Dams	6.1	1.8	2.9	13.5	6.1	2.1
Between 5 and 6 Dams	0.0	0.0	2.2	0.0	0.0	0.0
Between 6 and 7 Dams	0.7	0.0	6.4	2.1	1.1	0.0
Between 7 and 8 Dams	2.6	1.2	2.2	2.7	1.1	0.8
Between 8 and 9 Dams	32.5	42.0	17.4	13.9	35.9	1.6
Above Wells and Below Chief Joseph dams	4.2	4.1	0.0	2.0	2.0	30.3
Above Chief Joseph Dam	14.7	16.6	14.0	17.3	10.5	64.7
Above Hells Canyon Dam	15.3	34.2	28.4	0.0	14.6	0.5

¹ Pacific Northwest Regional Commission 1976. Investigative Report of Columbia River Fisheries Project, Report G, Distribution of Salmon and Steelhead in the Columbia River Basin—1850 and 1975 by Dorien C. Lavier. Council staff used this report and the maps it summarized to determine distribution by area above each dam.

² Percentages refer to the portion of production originating from an area as a portion of all the basin's predevelopment production.

³ Dams referred to are mainstem Snake and Columbia river dams.

⁴ Production of sockeye was distributed according to surface area of lakes used by sockeye. (See Compilation of Information on Salmon and Steelhead Losses in the Columbia River Basin, Appendix B, Table B-2.)

TABLE 3

**CURRENT (1975) DISTRIBUTION
OF SALMON AND STEELHEAD PRODUCTION
IN THE COLUMBIA RIVER BASIN¹**

Area of Production ³	Percentage of Production by Species ²						
	Spring Chinook	Summer Chinook	Fall Chinook ⁴		Coho	Steelhead	Sockeye ⁵
			Hatchery	Natural			
Between 1 and 2 Dams	2.7	0.0	26.0	17.5	17.6	4.7	0.0
Between 2 and 3 Dams	12.8	0.0	0.0	23.4	10.9	5.4	0.0
Between 3 and 4 Dams	0.0	0.0	15.0	0.0	3.1	10.7	0.0
Between 4 and 5 Dams	8.4	4.7	51.0	50.8	24.4	9.5	0.0
Between 5 and 6 Dams	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Between 6 and 7 Dams	2.1	0.0	5.0	0.0	0.0	2.3	0.0
Between 7 and 8 Dams	3.3	1.9	0.0	2.0	4.0	2.2	21.0
Between 8 9 Dams	65.4	87.0	2.0	6.3	35.9	61.4	29.6
Above Wells and Below Chief Joseph dams	5.3	6.4	0.0	0.0	4.6	3.8	49.3

¹ Pacific Northwest Regional Commission 1976. Investigative Report of Columbia River Fisheries Project, Report G, Distribution of Salmon and Steelhead in the Columbia River Basin—1850 and 1975 by Dorien C. Lavier. Council staff used this report and the maps it summarized to determine distribution by area above each dam.

² Percentages refer to the portion of production originating from an area as a portion of the basin's production above Bonneville Dam in 1975.

³ Dams referred to are mainstem Snake and Columbia river dams.

⁴ Hatchery fall chinook distribution from Water Budget Center Weekly Report #85-2, March 18, 1985.

⁵ Production of sockeye was distributed according to surface area of lakes used by sockeye. (See Compilation of Information on Salmon and Steelhead Losses in the Columbia River Basin, Appendix B, Table B-2.)

TABLE 4

CURRENT DISTRIBUTION OF SALMON AND STEELHEAD PRODUCTION POTENTIAL IN THE COLUMBIA RIVER BASIN¹
(Numbers of Smolts Produced by Area)

Areas of Production ²	Spring Chinook		Summer Chinook		Fall Chinook		Coho		Steelhead		Sockeye ³	
	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural
Between 1 & 2 Dams	4,985,397	863,522	---	---	4,431,200	---	1,750,400	268,710	96,000	197,133	---	---
Between 2 & 3 Dams	756,000	1,407,248	129,600	---	---	2,056,961	---	330,808	---	104,566	---	---
Between 3 & 4 Dams	48,000	4,272,578	---	---	2,580,000	2,024,606	---	---	---	457,564	---	---
Between 4 & 5 Dams	514,266	3,111,520	---	---	8,520,000	21,937,920	---	---	359,200	355,384	---	---
Between 5 & 6 Dams	---	---	---	---	---	---	---	---	---	---	---	---
Between 6 & 7 Dams	---	---	---	---	840,000	---	---	---	220,000	938	---	---
Between 7 & 8 Dams	1,640,000	887,035	---	556,176	---	---	---	---	---	94,387	---	316,250
Between 8 & 9 Dams	6,251,200	16,905,314	1,364,000	14,158,689	360,000	23,543	320,00	232,150	4,472,000	1,885,224	---	460,000
Above Wells and Below Chief Joseph dams	800,000	1,266,110	1,344,000	1,295,428	---	---	---	---	368,000	78,227	---	747,500

¹ Natural potential from the Northwest Power Planning Council's production planning data base and artificial potential from the Water Budget Center Weekly Report #85-2, March 18, 1985. Note that hatchery releases have been reduced by 20 percent to account for release mortality.

² Dams referred to are mainstem Snake and Columbia river dams

³ Sockeye numbers are converted from predevelopment adult run sizes. Numbers were computed by assuming that the current potential was the proportion of remaining surface area of sockeye production lakes as a percentage of predevelopment surface area. These percentages were 1.1, 1.6 and 2.6 for 7, 8, and 9 dams respectively. These percentages were then applied to total predevelopment adult to determine current potential in adults. (See Compilation of Information on Salmon and Steelhead Losses in the Columbia River Basin, Chapter 2.) Then adults were divided by a 10 percent ocean survival to determine smolts.

TABLE 5

HYDROPOWER ALLOCATION METHODS

<u>Projects</u>	<u>Repayment Allocations (%)</u>	<u>Benefits Allocations (%)</u>
Bonneville	94	- ¹
The Dalles	86	93
John Day	74	79
McNary	80	93
Chief Joseph	99	100
Grand Coulee	92	36
Ice Harbor	76	83
Lower Monumental	82	94
Little Goose	80	89
Lower Granite	82	92
Operational Loss Average ²	89	94
Blocked Loss Average ³	96	68

¹ Not available.

² Average of 13 dams where losses of salmon and steelhead occurs annually from operation of dams (Bonneville, The Dalles, John Day, McNary, Priest Rapids, Wanapum, Rock Island, Rocky Reach, Wells, Ice Harbor, Lower Monumental, Little Goose, Lower Granite). Allocations at the "non-federal" projects in assumed to be 100 percent.

³ Average of two dams where loss has occurred from blockage of access to habitat above Chief Joseph Dam (Chief Joseph, Grand Coulee). The percentage of losses caused in the blocked area above Hells Canyon Dam is considered to be 50 percent.

TABLE 6

STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
USING PRE-1850 RUN SIZE AS A BASIS

Fish Distribution (Percentage)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0.151	0.000	0.248	0.437	0.171	0.000
Between 1 & 2 Dams	0.009	0.000	0.010	0.049	0.022	0.000
Between 2 & 3 Dams	0.033	0.000	0.004	0.000	0.041	0.001
Between 3 & 4 Dams	0.045	0.000	0.004	0.000	0.052	0.000
Between 4 & 5 Dams	0.061	0.018	0.029	0.135	0.061	0.021
Between 5 & 6 Dams	0.000	0.000	0.022	0.000	0.000	0.000
Between 6 & 7 Dams	0.007	0.000	0.064	0.021	0.011	0.000
Between 7 & 8 Dams	0.026	0.012	0.022	0.027	0.011	0.008
Between 8 & 9 Dams	0.325	0.420	0.174	0.139	0.359	0.016
Between 9 & 10 Dams	0.042	0.041	0.000	0.020	0.020	0.303
Above Chief Joseph Dam	0.147	0.166	0.140	0.173	0.105	0.647
Above Hells Canyon Dam	0.153	0.342	0.284	0.000	0.146	0.005

TABLE 6 (cont.)

Calculation Parameters

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Total Adult Production (thousands)	1,449	3,569	1,971	1,342	959	2,722
Ocean Survival	0.02	0.04	0.04	0.08	0.10	0.10
Juvenile Down- stream Survival (per dam passed)	0.80	0.80	0.80	0.80	0.80	0.80
Adult Down- stream Survival (per dam passed)	0.95	0.95	0.95	0.95	0.95	0.95

CALCULATIONS

Number of Adults Without Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
1,449	3,569	1,971	1,342	959	2,722

Number of Smolts Without Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
72,450	89,225	49,275	16,775	9,590	27,220

TABLE 6 (cont.)

Numerical Distribution of Smolts Produced Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	10,940	0	12,220	7,331	1,640	0
Between 1 & 2 Dams	652	0	493	822	211	0
Between 2 & 3 Dams	2,391	0	197	0	393	27
Between 3 & 4 Dams	3,260	0	197	0	499	0
Between 4 & 5 Dams	4,419	1,606	1,429	2,265	585	572
Between 5 & 6 Dams	0	0	1,084	0	0	0
Between 6 & 7 Dams	507	0	3,154	352	105	0
Between 7 & 8 Dams	1,884	1,071	1,084	453	105	218
Between 8 & 9 Dams	23,546	37,475	8,574	2,332	3,443	436
Between 9 & 10 Dams	3,043	3,658	0	336	192	8,248
Above Chief Joseph Dam	10,650	14,811	6,899	2,902	1,007	17,611
Above Hells Canyon Dam	11,085	30,515	13,994	0	1,400	136
Totals:	72,378	89,136	49,324	16,792	9,580	27,247

TABLE 6 (cont.)

Number of Smolts at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	10,940	0	12,220	7,331	1,640	0
Between 1 & 2 Dams	522	0	394	658	169	0
Between 2 & 3 Dams	1,530	0	126	0	252	17
Between 3 & 4 Dams	1,669	0	101	0	255	0
Between 4 & 5 Dams	1,810	658	585	928	240	234
Between 5 & 6 Dams	0	0	355	0	0	0
Between 6 & 7 Dams	133	0	827	92	28	0
Between 7 & 8 Dams	395	225	227	95	22	46
Between 8 & 9 Dams	3,950	6,287	1,438	391	578	73
Between 9 & 10 Dams	408	491	0	45	26	1,107
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	21,358	7,661	16,274	9,539	3,208	1,477

TABLE 6 (cont.)

Number of Adults at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	10	0	16	53	17	0
Between 2 & 3 Dams	31	0	5	0	25	2
Between 3 & 4 Dams	33	0	4	0	26	0
Between 4 & 5 Dams	36	26	23	74	24	23
Between 5 & 6 Dams	0	0	14	0	0	0
Between 6 & 7 Dams	3	0	33	7	3	0
Between 7 & 8 Dams	8	9	9	8	2	5
Between 8 & 9 Dams	79	251	58	31	58	7
Between 9 & 10 Dams	8	20	0	4	3	111
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	427	306	651	763	321	148

TABLE 6 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	10	0	15	50	16	0
Between 2 & 3 Dams	28	0	5	0	23	2
Between 3 & 4 Dams	29	0	3	0	22	0
Between 4 & 5 Dams	29	21	19	60	20	19
Between 5 & 6 Dams	0	0	11	0	0	0
Between 6 & 7 Dams	2	0	24	5	2	0
Between 7 & 8 Dams	6	6	6	5	2	3
Between 8 & 9 Dams	52	167	38	21	38	5
Between 9 & 10 Dams	5	12	0	2	2	70
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	379	207	611	731	288	98

All Species Total: 2,314,000

TABLE 6 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	13	0	20	66	21	0
Between 2 & 3 Dams	48	0	8	0	39	3
Between 3 & 4 Dams	65	0	8	0	50	0
Between 4 & 5 Dams	88	64	57	181	58	57
Between 5 & 6 Dams	0	0	43	0	0	0
Between 6 & 7 Dams	10	0	126	28	11	0
Between 7 & 8 Dams	38	43	43	36	11	22
Between 8 & 9 Dams	471	1,499	343	187	344	44
Between 9 & 10 Dams	61	146	0	27	19	825
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	1,448	3,565	1,973	1,343	958	2,725

All Species Total: 12,012,000

TABLE 6 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0	0	0	0	0	0
Between 1 & 2 Dams	3	0	5	16	5	0
Between 2 & 3 Dams	20	0	3	0	17	1
Between 3 & 4 Dams	37	0	4	0	28	0
Between 4 & 5 Dams	59	43	38	121	39	38
Between 5 & 6 Dams	0	0	32	0	0	0
Between 6 & 7 Dams	8	0	102	23	9	0
Between 7 & 8 Dams	32	37	37	31	9	19
Between 8 & 9 Dams	419	1,332	305	166	306	39
Between 9 & 10 Dams	56	134	0	25	18	755
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
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Totals:	1,068	3,359	1,362	613	670	2,626

All Species Total: 9,698,000

TABLE 6 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0	0	0	0	0	0
Between 1 & 2 Dams	3	0	4	14	5	0
Between 2 & 3 Dams	18	0	3	0	15	1
Between 3 & 4 Dams	33	0	4	0	25	0
Between 4 & 5 Dams	52	38	34	107	35	34
Between 5 & 6 Dams	0	0	29	0	0	0
Between 6 & 7 Dams	7	0	91	20	8	0
Between 7 & 8 Dams	29	33	33	28	8	17
Between 8 & 9 Dams	372	1,186	271	148	272	34
Between 9 & 10 Dams	50	119	0	22	16	672
Above Chief Joseph Dam	196	545	254	214	93	1,620
Above Hells Canyon Dam	111	610	280	0	70	7
Totals:	871	2,531	1,002	552	545	2,385

All Species Total: 7,886,000

TABLE 7

**STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
USING CURRENT RUN SIZE AS A BASIS¹**

Fish Distribution (Percentage)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
			<u>Hatchery</u>	<u>Natural</u>			
Between 1 & 2 Dams	0.027	0.000	0.260	0.175	0.176	0.047	0.000
Between 2 & 3 Dams	0.128	0.000	0.000	0.234	0.109	0.054	0.000
Between 3 & 4 Dams	0.000	0.000	0.150	0.000	0.031	0.107	0.000
Between 4 & 5 Dams	0.084	0.047	0.510	0.508	0.244	0.095	0.000
Between 5 & 6 Dams	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Between 6 & 7 Dams	0.021	0.000	0.050	0.000	0.000	0.023	0.000
Between 7 & 8 Dams	0.033	0.019	0.000	0.020	0.040	0.022	0.210
Between 8 & 9 Dams	0.654	0.870	0.020	0.063	0.359	0.614	0.296
Between 9 & 10 Dams	0.053	0.064	0.000	0.000	0.046	0.038	0.493
Above Chief Joseph Dam	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Above Hells Canyon Dam	0.000	0.000	0.000	0.000	0.000	0.000	0.000

¹ Estimated hydropower-related losses above Chief Joseph and Hells Canyon dams are computed using predevelopment run sizes. (See Table 6.)

TABLE 7 (cont.)

Calculation Parameters

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
			<u>Hatchery</u>	<u>Natural</u>			
Total Adult Production (thousands)	92	77	334	360	179	143	58
Ocean Survival	0.02	0.04	0.04	0.04	0.08	0.10	0.10
Juvenile Down- stream Survival (per dam passed)	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adult Down- stream Survival (per dam passed)	0.95	0.95	0.95	0.95	0.95	0.95	0.95

CALCULATIONS

Number of Adults at River Mouth with Dams (Thousands)

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
			<u>Hatchery</u>	<u>Natural</u>			
	92	77	334	360	179	143	58

Number of Smolts at River Mouth with Dams (Thousands)

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
			<u>Hatchery</u>	<u>Natural</u>			
	4,600	1,925	8,350	9,000	2,238	1,430	580

TABLE 7 (cont.)

Number of Smolts Produced (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	155	0	4,683	492	84	0
Between 2 & 3 Dams	920	0	3,291	381	121	0
Between 3 & 4 Dams	0	0	2,446	135	299	0
Between 4 & 5 Dams	943	221	21,559	1,333	332	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	368	0	1,593	0	125	0
Between 7 & 8 Dams	724	174	858	427	150	581
Between 8 & 9 Dams	17,931	9,982	4,375	4,788	5,233	1,023
Between 9 & 10 Dams	1,816	918	0	767	405	2,130
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	22,859	11,295	38,804	8,323	6,749	3,734

TABLE 7 (cont.)

Number of Smolts at River Mouth Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	155	0	4,683	492	84	0
Between 2 & 3 Dams	920	0	3,291	381	121	0
Between 3 & 4 Dams	0	0	2,446	135	299	0
Between 4 & 5 Dams	943	221	21,559	1,333	332	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	368	0	1,593	0	125	0
Between 7 & 8 Dams	724	174	858	427	150	581
Between 8 & 9 Dams	17,931	9,982	4,375	4,788	5,233	1,023
Between 9 & 10 Dams	1,816	918	0	767	405	2,130
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	22,859	11,295	38,804	8,323	6,749	3,734

TABLE 7 (cont.)

Number of Adults at River Mouth Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	3	0	187	39	8	0
Between 2 & 3 Dams	18	0	132	30	12	0
Between 3 & 4 Dams	0	0	98	11	30	0
Between 4 & 5 Dams	19	9	862	107	33	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	7	0	64	0	13	0
Between 7 & 8 Dams	14	7	34	34	15	58
Between 8 & 9 Dams	359	399	175	383	523	102
Between 9 & 10 Dams	36	37	0	61	40	213
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	456	452	1,552	665	674	373

TABLE 7 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	3	0	187	39	8	0
Between 2 & 3 Dams	18	0	132	30	12	0
Between 3 & 4 Dams	0	0	98	11	30	0
Between 4 & 5 Dams	19	9	862	107	33	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	7	0	64	0	13	0
Between 7 & 8 Dams	14	7	34	34	15	58
Between 8 & 9 Dams	359	399	175	383	523	102
Between 9 & 10 Dams	36	37	0	61	40	213
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
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Totals:	892	2,265	2,388	898	916	2,148

All Species Total: 9,507,000

TABLE 7 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	2	0	142	30	6	0
Between 2 & 3 Dams	11	0	76	18	7	0
Between 3 & 4 Dams	0	0	43	5	13	0
Between 4 & 5 Dams	6	3	288	36	11	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	1	0	12	0	2	0
Between 7 & 8 Dams	2	1	5	5	2	9
Between 8 & 9 Dams	40	44	19	43	58	11
Between 9 & 10 Dams	3	3	0	5	3	18
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	66	52	586	141	104	38

All Species Total: 986,000

TABLE 7 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	1	0	45	9	2	0
Between 2 & 3 Dams	8	0	56	13	5	0
Between 3 & 4 Dams	0	0	55	6	17	0
Between 4 & 5 Dams	13	6	575	71	22	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	6	0	51	0	10	0
Between 7 & 8 Dams	12	6	29	29	13	50
Between 8 & 9 Dams	319	355	156	340	465	91
Between 9 & 10 Dams	33	34	0	56	37	195
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	826	2,213	1,802	757	812	2,111

All Species Total: 8,522,000

TABLE 7 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	1	0	40	8	2	0
Between 2 & 3 Dams	7	0	49	11	5	0
Between 3 & 4 Dams	0	0	49	5	15	0
Between 4 & 5 Dams	11	5	511	63	20	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	5	0	46	0	9	0
Between 7 & 8 Dams	11	5	26	26	11	44
Between 8 & 9 Dams	284	316	138	303	414	81
Between 9 & 10 Dams	30	30	0	50	33	174
Above Chief Joseph Dam	196	545	254	213	93	1,620
Above Hells Canyon Dam	111	611	280	0	70	7
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Totals:	655	1,511	1,394	681	671	1,926

All Species Total: 6,838,000

TABLE 8

**STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
USING CURRENT POTENTIAL RUN SIZE AS A BASIS¹**

(Numbers of Smolts Produced by Area)

<u>Areas of Production</u>	<u>Spring Chinook</u>		<u>Summer Chinook</u>		<u>Fall Chinook</u>		<u>Coho</u>		<u>Steelhead</u>		<u>Sockeye</u>	
	<u>Hatchery</u>	<u>Natural</u>	<u>Hatchery</u>	<u>Natural</u>	<u>Hatchery</u>	<u>Natural</u>	<u>Hatchery</u>	<u>Natural</u>	<u>Hatchery</u>	<u>Natural</u>	<u>Hatchery</u>	<u>Natural</u>
Between 1 & 2 Dams	4,917,000	864,000	---	---	4,431,000	---	1,750,000	269,000	160,000	197,000	---	---
Between 2 & 3 Dams	765,000	1,407,000	---	---	---	2,057,000	---	331,000	130,000	105,000	---	---
Between 3 & 4 Dams	---	4,273,000	---	---	2,580,000	2,025,000	---	---	48,000	458,000	---	---
Between 4 & 5 Dams	514,000	3,112,000	---	---	8,520,000	21,938,000	---	---	359,000	355,000	---	---
Between 5 & 6 Dams	---	---	---	---	---	---	---	---	---	---	---	---
Between 6 & 7 Dams	---	---	---	---	840,000	---	---	---	220,000	1,000	---	---
Between 7 & 8 Dams	1,640,000	887,000	---	556,000	---	---	---	---	---	94,000	---	316,000
Between 8 & 9 Dams	6,251,000	16,905,000	1,364,000	14,159,000	360,000	24,000	320,000	232,000	4,472,000	1,885,000	---	460,000
Above Wells and Below Chief Joseph dams	800,000	1,266,000	1,344,000	1,295,000	---	---	---	---	368,000	78,000	---	748,000

¹ Estimated hydropower-related losses above Chief Joseph and Hells Canyon dams are computed using predevelopment run sizes. (See Table 6.)

TABLE 8 (cont.)

Number of Smolts Produced (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	5,781	0	4,431	2,019	357	0
Between 2 & 3 Dams	2,172	0	2,057	331	235	0
Between 3 & 4 Dams	4,273	0	4,605	0	506	0
Between 4 & 5 Dams	3,626	0	30,458	0	714	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	840	0	221	0
Between 7 & 8 Dams	2,527	556	0	0	94	316
Between 8 & 9 Dams	23,156	15,523	384	552	6,357	460
Above Wells and Below Chief Joseph	2,066	2,639	0	0	446	748
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	43,601	18,718	42,775	2,902	8,930	1,524

All Species Total: 118,450,000

TABLE 8 (cont.)

Smolts to River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	4,625	0	3,545	1,615	286	0
Between 2 & 3 Dams	1,390	0	1,316	212	150	0
Between 3 & 4 Dams	2,188	0	2,358	0	259	0
Between 4 & 5 Dams	1,485	0	12,476	0	292	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	220	0	58	0
Between 7 & 8 Dams	530	117	0	0	20	66
Between 8 & 9 Dams	3,885	2,604	64	93	1,067	77
Above Wells and Below Chief Joseph	277	354	0	0	60	100
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	14,380	3,075	19,979	1,920	2,192	244

All Species Total: 41,789,000

TABLE 8 (cont.)

Number of Adults at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	92	0	142	129	29	0
Between 2 & 3 Dams	28	0	53	17	15	0
Between 3 & 4 Dams	44	0	94	0	26	0
Between 4 & 5 Dams	30	0	499	0	29	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	9	0	6	0
Between 7 & 8 Dams	11	5	0	0	2	7
Between 8 & 9 Dams	78	104	3	7	107	8
Above Wells and Below Chief Joseph	6	14	0	0	6	10
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	288	123	799	154	219	24

All Species Total: 1,607,000

TABLE 8 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	88	0	135	123	27	0
Between 2 & 3 Dams	25	0	48	15	14	0
Between 3 & 4 Dams	38	0	81	0	22	0
Between 4 & 5 Dams	24	0	406	0	24	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	6	0	4	0
Between 7 & 8 Dams	7	3	0	0	1	5
Between 8 & 9 Dams	52	69	2	5	71	5
Above Wells and Below Chief Joseph	3	9	0	0	4	6
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	237	81	678	143	167	16

All Species Total: 1,322,000

TABLE 8 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	116	0	177	162	36	0
Between 2 & 3 Dams	43	0	82	26	24	0
Between 3 & 4 Dams	85	0	184	0	51	0
Between 4 & 5 Dams	73	0	1,218	0	71	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	34	0	22	0
Between 7 & 8 Dams	51	22	0	0	9	32
Between 8 & 9 Dams	463	621	15	44	636	46
Above Wells and Below Chief Joseph	41	106	0	0	45	75
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	1,307	2,562	2,547	464	1,134	1,927

All Species Total: 9,941,000

TABLE 8 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	28	0	43	39	9	0
Between 2 & 3 Dams	18	0	35	11	10	0
Between 3 & 4 Dams	48	0	103	0	28	0
Between 4 & 5 Dams	48	0	812	0	48	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	27	0	18	0
Between 7 & 8 Dams	43	19	0	0	8	27
Between 8 & 9 Dams	412	552	14	39	565	41
Above Wells and Below Chief Joseph	38	97	0	0	41	68
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	1,070	2,480	1,869	321	967	1,911

All Species Total: 8,619,000

TABLE 8 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	25	0	38	35	8	0
Between 2 & 3 Dams	16	0	31	10	9	0
Between 3 & 4 Dams	43	0	92	0	25	0
Between 4 & 5 Dams	43	0	723	0	42	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	24	0	16	0
Between 7 & 8 Dams	38	17	0	0	7	24
Between 8 & 9 Dams	366	491	12	35	503	36
Above Wells and Below Chief Joseph	34	86	0	0	36	61
Above Chief Joseph Dam	196	545	254	213	93	1,620
Above Hells Canyon Dam	111	611	280	0	70	7
Totals:	872	1,749	1,454	293	809	1,748

All Species Total: 6,925,000

TABLE 9

**STAFF ESTIMATE OF HYDROPOWER RESPONSIBILITY
USING ALTERNATIVE 2**

Total Loss	7-14 million
	X
Percent Hydropower Purpose of Dams	77%
	=
Hydropower Responsibility	5-11 million

TABLE 10

VARIATION 1:
 STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
 USING PRE-1850 RUN SIZE AS A BASIN¹

Fish Distribution (Percentage)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0.151	0.000	0.248	0.437	0.171	0.000
Between 1 & 2 Dams	0.009	0.000	0.010	0.049	0.022	0.000
Between 2 & 3 Dams	0.033	0.000	0.004	0.000	0.041	0.001
Between 3 & 4 Dams	0.045	0.000	0.004	0.000	0.052	0.000
Between 4 & 5 Dams	0.061	0.018	0.029	0.135	0.061	0.021
Between 5 & 6 Dams	0.000	0.000	0.022	0.000	0.000	0.000
Between 6 & 7 Dams	0.007	0.000	0.064	0.021	0.011	0.000
Between 7 & 8 Dams	0.026	0.012	0.022	0.027	0.011	0.008
Between 8 & 9 Dams	0.325	0.420	0.174	0.139	0.359	0.016
Between 9 & 10 Dams	0.042	0.041	0.000	0.020	0.020	0.303
Above Chief Joseph Dam	0.147	0.166	0.140	0.173	0.105	0.647
Above Hells Canyon Dam	0.153	0.342	0.284	0.000	0.146	0.005

¹ Uses the pre-development run size based on a 67 percent catch efficiency. (See Table 6.)

TABLE 10 (cont.)

Calculation Parameters

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Total Adult Production (thousands)	597	2,537	1,642	903	570	2,843
Ocean Survival	0.02	0.04	0.04	0.08	0.10	0.10
Juvenile Down- stream Survival (per dam passed)	0.80	0.80	0.80	0.80	0.80	0.80
Adult Down- stream Survival (per dam passed)	0.95	0.95	0.95	0.95	0.95	0.95

CALCULATIONS

Number of Adults Without Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
597	2,537	1,642	903	570	2,843

Number of Smolts Without Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
29,850	63,425	41,050	11,288	5,700	28,430

TABLE 10 (cont.)

Numerical Distribution of Smolts Produced Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	4,507	0	10,180	4,933	975	0
Between 1 & 2 Dams	269	0	411	553	125	0
Between 2 & 3 Dams	985	0	164	0	234	28
Between 3 & 4 Dams	1,343	0	164	0	296	0
Between 4 & 5 Dams	1,821	1,142	1,190	1,524	348	597
Between 5 & 6 Dams	0	0	903	0	0	0
Between 6 & 7 Dams	209	0	2,627	237	63	0
Between 7 & 8 Dams	776	761	903	305	63	227
Between 8 & 9 Dams	9,701	26,639	7,143	1,569	2,046	455
Between 9 & 10 Dams	1,254	2,600	0	226	114	8,614
Above Chief Joseph Dam	4,388	10,529	5,747	1,953	599	18,394
Above Hells Canyon Dam	4,567	21,691	11,658	0	832	142
Totals:	29,820	63,362	41,091	11,299	5,694	28,458

TABLE 10 (cont.)

Number of Smolts at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	4,507	0	10,180	4,933	975	0
Between 1 & 2 Dams	215	0	328	442	100	0
Between 2 & 3 Dams	630	0	105	0	150	18
Between 3 & 4 Dams	688	0	84	0	152	0
Between 4 & 5 Dams	746	468	488	624	142	245
Between 5 & 6 Dams	0	0	296	0	0	0
Between 6 & 7 Dams	55	0	689	62	16	0
Between 7 & 8 Dams	163	160	189	64	13	48
Between 8 & 9 Dams	1,628	4,469	1,198	263	343	76
Between 9 & 10 Dams	168	349	0	30	15	1,156
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	8,800	5,445	13,558	6,419	1,907	1,543

TABLE 10 (cont.)

Number of Adults at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	90	0	407	395	97	0
Between 1 & 2 Dams	4	0	13	35	10	0
Between 2 & 3 Dams	13	0	4	0	15	2
Between 3 & 4 Dams	14	0	3	0	15	0
Between 4 & 5 Dams	15	19	20	50	14	24
Between 5 & 6 Dams	0	0	12	0	0	0
Between 6 & 7 Dams	1	0	28	5	2	0
Between 7 & 8 Dams	3	6	8	5	1	5
Between 8 & 9 Dams	33	179	48	21	34	8
Between 9 & 10 Dams	3	14	0	2	2	116
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	176	218	542	514	191	154

TABLE 10 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	90	0	407	395	97	0
Between 1 & 2 Dams	4	0	12	34	10	0
Between 2 & 3 Dams	11	0	4	0	13	2
Between 3 & 4 Dams	12	0	3	0	13	0
Between 4 & 5 Dams	12	15	16	41	12	20
Between 5 & 6 Dams	0	0	9	0	0	0
Between 6 & 7 Dams	1	0	20	4	1	0
Between 7 & 8 Dams	2	4	5	4	1	3
Between 8 & 9 Dams	22	119	32	14	23	5
Between 9 & 10 Dams	2	9	0	2	1	73
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	156	147	509	492	171	103

All Species Total: 1,578,000

TABLE 10 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	90	0	407	395	97	0
Between 1 & 2 Dams	5	0	16	44	13	0
Between 2 & 3 Dams	20	0	7	0	23	3
Between 3 & 4 Dams	27	0	7	0	30	0
Between 4 & 5 Dams	36	46	48	122	35	60
Between 5 & 6 Dams	0	0	36	0	0	0
Between 6 & 7 Dams	4	0	105	19	6	0
Between 7 & 8 Dams	16	30	36	24	6	23
Between 8 & 9 Dams	194	1,066	286	126	205	45
Between 9 & 10 Dams	25	104	0	18	11	861
Above Chief Joseph Dam	88	421	230	156	60	1,839
Above Hells Canyon Dam	91	868	466	0	83	14
Totals:	596	2,534	1,644	904	569	2,846

All Species Total: 9,094,000

TABLE 10 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0	0	0	0	0	0
Between 1 & 2 Dams	1	0	4	11	3	0
Between 2 & 3 Dams	8	0	3	0	10	1
Between 3 & 4 Dams	15	0	4	0	17	0
Between 4 & 5 Dams	24	30	32	81	23	40
Between 5 & 6 Dams	0	0	27	0	0	0
Between 6 & 7 Dams	3	0	85	15	5	0
Between 7 & 8 Dams	13	26	31	21	5	19
Between 8 & 9 Dams	172	947	254	112	182	40
Between 9 & 10 Dams	23	95	0	17	10	789
Above Chief Joseph Dam	88	421	230	156	60	1,839
Above Hells Canyon Dam	91	868	466	0	83	14
Totals:	440	2,387	1,135	412	398	2,743

All Species Total: 7,516,000

TABLE 10 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0	0	0	0	0	0
Between 1 & 2 Dams	1	0	4	9	3	0
Between 2 & 3 Dams	7	0	2	0	9	1
Between 3 & 4 Dams	13	0	3	0	15	0
Between 4 & 5 Dams	22	27	28	72	21	35
Between 5 & 6 Dams	0	0	24	0	0	0
Between 6 & 7 Dams	3	0	76	14	5	0
Between 7 & 8 Dams	12	23	27	19	5	17
Between 8 & 9 Dams	153	843	226	99	162	36
Between 9 & 10 Dams	20	85	0	15	9	702
Above Chief Joseph Dam	81	387	211	144	55	1,692
Above Hells Canyon Dam	46	434	233	0	42	7
Totals:	359	1,799	835	372	324	2,491

All Species Total: 6,179,000

TABLE 11

VARIATION 1:
 STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
 USING PRE-1850 RUN SIZE AS A BASIS¹

Fish Distribution (Percentage)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0.151	0.000	0.248	0.437	0.171	0.000
Between 1 & 2 Dams	0.009	0.000	0.010	0.049	0.022	0.000
Between 2 & 3 Dams	0.033	0.000	0.004	0.000	0.041	0.001
Between 3 & 4 Dams	0.045	0.000	0.004	0.000	0.052	0.000
Between 4 & 5 Dams	0.061	0.018	0.029	0.135	0.061	0.021
Between 5 & 6 Dams	0.000	0.000	0.022	0.000	0.000	0.000
Between 6 & 7 Dams	0.007	0.000	0.064	0.021	0.011	0.000
Between 7 & 8 Dams	0.026	0.012	0.022	0.027	0.011	0.008
Between 8 & 9 Dams	0.325	0.420	0.174	0.139	0.359	0.016
Between 9 & 10 Dams	0.042	0.041	0.000	0.020	0.020	0.303
Above Chief Joseph Dam	0.147	0.166	0.140	0.173	0.105	0.647
Above Hells Canyon Dam	0.153	0.342	0.284	0.000	0.146	0.005

¹ Uses the pre-development run size based on a 50 percent catch efficiency. (See Table 6.)

TABLE 11 (cont.)

Calculation Parameters

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Total Adult Production (thousands)	2.300	4.600	2.300	1.780	1,348	2.600
Ocean Survival	0.02	0.04	0.04	0.08	0.10	0.10
Juvenile Down- stream Survival (per dam passed)	0.80	0.80	0.80	0.80	0.80	0.80
Adult Down- stream Survival (per dam passed)	0.95	0.95	0.95	0.95	0.95	0.95

CALCULATIONS

Number of Adults Without Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
2.300	4.600	2.300	1.780	1,348	2.600

Number of Smolts Without Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
115.000	115.000	57.500	22.250	13.480	26.000

TABLE 11 (cont.)

Numerical Distribution of Smolts Produced Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	17.365	0	14,260	9,723	2,305	0
Between 1 & 2 Dams	1.035	0	575	1,090	297	0
Between 2 & 3 Dams	3.795	0	230	0	553	26
Between 3 & 4 Dams	5.175	0	230	0	701	0
Between 4 & 5 Dams	7.015	2,070	1,668	3,004	822	546
Between 5 & 6 Dams	0	0	1,265	0	0	0
Between 6 & 7 Dams	805	0	3,680	467	148	0
Between 7 & 8 Dams	2,990	1,380	1,265	601	148	208
Between 8 & 9 Dams	37.375	48,300	10,005	3,093	4,839	416
Between 9 & 10 Dams	4.830	4,175	0	445	270	7,878
Above Chief Joseph Dam	16.905	19,090	8,050	3,849	1,415	16,822
Above Hells Canyon Dam	17.595	39,330	16,330	0	1,968	130
Totals:	114.885	114,885	57,558	22,272	13,467	26,026

TABLE 11 (cont.)

Number of Smolts at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	17.365	0	14.260	9.723	2.305	0
Between 1 & 2 Dams	828	0	460	872	237	0
Between 2 & 3 Dams	2.429	0	147	0	354	17
Between 3 & 4 Dams	2.650	0	118	0	359	0
Between 4 & 5 Dams	2.873	848	683	1,230	337	224
Between 5 & 6 Dams	0	0	415	0	0	0
Between 6 & 7 Dams	211	0	965	122	39	0
Between 7 & 8 Dams	627	289	265	126	31	44
Between 8 & 9 Dams	6.270	8.103	1,679	519	812	70
Between 9 & 10 Dams	648	633	0	60	36	1,057
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	33.902	9.874	18.991	12.653	4.510	1.411

TABLE 11 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	347	0	570	778	231	0
Between 1 & 2 Dams	16	0	17	66	23	0
Between 2 & 3 Dams	44	0	5	0	32	2
Between 3 & 4 Dams	45	0	4	0	31	0
Between 4 & 5 Dams	47	28	22	80	27	18
Between 5 & 6 Dams	0	0	13	0	0	0
Between 6 & 7 Dams	3	0	28	7	3	0
Between 7 & 8 Dams	9	8	7	7	2	3
Between 8 & 9 Dams	83	215	45	28	54	5
Between 9 & 10 Dams	8	16	0	3	2	67
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	602	267	713	969	404	94

All Species Total: 3,049,000

TABLE 11 (cont.)

Number of Adults at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	347	0	570	778	231	0
Between 1 & 2 Dams	17	0	18	70	24	0
Between 2 & 3 Dams	49	0	6	0	35	2
Between 3 & 4 Dams	53	0	5	0	36	0
Between 4 & 5 Dams	57	34	27	98	34	22
Between 5 & 6 Dams	0	0	17	0	0	0
Between 6 & 7 Dams	4	0	39	10	4	0
Between 7 & 8 Dams	13	12	11	10	3	4
Between 8 & 9 Dams	125	324	67	42	81	7
Between 9 & 10 Dams	13	25	0	5	4	106
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	678	395	760	1,012	451	141

TABLE 11 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	347	0	570	778	231	0
Between 1 & 2 Dams	21	0	23	87	30	0
Between 2 & 3 Dams	76	0	9	0	55	3
Between 3 & 4 Dams	104	0	9	0	70	0
Between 4 & 5 Dams	140	83	67	240	82	55
Between 5 & 6 Dams	0	0	51	0	0	0
Between 6 & 7 Dams	16	0	147	37	15	0
Between 7 & 8 Dams	60	55	51	48	15	21
Between 8 & 9 Dams	748	1,932	400	247	484	42
Between 9 & 10 Dams	97	189	0	36	27	788
Above Chief Joseph Dam	338	764	322	308	142	1,682
Above Hells Canyon Dam	352	1,573	653	0	197	13
<hr/>						
Totals:	2,298	4,595	2,302	1,782	1,347	2,603

All Species Total: 14,926,000

TABLE 11 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0	0	0	0	0	0
Between 1 & 2 Dams	5	0	6	21	7	0
Between 2 & 3 Dams	32	0	4	0	23	1
Between 3 & 4 Dams	58	0	5	0	39	0
Between 4 & 5 Dams	93	55	44	160	55	36
Between 5 & 6 Dams	0	0	38	0	0	0
Between 6 & 7 Dams	13	0	119	30	12	0
Between 7 & 8 Dams	51	47	43	41	13	18
Between 8 & 9 Dams	664	1,717	356	220	430	37
Between 9 & 10 Dams	88	173	0	33	25	721
Above Chief Joseph Dam	338	764	322	308	142	1,682
Above Hells Canyon Dam	352	1,573	653	0	197	13
Totals:	1,695	4,329	1,590	813	942	2,509

All Species Total: 11,877,000

TABLE 11 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0	0	0	0	0	0
Between 1 & 2 Dams	4	0	5	19	6	0
Between 2 & 3 Dams	29	0	3	0	21	1
Between 3 & 4 Dams	52	0	5	0	35	0
Between 4 & 5 Dams	83	49	40	143	49	32
Between 5 & 6 Dams	0	0	34	0	0	0
Between 6 & 7 Dams	12	0	106	27	11	0
Between 7 & 8 Dams	45	42	38	37	11	16
Between 8 & 9 Dams	591	1,528	317	196	383	33
Between 9 & 10 Dams	79	154	0	29	22	642
Above Chief Joseph Dam	311	703	296	283	130	1,548
Above Hells Canyon Dam	176	787	327	0	98	7
Totals:	1,382	3,262	1,170	733	766	2,278

All Species Total: 9,590,000

TABLE 12

VARIATION 2:
STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
USING CURRENT RUN SIZE AS A BASIS¹

Fish Distribution (Percentage)

Area of Production	Spring Chinook	Summer Chinook	Fall Chinook		Coho	Steelhead	Sockeye
			Hatchery	Natural			
Between 1 & 2 Dams	0.027	0.000	0.260	0.175	0.176	0.047	0.000
Between 2 & 3 Dams	0.128	0.000	0.000	0.234	0.109	0.054	0.000
Between 3 & 4 Dams	0.000	0.000	0.150	0.000	0.031	0.107	0.000
Between 4 & 5 Dams	0.084	0.047	0.510	0.508	0.244	0.095	0.000
Between 5 & 6 Dams	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Between 6 & 7 Dams	0.021	0.000	0.050	0.000	0.000	0.023	0.000
Between 7 & 8 Dams	0.033	0.019	0.000	0.020	0.040	0.022	0.210
Between 8 & 9 Dams	0.654	0.870	0.020	0.063	0.359	0.614	0.296
Between 9 & 10 Dams	0.053	0.064	0.000	0.000	0.046	0.038	0.493
Above Chief Joseph Dam	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Above Hells Canyon Dam	0.000	0.000	0.000	0.000	0.000	0.000	0.000

¹ Variation assumes that the percentage of production above and below blocked areas is the same proportion now as prior to 1850.

TABLE 12 (cont.)

Calculation Parameters

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
			<u>Hatchery</u>	<u>Natural</u>			
Total Adult Production (thousands)	92	77	334	360	179	143	58
Ocean Survival	0.02	0.04	0.04	0.04	0.08	0.10	0.10
Juvenile Down- stream Survival (per dam passed)	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adult Down- stream Survival (per dam passed)	0.95	0.95	0.95	0.95	0.95	0.95	0.95

CALCULATIONS

Number of Adults at River Mouth with Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
		<u>Hatchery</u>	<u>Natural</u>			
92	77	334	360	179	143	58

Number of Smolts at River Mouth with Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
		<u>Hatchery</u>	<u>Natural</u>			
4,600	1,925	8,350	9,000	2,238	1,430	580

TABLE 12 (cont.)

Number of Smolts Produced (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	155	0	4,683	492	84	0
Between 2 & 3 Dams	920	0	3,291	381	121	0
Between 3 & 4 Dams	0	0	2,446	135	299	0
Between 4 & 5 Dams	943	221	21,559	1,333	332	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	368	0	1,593	0	125	0
Between 7 & 8 Dams	724	174	858	427	150	581
Between 8 & 9 Dams	17,931	9,982	4,375	4,788	5,233	1,023
Between 9 & 10 Dams	1,816	918	0	767	405	2,130
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	22,859	11,295	38,804	8,323	6,749	3,734

TABLE 12 (cont.)

Number of Smolts at River Mouth Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	155	0	4,683	492	84	0
Between 2 & 3 Dams	920	0	3,291	381	121	0
Between 3 & 4 Dams	0	0	2,446	135	299	0
Between 4 & 5 Dams	943	221	21,559	1,333	332	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	368	0	1,593	0	125	0
Between 7 & 8 Dams	724	174	858	427	150	581
Between 8 & 9 Dams	17,931	9,982	4,375	4,788	5,233	1,023
Between 9 & 10 Dams	1,816	918	0	767	405	2,130
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	22,859	11,295	38,804	8,323	6,749	3,734

TABLE 12 (cont.)

Number of Adults at River Mouth Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	3	0	187	39	8	0
Between 2 & 3 Dams	18	0	132	30	12	0
Between 3 & 4 Dams	0	0	98	11	30	0
Between 4 & 5 Dams	19	9	862	107	33	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	7	0	64	0	13	0
Between 7 & 8 Dams	14	7	34	34	15	58
Between 8 & 9 Dams	359	399	175	383	523	102
Between 9 & 10 Dams	36	37	0	61	40	213
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	456	452	1,552	665	674	373

TABLE 12 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	3	0	187	39	8	0
Between 2 & 3 Dams	18	0	132	30	12	0
Between 3 & 4 Dams	0	0	98	11	30	0
Between 4 & 5 Dams	19	9	862	107	33	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	7	0	64	0	13	0
Between 7 & 8 Dams	14	7	34	34	15	58
Between 8 & 9 Dams	359	399	175	383	523	102
Between 9 & 10 Dams	36	37	0	61	40	213
Above Chief Joseph Dam	96	152	377	139	95	694
Above Hells Canyon Dam	100	314	765	0	132	5
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Totals:	653	918	2,695	805	901	1,073

All Species Total: 7,046,000

TABLE 12 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	2	0	142	30	6	0
Between 2 & 3 Dams	11	0	76	18	7	0
Between 3 & 4 Dams	0	0	43	5	13	0
Between 4 & 5 Dams	6	3	288	36	11	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	1	0	12	0	2	0
Between 7 & 8 Dams	2	1	5	5	2	9
Between 8 & 9 Dams	40	44	19	43	58	11
Between 9 & 10 Dams	3	3	0	5	3	18
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	66	52	586	141	104	38

All Species Total: 986,000

TABLE 12 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	1	0	45	9	2	0
Between 2 & 3 Dams	8	0	56	13	5	0
Between 3 & 4 Dams	0	0	55	6	17	0
Between 4 & 5 Dams	13	6	575	71	22	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	6	0	51	0	10	0
Between 7 & 8 Dams	12	6	29	29	13	50
Between 8 & 9 Dams	319	355	156	340	465	91
Between 9 & 10 Dams	33	34	0	56	37	195
Above Chief Joseph Dam	96	152	377	139	95	694
Above Hells Canyon Dam	100	314	765	0	132	5
<hr/>						
Totals:	587	867	2,109	664	797	1,035
All Species Total: 6,060,000						

TABLE 12 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	1	0	40	8	2	0
Between 2 & 3 Dams	7	0	49	11	5	0
Between 3 & 4 Dams	0	0	49	5	15	0
Between 4 & 5 Dams	11	5	511	63	20	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	5	0	46	0	9	0
Between 7 & 8 Dams	11	5	26	26	11	44
Between 8 & 9 Dams	284	316	138	303	414	81
Between 9 & 10 Dams	30	30	0	50	33	174
Above Chief Joseph Dam	88	140	347	128	87	639
Above Hells Canyon Dam	50	157	383	0	66	3
Totals:	487	654	1,590	596	661	940

All Species Total: 4,927,000

TABLE 13

**VARIATION 2:
STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
USING CURRENT POTENTIAL RUN SIZE AS A BASIS¹**

(Numbers of Smolts Produced by Area)

Areas of Production	Spring Chinook		Summer Chinook		Fall Chinook		Coho		Steelhead		Sockeye	
	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural
Between 1 & 2 Dams	4,917,000	864,000	---	---	4,431,000	---	1,750,000	269,000	160,000	197,000	---	---
Between 2 & 3 Dams	765,000	1,407,000	---	---	---	2,057,000	---	331,000	130,000	105,000	---	---
Between 3 & 4 Dams	---	4,273,000	---	---	2,580,000	2,025,000	---	---	48,000	458,000	---	---
Between 4 & 5 Dams	514,000	3,112,000	---	---	8,520,000	21,938,000	---	---	359,000	355,000	---	---
Between 5 & 6 Dams	---	---	---	---	---	---	---	---	---	---	---	---
Between 6 & 7 Dams	---	---	---	---	840,000	---	---	---	220,000	1,000	---	---
Between 7 & 8 Dams	1,640,000	887,000	---	556,000	---	---	---	---	---	94,000	---	316,000
Between 8 & 9 Dams	6,251,000	16,905,000	1,364,000	14,159,000	360,000	24,000	320,000	232,000	4,472,000	1,885,000	---	460,000
Above Wells and Below Chief Joseph dams	800,000	1,266,000	1,344,000	1,295,000	---	---	---	---	368,000	78,000	---	748,000

¹ Variation assumes that the percentage of production above and below blocked areas is the same proportion now as prior to 1850

TABLE 13 (cont.)

Calculation Parameters

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Ocean Survival	0.02	0.04	0.04	0.08	0.10	0.10
Juvenile Down- stream Survival (per dam passed)	0.80	0.80	0.80	0.80	0.80	0.80
Adult Down- stream Survival (per dam passed)	0.95	0.95	0.95	0.95	0.95	0.95
% Hydropower Loss						
Operational	0.89	0.89	0.89	0.89	0.89	0.89
Above Chief Joseph	0.92	0.92	0.92	0.92	0.92	0.92
Above Hells Canyon	0.50	0.50	0.50	0.50	0.50	0.50

Proportion of Salmon and Steelhead in Blocked Areas in Predevelopment Times

Above Chief Joseph Dam	0.147	0.166	0.140	0.173	0.105	0.647
Above Hells Canyon Dam	0.153	0.342	0.284	0.000	0.146	0.005

TABLE 13 (cont.)

Number of Smolts Produced (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	5,781	0	4,431	2,019	357	0
Between 2 & 3 Dams	2,172	0	2,057	331	235	0
Between 3 & 4 Dams	4,273	0	4,605	0	506	0
Between 4 & 5 Dams	3,626	0	30,458	0	714	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	840	0	221	0
Between 7 & 8 Dams	2,527	556	0	0	94	316
Between 8 & 9 Dams	23,156	15,523	384	552	6,357	460
Above Wells and Below Chief Joseph	2,066	2,639	0	0	446	748
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	43,601	18,718	42,775	2,902	8,930	1,524

All Species Total: 118,450,000

TABLE 13 (cont.)

Smolts to River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	4.625	0	3.545	1.615	286	0
Between 2 & 3 Dams	1.390	0	1,316	212	150	0
Between 3 & 4 Dams	2.188	0	2,358	0	259	0
Between 4 & 5 Dams	1.485	0	12,476	0	292	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	220	0	58	0
Between 7 & 8 Dams	530	117	0	0	20	66
Between 8 & 9 Dams	3,885	2,604	64	93	1,067	77
Above Wells and Below Chief Joseph	277	354	0	0	60	100
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	14,380	3,075	19,979	1,920	2,192	244

All Species Total: 41,789,000

TABLE 13 (cont.)

Number of Adults at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	92	0	142	129	29	0
Between 2 & 3 Dams	28	0	53	17	15	0
Between 3 & 4 Dams	44	0	94	0	26	0
Between 4 & 5 Dams	30	0	499	0	29	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	9	0	6	0
Between 7 & 8 Dams	11	5	0	0	2	7
Between 8 & 9 Dams	78	104	3	7	107	8
Above Wells and Below Chief Joseph	6	14	0	0	6	10
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	288	123	799	154	219	24

All Species Total: 1,607,000

TABLE 13 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	88	0	135	123	27	0
Between 2 & 3 Dams	25	0	48	15	14	0
Between 3 & 4 Dams	38	0	81	0	22	0
Between 4 & 5 Dams	24	0	406	0	24	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	6	0	4	0
Between 7 & 8 Dams	7	3	0	0	1	5
Between 8 & 9 Dams	52	69	2	5	71	5
Above Wells and Below Chief Joseph	3	9	0	0	4	6
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	237	81	678	143	167	16

All Species Total: 1,322,000

TABLE 13 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	116	0	177	162	36	0
Between 2 & 3 Dams	43	0	82	26	24	0
Between 3 & 4 Dams	85	0	184	0	51	0
Between 4 & 5 Dams	73	0	1,218	0	71	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	34	0	22	0
Between 7 & 8 Dams	51	22	0	0	9	32
Between 8 & 9 Dams	463	621	15	44	636	46
Above Wells and Below Chief Joseph	41	106	0	0	45	75
Above Chief Joseph Dam	183	253	416	49	125	283
Above Hells Canyon Dam	191	520	844	0	174	2
Totals:	1,246	1,522	2,970	281	1,192	438

All Species Total: 7,649,000

TABLE 13 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	28	0	43	39	9	0
Between 2 & 3 Dams	18	0	35	11	10	0
Between 3 & 4 Dams	48	0	103	0	28	0
Between 4 & 5 Dams	48	0	812	0	48	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	27	0	18	0
Between 7 & 8 Dams	43	19	0	0	8	27
Between 8 & 9 Dams	412	552	14	39	565	41
Above Wells and Below Chief Joseph	38	97	0	0	41	68
Above Chief Joseph Dam	183	253	416	49	125	283
Above Hells Canyon Dam	191	520	844	0	174	2
Totals:	1,009	1,440	2,293	138	1,025	422

All Species Total: 6,327,000

TABLE 13 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	25	0	38	35	8	0
Between 2 & 3 Dams	16	0	31	10	9	0
Between 3 & 4 Dams	43	0	92	0	25	0
Between 4 & 5 Dams	43	0	723	0	42	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	24	0	16	0
Between 7 & 8 Dams	38	17	0	0	7	24
Between 8 & 9 Dams	366	491	12	35	503	36
Above Wells and Below Chief Joseph	34	86	0	0	36	61
Above Chief Joseph Dam	168	232	383	45	115	261
Above Hells Canyon Dam	95	260	422	0	87	1
Totals:	829	1,087	1,724	124	848	383

All Species Total: 4,995,000

TABLE 14

VARIATION 3:
 STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
 USING PRE-1850 RUN SIZE AS A BASIS¹

Fish Distribution (Percentage)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0.151	0.000	0.248	0.437	0.171	0.000
Between 1 & 2 Dams	0.009	0.000	0.010	0.049	0.022	0.000
Between 2 & 3 Dams	0.033	0.000	0.004	0.000	0.041	0.001
Between 3 & 4 Dams	0.045	0.000	0.004	0.000	0.052	0.000
Between 4 & 5 Dams	0.061	0.018	0.029	0.135	0.061	0.021
Between 5 & 6 Dams	0.000	0.000	0.022	0.000	0.000	0.000
Between 6 & 7 Dams	0.007	0.000	0.064	0.021	0.011	0.000
Between 7 & 8 Dams	0.026	0.012	0.022	0.027	0.011	0.008
Between 8 & 9 Dams	0.325	0.420	0.174	0.139	0.359	0.016
Between 9 & 10 Dams	0.042	0.041	0.000	0.020	0.020	0.303
Above Chief Joseph Dam	0.147	0.166	0.140	0.173	0.105	0.647
Above Hells Canyon Dam	0.153	0.342	0.284	0.000	0.146	0.005

¹ Percent hydropower loss is computed using benefits allocation instead of repayment allocation.

TABLE 14 (cont.)

Calculation Parameters

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Total Adult Production (thousands)	1,449	3,569	1,971	1,342	959	2,722
Ocean Survival	0.02	0.04	0.04	0.08	0.10	0.10
Juvenile Down- stream Survival (per dam passed)	0.80	0.80	0.80	0.80	0.80	0.80
Adult Down- stream Survival (per dam passed)	0.95	0.95	0.95	0.95	0.95	0.95

CALCULATIONS

Number of Adults Without Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
1,449	3,569	1,971	1,342	959	2,722

Number of Smolts Without Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
72,450	89,225	49,275	16,775	9,590	27,220

TABLE 14 (cont.)

Numerical Distribution of Smolts Produced Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	10,940	0	12,220	7,331	1,640	0
Between 1 & 2 Dams	652	0	493	822	211	0
Between 2 & 3 Dams	2,391	0	197	0	393	27
Between 3 & 4 Dams	3,260	0	197	0	499	0
Between 4 & 5 Dams	4,419	1,606	1,429	2,265	585	572
Between 5 & 6 Dams	0	0	1,084	0	0	0
Between 6 & 7 Dams	507	0	3,154	352	105	0
Between 7 & 8 Dams	1,884	1,071	1,084	453	105	218
Between 8 & 9 Dams	23,546	37,475	8,574	2,332	3,443	436
Between 9 & 10 Dams	3,043	3,658	0	336	192	8,248
Above Chief Joseph Dam	10,650	14,811	6,899	2,902	1,007	17,611
Above Hells Canyon Dam	11,085	30,515	13,994	0	1,400	136
Totals:	72,378	89,136	49,324	16,792	9,580	27,247

TABLE 14 (cont.)

Number of Smolts at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	10,940	0	12,220	7,331	1,640	0
Between 1 & 2 Dams	522	0	394	658	169	0
Between 2 & 3 Dams	1,530	0	126	0	252	17
Between 3 & 4 Dams	1,669	0	101	0	255	0
Between 4 & 5 Dams	1,810	658	585	928	240	234
Between 5 & 6 Dams	0	0	355	0	0	0
Between 6 & 7 Dams	133	0	827	92	28	0
Between 7 & 8 Dams	395	225	227	95	22	46
Between 8 & 9 Dams	3,950	6,287	1,438	391	578	73
Between 9 & 10 Dams	408	491	0	45	26	1,107
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	21,358	7,661	16,274	9,539	3,208	1,477

TABLE 14 (cont.)

Number of Adults at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	10	0	16	53	17	0
Between 2 & 3 Dams	31	0	5	0	25	2
Between 3 & 4 Dams	33	0	4	0	26	0
Between 4 & 5 Dams	36	26	23	74	24	23
Between 5 & 6 Dams	0	0	14	0	0	0
Between 6 & 7 Dams	3	0	33	7	3	0
Between 7 & 8 Dams	8	9	9	8	2	5
Between 8 & 9 Dams	79	251	58	31	58	7
Between 9 & 10 Dams	8	20	0	4	3	111
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	427	306	651	763	321	148

TABLE 14 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	10	0	15	50	16	0
Between 2 & 3 Dams	28	0	5	0	23	2
Between 3 & 4 Dams	29	0	3	0	22	0
Between 4 & 5 Dams	29	21	19	60	20	19
Between 5 & 6 Dams	0	0	11	0	0	0
Between 6 & 7 Dams	2	0	24	5	2	0
Between 7 & 8 Dams	6	6	6	5	2	3
Between 8 & 9 Dams	52	167	38	21	38	5
Between 9 & 10 Dams	5	12	0	2	2	70
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	379	207	611	731	288	98

All Species Total: 2,314,000

TABLE 14 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	13	0	20	66	21	0
Between 2 & 3 Dams	48	0	8	0	39	3
Between 3 & 4 Dams	65	0	8	0	50	0
Between 4 & 5 Dams	88	64	57	181	58	57
Between 5 & 6 Dams	0	0	43	0	0	0
Between 6 & 7 Dams	10	0	126	28	11	0
Between 7 & 8 Dams	38	43	43	36	11	22
Between 8 & 9 Dams	471	1,499	343	187	344	44
Between 9 & 10 Dams	61	146	0	27	19	825
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	1,448	3,565	1,973	1,343	958	2,725

All Species Total: 12,012,000

TABLE 14 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Cono</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0	0	0	0	0	0
Between 1 & 2 Dams	3	0	5	16	5	0
Between 2 & 3 Dams	20	0	3	0	17	1
Between 3 & 4 Dams	37	0	4	0	28	0
Between 4 & 5 Dams	59	43	38	121	39	38
Between 5 & 6 Dams	0	0	32	0	0	0
Between 6 & 7 Dams	8	0	102	23	9	0
Between 7 & 8 Dams	32	37	37	31	9	19
Between 8 & 9 Dams	419	1,332	305	166	306	39
Between 9 & 10 Dams	56	134	0	25	18	755
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	1,068	3,359	1,362	613	670	2,626

All Species Total: 9,698,000

TABLE 14 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0	0	0	0	0	0
Between 1 & 2 Dams	3	0	4	15	5	0
Between 2 & 3 Dams	19	0	3	0	16	1
Between 3 & 4 Dams	34	0	4	0	26	0
Between 4 & 5 Dams	55	40	36	113	37	36
Between 5 & 6 Dams	0	0	30	0	0	0
Between 6 & 7 Dams	8	0	96	21	8	0
Between 7 & 8 Dams	30	34	35	29	8	17
Between 8 & 9 Dams	393	1,252	286	156	288	36
Between 9 & 10 Dams	52	126	0	23	17	710
Above Chief Joseph Dam	145	403	188	158	68	1,198
Above Hells Canyon Dam	111	610	280	0	70	7
Totals:	851	2,466	962	516	542	2,005

All Species Total: 7,342,000

TABLE 15

VARIATION 3:
STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
USING CURRENT RUN SIZE AS A BASIS¹

Fish Distribution (Percentage)

Area of Production	Spring Chinook	Summer Chinook	Fall Chinook		Coho	Steelhead	Sockeye
			Hatchery	Natural			
Between 1 & 2 Dams	0.027	0.000	0.260	0.175	0.176	0.047	0.000
Between 2 & 3 Dams	0.128	0.000	0.000	0.234	0.109	0.054	0.000
Between 3 & 4 Dams	0.000	0.000	0.150	0.000	0.031	0.107	0.000
Between 4 & 5 Dams	0.084	0.047	0.510	0.508	0.244	0.095	0.000
Between 5 & 6 Dams	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Between 6 & 7 Dams	0.021	0.000	0.050	0.000	0.000	0.023	0.000
Between 7 & 8 Dams	0.033	0.019	0.000	0.020	0.040	0.022	0.210
Between 8 & 9 Dams	0.654	0.870	0.020	0.063	0.359	0.614	0.296
Between 9 & 10 Dams	0.053	0.064	0.000	0.000	0.046	0.038	0.493
Above Chief Joseph Dam	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Above Hells Canyon Dam	0.000	0.000	0.000	0.000	0.000	0.000	0.000

¹ Percent hydropower loss is computed using benefits allocation instead of repayment allocation.

TABLE 15 (cont.)

Calculation Parameters

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
			<u>Hatchery</u>	<u>Natural</u>			
Total Adult Production (thousands)	92	77	334	360	179	143	58
Ocean Survival	0.02	0.04	0.04	0.04	0.08	0.10	0.10
Juvenile Down- stream Survival (per dam passed)	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adult Down- stream Survival (per dam passed)	0.95	0.95	0.95	0.95	0.95	0.95	0.95

CALCULATIONS

Number of Adults at River Mouth with Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
		<u>Hatchery</u>	<u>Natural</u>			
92	77	334	360	179	143	58

Number of Smolts at River Mouth with Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
		<u>Hatchery</u>	<u>Natural</u>			
4,600	1,925	8,350	9,000	2,238	1,430	580

TABLE 15 (cont.)

Number of Smolts Produced (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	155	0	4,683	492	84	0
Between 2 & 3 Dams	920	0	3,291	381	121	0
Between 3 & 4 Dams	0	0	2,446	135	299	0
Between 4 & 5 Dams	943	221	21,559	1,333	332	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	368	0	1,593	0	125	0
Between 7 & 8 Dams	724	174	858	427	150	581
Between 8 & 9 Dams	17,931	9,982	4,375	4,788	5,233	1,023
Between 9 & 10 Dams	1,816	918	0	767	405	2,130
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	22,859	11,295	38,804	8,323	6,749	3,734

TABLE 15 (cont.)

Number of Smolts at River Mouth Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	155	0	4,683	492	84	0
Between 2 & 3 Dams	920	0	3,291	381	121	0
Between 3 & 4 Dams	0	0	2,446	135	299	0
Between 4 & 5 Dams	943	221	21,559	1,333	332	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	368	0	1,593	0	125	0
Between 7 & 8 Dams	724	174	858	427	150	581
Between 8 & 9 Dams	17,931	9,982	4,375	4,788	5,233	1,023
Between 9 & 10 Dams	1,816	918	0	767	405	2,130
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	22,859	11,295	38,804	8,323	6,749	3,734

TABLE 15 (cont.)

Number of Adults at River Mouth Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Cono</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	3	0	187	39	8	0
Between 2 & 3 Dams	18	0	132	30	12	0
Between 3 & 4 Dams	0	0	98	11	30	0
Between 4 & 5 Dams	19	9	862	107	33	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	7	0	64	0	13	0
Between 7 & 8 Dams	14	7	34	34	15	58
Between 8 & 9 Dams	359	399	175	383	523	102
Between 9 & 10 Dams	36	37	0	61	40	213
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	892	2,265	2,388	898	916	2,148

TABLE 15 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	3	0	187	39	8	0
Between 2 & 3 Dams	18	0	132	30	12	0
Between 3 & 4 Dams	0	0	98	11	30	0
Between 4 & 5 Dams	19	9	862	107	33	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	7	0	64	0	13	0
Between 7 & 8 Dams	14	7	34	34	15	58
Between 8 & 9 Dams	359	399	175	383	523	102
Between 9 & 10 Dams	36	37	0	61	40	213
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	892	2,265	2,388	898	916	2,148

All Species Total: 9,507,000

TABLE 15 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	2	0	142	30	6	0
Between 2 & 3 Dams	11	0	76	18	7	0
Between 3 & 4 Dams	0	0	43	5	13	0
Between 4 & 5 Dams	6	3	288	36	11	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	1	0	12	0	2	0
Between 7 & 8 Dams	2	1	5	5	2	9
Between 8 & 9 Dams	40	44	19	43	58	11
Between 9 & 10 Dams	3	3	0	5	3	18
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	66	52	586	141	104	38

All Species Total: 986,000

TABLE 15 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	1	0	45	9	2	0
Between 2 & 3 Dams	8	0	56	13	5	0
Between 3 & 4 Dams	0	0	55	6	17	0
Between 4 & 5 Dams	13	6	575	71	22	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	6	0	51	0	10	0
Between 7 & 8 Dams	12	6	29	29	13	50
Between 8 & 9 Dams	319	355	156	340	465	91
Between 9 & 10 Dams	33	34	0	56	37	195
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	826	2,213	1,802	757	812	2,111

All Species Total: 8,522,000

TABLE 15 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	1	0	42	9	2	0
Between 2 & 3 Dams	7	0	52	12	5	0
Between 3 & 4 Dams	0	0	52	6	16	0
Between 4 & 5 Dams	12	6	540	67	21	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	6	0	48	0	10	0
Between 7 & 8 Dams	12	6	28	27	12	47
Between 8 & 9 Dams	300	334	146	320	437	85
Between 9 & 10 Dams	31	32	0	53	35	183
Above Chief Joseph Dam	145	403	188	158	69	1,197
Above Hells Canyon Dam	111	611	280	0	70	7
Totals:	624	1,389	1,376	651	675	1,520

All Species Total: 6,236,000

TABLE 16

**VARIATION 3:
STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
USING CURRENT POTENTIAL RUN SIZE AS A BASIS¹**

(Numbers of Smolts Produced by Area)

Areas of Production	Spring Chinook		Summer Chinook		Fall Chinook		Coho		Steelhead		Sockeye	
	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural
Between 1 & 2 Dams	4,917,000	864,000	---	---	4,431,000	---	1,750,000	269,000	160,000	197,000	---	---
Between 2 & 3 Dams	765,000	1,407,000	---	---	---	2,057,000	---	331,000	130,000	105,000	---	---
Between 3 & 4 Dams	---	4,273,000	---	---	2,580,000	2,025,000	---	---	48,000	458,000	---	---
Between 4 & 5 Dams	514,000	3,112,000	---	---	8,520,000	21,938,000	---	---	359,000	355,000	---	---
Between 5 & 6 Dams	---	---	---	---	---	---	---	---	---	---	---	---
Between 6 & 7 Dams	---	---	---	---	840,000	---	---	---	220,000	1,000	---	---
Between 7 & 8 Dams	1,640,000	887,000	---	556,000	---	---	---	---	---	94,000	---	316,000
Between 8 & 9 Dams	6,251,000	16,905,000	1,364,000	14,159,000	360,000	24,000	320,000	232,000	4,472,000	1,885,000	---	460,000
Above Wells and Below Chief Joseph dams	800,000	1,266,000	1,344,000	1,295,000	---	---	---	---	368,000	78,000	---	748,000

¹ Percent hydropower loss is computed using benefits allocation instead of repayment allocation.

TABLE 16 (cont.)

Number of Smolts Produced (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	5.781	0	4.431	2.019	357	0
Between 2 & 3 Dams	2.172	0	2.057	331	235	0
Between 3 & 4 Dams	4.273	0	4.605	0	506	0
Between 4 & 5 Dams	3.626	0	30.458	0	714	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	840	0	221	0
Between 7 & 8 Dams	2.527	556	0	0	94	316
Between 8 & 9 Dams	23.156	15.523	384	552	6.357	460
Above Wells and Below Chief Joseph	2.066	2.639	0	0	446	748
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	43.601	18.718	42.775	2.902	8.930	1.524

All Species Total: 118.450.000

TABLE 16 (cont.)

Smolts to River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	4.625	0	3.545	1.615	286	0
Between 2 & 3 Dams	1.390	0	1.316	212	150	0
Between 3 & 4 Dams	2.188	0	2.358	0	259	0
Between 4 & 5 Dams	1.485	0	12.476	0	292	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	220	0	58	0
Between 7 & 8 Dams	530	117	0	0	20	66
Between 8 & 9 Dams	3.885	2.604	64	93	1,067	77
Above Wells and Below Chief Joseph	277	354	0	0	60	100
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	14.380	3.075	19.979	1.920	2,192	244

All Species Total: 41,789,000

TABLE 16 (cont.)

Number of Adults at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	92	0	142	129	29	0
Between 2 & 3 Dams	28	0	53	17	15	0
Between 3 & 4 Dams	44	0	94	0	26	0
Between 4 & 5 Dams	30	0	499	0	29	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	9	0	6	0
Between 7 & 8 Dams	11	5	0	0	2	7
Between 8 & 9 Dams	78	104	3	7	107	8
Above Wells and Below Chief Joseph	6	14	0	0	6	10
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	288	123	799	154	219	24

All Species Total: 1,607,000

TABLE 16 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	88	0	135	123	27	0
Between 2 & 3 Dams	25	0	48	15	14	0
Between 3 & 4 Dams	38	0	81	0	22	0
Between 4 & 5 Dams	24	0	406	0	24	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	6	0	4	0
Between 7 & 8 Dams	7	3	0	0	1	5
Between 8 & 9 Dams	52	69	2	5	71	5
Above Wells and Below Chief Joseph	3	9	0	0	4	6
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	237	81	678	143	167	16

All Species Total: 1,322,000

TABLE 16 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	116	0	177	162	36	0
Between 2 & 3 Dams	43	0	82	26	24	0
Between 3 & 4 Dams	85	0	184	0	51	0
Between 4 & 5 Dams	73	0	1,218	0	71	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	34	0	22	0
Between 7 & 8 Dams	51	22	0	0	9	32
Between 8 & 9 Dams	463	621	15	44	636	46
Above Wells and Below Chief Joseph	41	106	0	0	45	75
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	1,307	2,562	2,547	464	1,134	1,927

All Species Total: 9,941,000

TABLE 16 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	28	0	43	39	9	0
Between 2 & 3 Dams	18	0	35	11	10	0
Between 3 & 4 Dams	48	0	103	0	28	0
Between 4 & 5 Dams	48	0	812	0	48	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	27	0	18	0
Between 7 & 8 Dams	43	19	0	0	8	27
Between 8 & 9 Dams	412	552	14	39	565	41
Above Wells and Below Chief Joseph	38	97	0	0	41	68
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	1,070	2,480	1,869	321	967	1,911

All Species Total: 8,619,000

TABLE 16 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	26	0	40	36	8	0
Between 2 & 3 Dams	17	0	33	11	9	0
Between 3 & 4 Dams	45	0	97	0	27	0
Between 4 & 5 Dams	45	0	763	0	45	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	25	0	17	0
Between 7 & 8 Dams	41	18	0	0	8	25
Between 8 & 9 Dams	387	519	13	37	531	38
Above Wells and Below Chief Joseph	36	91	0	0	38	64
Above Chief Joseph Dam	145	403	188	158	69	1,197
Above Hells Canyon Dam	111	611	280	0	70	7
Totals:	853	1,640	1,439	242	821	1,333

All Species Total: 6,327,000

TABLE 17

VARIATION 3:
STAFF ESTIMATE OF HYDROPOWER RESPONSIBILITY
USING ALTERNATIVE 2

Total Loss	7-14 million
	X
Percent Hydropower Purpose of Dams	71% ¹
	=
Hydropower Responsibility	5-10 million

¹ Average of benefits allocations of 94 percent for areas currently available to salmon and steelhead, 68 percent for the area above Grand Coulee Dam, and 50 percent for the area above Hells Canyon Dam.

TABLE 18

VARIATION 4:
 STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
 USING PRE-1850 RUN SIZE AS A BASIS¹

Fish Distribution (Percentage)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0.151	0.000	0.248	0.437	0.171	0.000
Between 1 & 2 Dams	0.009	0.000	0.010	0.049	0.022	0.000
Between 2 & 3 Dams	0.033	0.000	0.004	0.000	0.041	0.001
Between 3 & 4 Dams	0.045	0.000	0.004	0.000	0.052	0.000
Between 4 & 5 Dams	0.061	0.018	0.029	0.135	0.061	0.021
Between 5 & 6 Dams	0.000	0.000	0.022	0.000	0.000	0.000
Between 6 & 7 Dams	0.007	0.000	0.064	0.021	0.011	0.000
Between 7 & 8 Dams	0.026	0.012	0.022	0.027	0.011	0.008
Between 8 & 9 Dams	0.325	0.420	0.174	0.139	0.359	0.016
Between 9 & 10 Dams	0.042	0.041	0.000	0.020	0.020	0.303
Above Chief Joseph Dam	0.147	0.166	0.140	0.173	0.105	0.647
Above Hells Canyon Dam	0.153	0.342	0.284	0.000	0.146	0.005

¹ This variation assumes that the percent of operational hydropower loss (that occurring below the blocked areas) is 100 percent because, in theory, the dams could be operated for fish passage if it were not for hydropower.

TABLE 18 (cont.)

Calculation Parameters

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Total Adult Production (thousands)	1,449	3,569	1,971	1,342	959	2,722
Ocean Survival	0.02	0.04	0.04	0.08	0.10	0.10
Juvenile Down- stream Survival (per dam passed)	0.80	0.80	0.80	0.80	0.80	0.80
Adult Down- stream Survival (per dam passed)	0.95	0.95	0.95	0.95	0.95	0.95

CALCULATIONS

Number of Adults Without Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
1,449	3,569	1,971	1,342	959	2,722

Number of Smolts Without Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
72.450	89.225	49.275	16.775	9.590	27.220

TABLE 18 (cont.)

Numerical Distribution of Smolts Produced Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Cono</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	10,940	0	12,220	7,331	1,640	0
Between 1 & 2 Dams	652	0	493	822	211	0
Between 2 & 3 Dams	2,391	0	197	0	393	27
Between 3 & 4 Dams	3,260	0	197	0	499	0
Between 4 & 5 Dams	4,419	1,606	1,429	2,265	585	572
Between 5 & 6 Dams	0	0	1,084	0	0	0
Between 6 & 7 Dams	507	0	3,154	352	105	0
Between 7 & 8 Dams	1,884	1,071	1,084	453	105	218
Between 8 & 9 Dams	23,546	37,475	8,574	2,332	3,443	436
Between 9 & 10 Dams	3,043	3,658	0	336	192	8,248
Above Chief Joseph Dam	10,650	14,811	6,899	2,902	1,007	17,611
Above Hells Canyon Dam	11,085	30,515	13,994	0	1,400	136
Totals:	72,378	89,136	49,324	16,792	9,580	27,247

TABLE 18 (cont.)

Number of Smolts at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	10.940	0	12.220	7.331	1.640	0
Between 1 & 2 Dams	522	0	394	658	169	0
Between 2 & 3 Dams	1.530	0	126	0	252	17
Between 3 & 4 Dams	1.669	0	101	0	255	0
Between 4 & 5 Dams	1.810	658	585	928	240	234
Between 5 & 6 Dams	0	0	355	0	0	0
Between 6 & 7 Dams	133	0	827	92	28	0
Between 7 & 8 Dams	395	225	227	95	22	46
Between 8 & 9 Dams	3.950	6.287	1.438	391	578	73
Between 9 & 10 Dams	408	491	0	45	26	1,107
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	21.358	7,661	16,274	9,539	3,208	1,477

TABLE 18 (cont.)

Number of Adults at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	10	0	16	53	17	0
Between 2 & 3 Dams	31	0	5	0	25	2
Between 3 & 4 Dams	33	0	4	0	26	0
Between 4 & 5 Dams	36	26	23	74	24	23
Between 5 & 6 Dams	0	0	14	0	0	0
Between 6 & 7 Dams	3	0	33	7	3	0
Between 7 & 8 Dams	8	9	9	8	2	5
Between 8 & 9 Dams	79	251	58	31	58	7
Between 9 & 10 Dams	8	20	0	4	3	111
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	427	306	651	763	321	148

TABLE 18 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	10	0	15	50	16	0
Between 2 & 3 Dams	28	0	5	0	23	2
Between 3 & 4 Dams	29	0	3	0	22	0
Between 4 & 5 Dams	29	21	19	60	20	19
Between 5 & 6 Dams	0	0	11	0	0	0
Between 6 & 7 Dams	2	0	24	5	2	0
Between 7 & 8 Dams	6	6	6	5	2	3
Between 8 & 9 Dams	52	167	38	21	38	5
Between 9 & 10 Dams	5	12	0	2	2	70
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	379	207	611	731	288	98

All Species Total: 2,314,000

TABLE 18 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	13	0	20	66	21	0
Between 2 & 3 Dams	48	0	8	0	39	3
Between 3 & 4 Dams	65	0	8	0	50	0
Between 4 & 5 Dams	88	64	57	181	58	57
Between 5 & 6 Dams	0	0	43	0	0	0
Between 6 & 7 Dams	10	0	126	28	11	0
Between 7 & 8 Dams	38	43	43	36	11	22
Between 8 & 9 Dams	471	1,499	343	187	344	44
Between 9 & 10 Dams	61	146	0	27	19	825
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	1,448	3,565	1,973	1,343	958	2,725

All Species Total: 12,012,000

TABLE 18 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0	0	0	0	0	0
Between 1 & 2 Dams	3	0	5	16	5	0
Between 2 & 3 Dams	20	0	3	0	17	1
Between 3 & 4 Dams	37	0	4	0	28	0
Between 4 & 5 Dams	59	43	38	121	39	38
Between 5 & 6 Dams	0	0	32	0	0	0
Between 6 & 7 Dams	8	0	102	23	9	0
Between 7 & 8 Dams	32	37	37	31	9	19
Between 8 & 9 Dams	419	1,332	305	166	306	39
Between 9 & 10 Dams	56	134	0	25	18	755
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	1,068	3,359	1,362	613	670	2,626

All Species Total: 9,698,000

TABLE 18 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0	0	0	0	0	0
Between 1 & 2 Dams	3	0	5	16	5	0
Between 2 & 3 Dams	20	0	3	0	17	1
Between 3 & 4 Dams	37	0	4	0	28	0
Between 4 & 5 Dams	59	43	38	121	39	38
Between 5 & 6 Dams	0	0	32	0	0	0
Between 6 & 7 Dams	8	0	102	23	9	0
Between 7 & 8 Dams	32	37	37	31	9	19
Between 8 & 9 Dams	419	1,332	305	166	306	39
Between 9 & 10 Dams	56	134	0	25	18	755
Above Chief Joseph Dam	196	545	254	214	93	1,620
Above Hells Canyon Dam	111	610	280	0	70	7
Totals:	940	2,701	1,060	594	592	2,479

All Species Total: 8,366,000

TABLE 19

VARIATION 4:
STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
USING CURRENT RUN SIZE AS A BASIS¹

Fish Distribution (Percentage)

Area of Production	Spring Chinook	Summer Chinook	Fall Chinook		Coho	Steelhead	Sockeye
			Hatchery	Natural			
Between 1 & 2 Dams	0.027	0.000	0.260	0.175	0.176	0.047	0.000
Between 2 & 3 Dams	0.128	0.000	0.000	0.234	0.109	0.054	0.000
Between 3 & 4 Dams	0.000	0.000	0.150	0.000	0.031	0.107	0.000
Between 4 & 5 Dams	0.084	0.047	0.510	0.508	0.244	0.095	0.000
Between 5 & 6 Dams	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Between 6 & 7 Dams	0.021	0.000	0.050	0.000	0.000	0.023	0.000
Between 7 & 8 Dams	0.033	0.019	0.000	0.020	0.040	0.022	0.210
Between 8 & 9 Dams	0.654	0.870	0.020	0.063	0.359	0.614	0.296
Between 9 & 10 Dams	0.053	0.064	0.000	0.000	0.046	0.038	0.493
Above Chief Joseph Dam	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Above Hells Canyon Dam	0.000	0.000	0.000	0.000	0.000	0.000	0.000

¹ This variation assumes that the percent of operational hydropower loss (that occurring below the blocked ares) is 100 percent because, in theory, the dams could be operated for fish passage if it were not for hydropower.

TABLE 19 (cont.)

Calculation Parameters

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
			<u>Hatchery</u>	<u>Natural</u>			
Total Adult Production (thousands)	92	77	334	360	179	143	58
Ocean Survival	0.02	0.04	0.04	0.04	0.08	0.10	0.10
Juvenile Down- stream Survival (per dam passed)	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adult Down- stream Survival (per dam passed)	0.95	0.95	0.95	0.95	0.95	0.95	0.95

CALCULATIONS

Number of Adults at River Mouth with Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
		<u>Hatchery</u>	<u>Natural</u>			
92	77	334	360	179	143	58

Number of Smolts at River Mouth with Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
		<u>Hatchery</u>	<u>Natural</u>			
4.600	1.925	8.350	9.000	2.238	1.430	580

TABLE 19 (cont.)

Number of Smolts Produced (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	155	0	4.683	492	84	0
Between 2 & 3 Dams	920	0	3.291	381	121	0
Between 3 & 4 Dams	0	0	2.446	135	299	0
Between 4 & 5 Dams	943	221	21.559	1,333	332	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	368	0	1,593	0	125	0
Between 7 & 8 Dams	724	174	858	427	150	581
Between 8 & 9 Dams	17,931	9,982	4,375	4,788	5,233	1,023
Between 9 & 10 Dams	1,816	918	0	767	405	2,130
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	22,859	11,295	38,804	8,323	6,749	3,734

TABLE 19 (cont.)

Number of Smolts at River Mouth Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	155	0	4,683	492	84	0
Between 2 & 3 Dams	920	0	3,291	381	121	0
Between 3 & 4 Dams	0	0	2,446	135	299	0
Between 4 & 5 Dams	943	221	21,559	1,333	332	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	368	0	1,593	0	125	0
Between 7 & 8 Dams	724	174	858	427	150	581
Between 8 & 9 Dams	17,931	9,982	4,375	4,788	5,233	1,023
Between 9 & 10 Dams	1,816	918	0	767	405	2,130
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	22,859	11,295	38,804	8,323	6,749	3,734

TABLE 19 (cont.)

Number of Adults at River Mouth Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	3	0	187	39	8	0
Between 2 & 3 Dams	18	0	132	30	12	0
Between 3 & 4 Dams	0	0	98	11	30	0
Between 4 & 5 Dams	19	9	862	107	33	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	7	0	64	0	13	0
Between 7 & 8 Dams	14	7	34	34	15	58
Between 8 & 9 Dams	359	399	175	383	523	102
Between 9 & 10 Dams	36	37	0	61	40	213
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	892	2,265	2,388	898	916	2,148

TABLE 19 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	3	0	187	39	8	0
Between 2 & 3 Dams	18	0	132	30	12	0
Between 3 & 4 Dams	0	0	98	11	30	0
Between 4 & 5 Dams	19	9	862	107	33	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	7	0	64	0	13	0
Between 7 & 8 Dams	14	7	34	34	15	58
Between 8 & 9 Dams	359	399	175	383	523	102
Between 9 & 10 Dams	36	37	0	61	40	213
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	892	2,265	2,388	898	916	2,148

All Species Total: 9,507,000

TABLE 19 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	2	0	142	30	6	0
Between 2 & 3 Dams	11	0	76	18	7	0
Between 3 & 4 Dams	0	0	43	5	13	0
Between 4 & 5 Dams	6	3	288	36	11	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	1	0	12	0	2	0
Between 7 & 8 Dams	2	1	5	5	2	9
Between 8 & 9 Dams	40	44	19	43	58	11
Between 9 & 10 Dams	3	3	0	5	3	18
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	66	52	586	141	104	38

All Species Total: 986,000

TABLE 19 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	1	0	45	9	2	0
Between 2 & 3 Dams	8	0	56	13	5	0
Between 3 & 4 Dams	0	0	55	6	17	0
Between 4 & 5 Dams	13	6	575	71	22	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	6	0	51	0	10	0
Between 7 & 8 Dams	12	6	29	29	13	50
Between 8 & 9 Dams	319	355	156	340	465	91
Between 9 & 10 Dams	33	34	0	56	37	195
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	826	2,213	1,802	757	812	2,111

All Species Total: 8,522,000

TABLE 19 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	1	0	45	9	2	0
Between 2 & 3 Dams	8	0	56	13	5	0
Between 3 & 4 Dams	0	0	55	6	17	0
Between 4 & 5 Dams	13	6	575	71	22	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	6	0	51	0	10	0
Between 7 & 8 Dams	12	6	29	29	13	50
Between 8 & 9 Dams	319	355	156	340	465	91
Between 9 & 10 Dams	33	34	0	56	37	195
Above Chief Joseph Dam	196	545	254	213	93	1,620
Above Hells Canyon Dam	111	611	280	0	70	7
Totals:	698	1,555	1,500	739	734	1,963

All Species Total: 7,189,000

**VARIATION 4:
STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
USING CURRENT POTENTIAL RUN SIZE AS A BASIS¹**

(Numbers of Smolts Produced by Area)

Areas of Production	Spring Chinook		Summer Chinook		Fall Chinook		Coho		Steelhead		Sockeye	
	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural
Between 1 & 2 Dams	4,917,000	864,000	---	---	4,431,000	---	1,750,000	269,000	160,000	197,000	---	---
Between 2 & 3 Dams	765,000	1,407,000	---	---	---	2,057,000	---	331,000	130,000	105,000	---	---
Between 3 & 4 Dams	---	4,273,000	---	---	2,580,000	2,025,000	---	---	48,000	458,000	---	---
Between 4 & 5 Dams	514,000	3,112,000	---	---	8,520,000	21,938,000	---	---	359,000	355,000	---	---
Between 5 & 6 Dams	---	---	---	---	---	---	---	---	---	---	---	---
Between 6 & 7 Dams	---	---	---	---	840,000	---	---	---	220,000	1,000	---	---
Between 7 & 8 Dams	1,640,000	887,000	---	556,000	---	---	---	---	---	94,000	---	316,000
Between 8 & 9 Dams	6,251,000	16,905,000	1,364,000	14,159,000	360,000	24,000	320,000	232,000	4,472,000	1,885,000	---	460,000
Above Wells and Below Chief Joseph dams	800,000	1,266,000	1,344,000	1,295,000	---	---	---	---	368,000	78,000	---	748,000

¹ This variation assumes that the percent of operational hydropower loss (that occurring below the blocked areas) is 100 percent because, in theory, the dams could be operated for fish passage if it were not for hydropower

TABLE 20 (cont.)

Number of Smolts Produced (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	5.781	0	4.431	2.019	357	0
Between 2 & 3 Dams	2.172	0	2.057	331	235	0
Between 3 & 4 Dams	4.273	0	4.605	0	506	0
Between 4 & 5 Dams	3.626	0	30.458	0	714	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	840	0	221	0
Between 7 & 8 Dams	2.527	556	0	0	94	316
Between 8 & 9 Dams	23.156	15.523	384	552	6.357	460
Above Wells and Below Chief Joseph	2.066	2.639	0	0	446	748
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	43.601	18.718	42.775	2.902	8.930	1,524

All Species Total: 118,450,000

TABLE 20 (cont.)

Smolts to River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	4.625	0	3,345	1,615	286	0
Between 2 & 3 Dams	1,390	0	1,316	212	150	0
Between 3 & 4 Dams	2,188	0	2,358	0	259	0
Between 4 & 5 Dams	1,485	0	12,476	0	292	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	220	0	58	0
Between 7 & 8 Dams	530	117	0	0	20	66
Between 8 & 9 Dams	3,885	2,604	64	93	1,067	77
Above Wells and Below Chief Joseph	277	354	0	0	60	100
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	14,380	3,075	19,979	1,920	2,192	244
All Species Total: 41,789,000						

TABLE 20 (cont.)

Number of Adults at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	92	0	142	129	29	0
Between 2 & 3 Dams	28	0	53	17	15	0
Between 3 & 4 Dams	44	0	94	0	26	0
Between 4 & 5 Dams	30	0	499	0	29	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	9	0	6	0
Between 7 & 8 Dams	11	5	0	0	2	7
Between 8 & 9 Dams	78	104	3	7	107	8
Above Wells and Below Chief Joseph	6	14	0	0	6	10
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	288	123	799	154	219	24

All Species Total: 1,607,000

TABLE 20 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	88	0	135	123	27	0
Between 2 & 3 Dams	25	0	48	15	14	0
Between 3 & 4 Dams	38	0	81	0	22	0
Between 4 & 5 Dams	24	0	406	0	24	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	6	0	4	0
Between 7 & 8 Dams	7	3	0	0	1	5
Between 8 & 9 Dams	52	69	2	5	71	5
Above Wells and Below Chief Joseph	3	9	0	0	4	6
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	237	81	678	143	167	16

All Species Total: 1,322,000

TABLE 20 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	116	0	177	162	36	0
Between 2 & 3 Dams	43	0	82	26	24	0
Between 3 & 4 Dams	85	0	184	0	51	0
Between 4 & 5 Dams	73	0	1,218	0	71	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	34	0	22	0
Between 7 & 8 Dams	51	22	0	0	9	32
Between 8 & 9 Dams	463	621	15	44	636	46
Above Wells and Below Chief Joseph	41	106	0	0	45	75
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	1,307	2,562	2,547	464	1,134	1,927

All Species Total: 9,941,000

TABLE 20 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	28	0	43	39	9	0
Between 2 & 3 Dams	18	0	35	11	10	0
Between 3 & 4 Dams	48	0	103	0	28	0
Between 4 & 5 Dams	48	0	812	0	48	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	27	0	18	0
Between 7 & 8 Dams	43	19	0	0	8	27
Between 8 & 9 Dams	412	552	14	39	565	41
Above Wells and Below Chief Joseph	38	97	0	0	41	68
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	1,070	2,480	1,869	321	967	1,911

All Species Total: 8,619,000

TABLE 20 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	28	0	43	39	9	0
Between 2 & 3 Dams	18	0	35	11	10	0
Between 3 & 4 Dams	48	0	103	0	28	0
Between 4 & 5 Dams	48	0	812	0	48	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	27	0	18	0
Between 7 & 8 Dams	43	19	0	0	8	27
Between 8 & 9 Dams	412	552	14	39	565	41
Above Wells and Below Chief Joseph	38	97	0	0	41	68
Above Chief Joseph Dam	196	545	254	213	93	1,620
Above Hells Canyon Dam	111	611	280	0	70	7
Totals:	942	1,823	1,567	303	889	1,763

All Species Total: 7,287,000

TABLE 21

**VARIATION 4:
STAFF ESTIMATE OF HYDROPOWER RESPONSIBILITY
USING ALTERNATIVE 2**

Total Loss	7-14 million
	X
Percent Hydropower Purpose of Dam	81% ¹
	=
Hydropower Responsibility	6-11 million

¹ Average of repayment allocations of 92 percent for the area above Grand Coulee Dam and 50 percent for the area above Hells Canyon Dam, and assuming 100 percent hydropower purpose for the area currently available to salmon and steelhead.

TABLE 22

VARIATION 5:
STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
USING PRE-1850 RUN SIZE AS A BASIS¹

Fish Distribution (Percentage)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0.151	0.000	0.248	0.437	0.171	0.000
Between 1 & 2 Dams	0.009	0.000	0.010	0.049	0.022	0.000
Between 2 & 3 Dams	0.033	0.000	0.004	0.000	0.041	0.001
Between 3 & 4 Dams	0.045	0.000	0.004	0.000	0.052	0.000
Between 4 & 5 Dams	0.061	0.018	0.029	0.135	0.061	0.021
Between 5 & 6 Dams	0.000	0.000	0.022	0.000	0.000	0.000
Between 6 & 7 Dams	0.007	0.000	0.064	0.021	0.011	0.000
Between 7 & 8 Dams	0.026	0.012	0.022	0.027	0.011	0.008
Between 8 & 9 Dams	0.325	0.420	0.174	0.139	0.359	0.016
Between 9 & 10 Dams	0.042	0.041	0.000	0.020	0.020	0.303
Above Chief Joseph Dam	0.147	0.166	0.140	0.173	0.105	0.647
Above Hells Canyon Dam	0.153	0.342	0.284	0.000	0.146	0.005

¹ This variation assumes a natural downstream and upstream mortality without dams. Mortality is assumed to be two percent for downstream migrants and one percent for upstream migrants per each section of the river where dams now stand.

TABLE 22 (cont.)

Calculation Parameters

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Total Adult Production (thousands)	1,449	3,569	1,971	1,342	959	2,722
Ocean Survival	0.02	0.04	0.04	0.08	0.10	0.10
Juvenile Down- stream Survival (per dam passed)	0.80	0.80	0.80	0.80	0.80	0.80
Adult Down- stream Survival (per dam passed)	0.95	0.95	0.95	0.95	0.95	0.95

CALCULATIONS

Number of Adults Without Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
1,449	3,569	1,971	1,342	959	2,722

Number of Smolts Without Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
72,450	89,225	49,275	16,775	9,590	27,220

TABLE 22 (cont.)

Numerical Distribution of Smolts (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Conc</u>	<u>Steelhead</u>	<u>Socketve</u>
Below Bonneville	10.940	0	12.220	7.331	1.640	0
Between 1 & 2 Dams	652	0	493	822	211	0
Between 2 & 3 Dams	2.391	0	197	0	393	27
Between 3 & 4 Dams	3.260	0	197	0	499	0
Between 4 & 5 Dams	4.419	1.606	1.429	2.265	585	572
Between 5 & 6 Dams	0	0	1,084	0	0	0
Between 6 & 7 Dams	507	0	3,154	352	105	0
Between 7 & 8 Dams	1,884	1,071	1,084	453	105	218
Between 8 & 9 Dams	23,546	37,475	8,574	2,332	3,443	436
Between 9 & 10 Dams	3,043	3,658	0	336	192	8,248
Above Chief Joseph Dam	10,650	14,811	6,899	2,902	1,007	17,611
Above Hells Canyon Dam	11,085	30,515	13,994	0	1,400	136
Totals:	72,378	89,136	49,324	16,792	9,580	27,247

TABLE 22 (cont.)

Number of Smolts at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	10,940	0	12,220	7,331	1,640	0
Between 1 & 2 Dams	522	0	394	658	169	0
Between 2 & 3 Dams	1,530	0	126	0	252	17
Between 3 & 4 Dams	1,669	0	101	0	255	0
Between 4 & 5 Dams	1,810	658	585	928	240	234
Between 5 & 6 Dams	0	0	355	0	0	0
Between 6 & 7 Dams	133	0	827	92	28	0
Between 7 & 8 Dams	395	225	227	95	22	46
Between 8 & 9 Dams	3,950	6,287	1,438	391	578	73
Between 9 & 10 Dams	408	491	0	45	26	1,107
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	21,358	7,661	16,274	9,539	3,208	1,477

TABLE 22 (cont.)

Number of Smolts at River Mouth Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	10.940	0	12.220	7 331	1,640	0
Between 1 & 2 Dams	639	0	483	806	207	0
Between 2 & 3 Dams	2.296	0	189	0	378	26
Between 3 & 4 Dams	3.069	0	186	0	469	0
Between 4 & 5 Dams	4.076	1,481	1,318	2,089	540	527
Between 5 & 6 Dams	0	0	980	0	0	0
Between 6 & 7 Dams	449	0	2,794	312	93	0
Between 7 & 8 Dams	1,635	930	941	393	92	189
Between 8 & 9 Dams	20.032	31,882	7,294	1,984	2,929	371
Between 9 & 10 Dams	2,537	3,050	0	280	160	6,876
Above Chief Joseph Dam	8,702	12,102	5,637	2,371	823	14,390
Above Hells Canyon Dam	9,242	25,442	11,668	0	1,167	113
<hr/>						
Totals:	63,618	74,887	43,709	15,565	8,497	22,493

TABLE 22 (cont.)

Number of Adults at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	10	0	16	53	17	0
Between 2 & 3 Dams	31	0	5	0	25	2
Between 3 & 4 Dams	33	0	4	0	26	0
Between 4 & 5 Dams	36	26	23	74	24	23
Between 5 & 6 Dams	0	0	14	0	0	0
Between 6 & 7 Dams	3	0	33	7	3	0
Between 7 & 8 Dams	8	9	9	8	2	5
Between 8 & 9 Dams	79	251	58	31	58	7
Between 9 & 10 Dams	8	20	0	4	3	111
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	427	306	651	763	321	148

TABLE 22 (cont.)

Number of Adults at River Mouth Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	13	0	19	64	21	0
Between 2 & 3 Dams	46	0	8	0	38	3
Between 3 & 4 Dams	61	0	7	0	47	0
Between 4 & 5 Dams	82	59	53	167	54	53
Between 5 & 6 Dams	0	0	39	0	0	0
Between 6 & 7 Dams	9	0	112	25	9	0
Between 7 & 8 Dams	33	37	38	31	9	19
Between 8 & 9 Dams	401	1,275	292	159	293	37
Between 9 & 10 Dams	51	122	0	22	16	688
Above Chief Joseph Dam	174	484	225	190	82	1,439
Above Hells Canyon Dam	185	1,018	467	0	117	11
Totals:	1,272	2,995	1,748	1,245	850	2,249

TABLE 22 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	10	0	15	50	16	0
Between 2 & 3 Dams	28	0	5	0	23	2
Between 3 & 4 Dams	29	0	3	0	22	0
Between 4 & 5 Dams	29	21	19	60	20	19
Between 5 & 6 Dams	0	0	11	0	0	0
Between 6 & 7 Dams	2	0	24	5	2	0
Between 7 & 8 Dams	6	6	6	5	2	3
Between 8 & 9 Dams	52	167	38	21	38	5
Between 9 & 10 Dams	5	12	0	2	2	70
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	379	207	611	731	288	98

All Species Total: 2,314,000

TABLE 22 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Cono</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	13	0	19	64	20	0
Between 2 & 3 Dams	45	0	7	0	37	3
Between 3 & 4 Dams	60	0	7	0	46	0
Between 4 & 5 Dams	78	57	51	161	52	51
Between 5 & 6 Dams	0	0	37	0	0	0
Between 6 & 7 Dams	8	0	105	24	9	0
Between 7 & 8 Dams	30	35	35	29	9	18
Between 8 & 9 Dams	370	1,177	269	146	270	34
Between 9 & 10 Dams	46	111	0	20	15	628
Above Chief Joseph Dam	157	438	204	172	74	1,301
Above Hells Canyon Dam	169	930	426	0	107	10
Totals:	1,196	2,747	1,650	1,202	802	2,045

All Species Total: 9,642,000

TABLE 22 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0	0	0	0	0	0
Between 1 & 2 Dams	3	0	4	14	4	0
Between 2 & 3 Dams	17	0	3	0	14	1
Between 3 & 4 Dams	31	0	4	0	24	0
Between 4 & 5 Dams	49	35	32	100	32	32
Between 5 & 6 Dams	0	0	26	0	0	0
Between 6 & 7 Dams	7	0	81	18	7	0
Between 7 & 8 Dams	25	28	29	24	7	14
Between 8 & 9 Dams	317	1,010	231	126	232	29
Between 9 & 10 Dams	41	99	0	18	13	558
Above Chief Joseph Dam	157	438	204	172	74	1,301
Above Hells Canyon Dam	169	930	426	0	107	10
Totals:	816	2,540	1,040	471	514	1,946

All Species Total: 7,328,000

TABLE 22 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0	0	0	0	0	0
Between 1 & 2 Dams	2	0	4	12	4	0
Between 2 & 3 Dams	15	0	3	0	13	1
Between 3 & 4 Dams	28	0	3	0	21	0
Between 4 & 5 Dams	43	32	28	89	29	28
Between 5 & 6 Dams	0	0	23	0	0	0
Between 6 & 7 Dams	6	0	72	16	6	0
Between 7 & 8 Dams	22	25	26	21	6	13
Between 8 & 9 Dams	282	899	206	112	206	26
Between 9 & 10 Dams	37	88	0	16	12	497
Above Chief Joseph Dam	145	403	188	158	68	1,197
Above Hells Canyon Dam	84	465	213	0	53	5
Totals:	665	1,911	765	425	418	1,767

All Species Total: 5,952,000

TABLE 23

VARIATION 5:
STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
USING CURRENT RUN SIZE AS A BASIS¹

Fish Distribution (Percentage)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
			<u>Hatchery</u>	<u>Natural</u>			
Between 1 & 2 Dams	0.027	0.000	0.260	0.175	0.176	0.047	0.000
Between 2 & 3 Dams	0.128	0.000	0.000	0.234	0.109	0.054	0.000
Between 3 & 4 Dams	0.000	0.000	0.150	0.000	0.031	0.107	0.000
Between 4 & 5 Dams	0.084	0.047	0.510	0.508	0.244	0.095	0.000
Between 5 & 6 Dams	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Between 6 & 7 Dams	0.021	0.000	0.050	0.000	0.000	0.023	0.000
Between 7 & 8 Dams	0.033	0.019	0.000	0.020	0.040	0.022	0.210
Between 8 & 9 Dams	0.654	0.870	0.020	0.063	0.359	0.614	0.296
Between 9 & 10 Dams	0.053	0.064	0.000	0.000	0.046	0.038	0.493
Above Chief Joseph Dam	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Above Hells Canyon Dam	0.000	0.000	0.000	0.000	0.000	0.000	0.000

¹ This variation assumes a natural downstream and upstream mortality without dams. Mortality is assumed to be two percent for downstream migrants and one percent for upstream migrants per each section of the river where dams now stand.

TABLE 23 (cont.)

Calculation Parameters

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
			<u>Hatchery</u>	<u>Natural</u>			
Total Adult Production (thousands)	92	77	334	360	179	143	58
Ocean Survival	0.02	0.04	0.04	0.04	0.08	0.10	0.10
Juvenile Down- stream Survival (per dam passed)	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adult Down- stream Survival (per dam passed)	0.95	0.95	0.95	0.95	0.95	0.95	0.95

CALCULATIONS

Number of Adults at River Mouth with Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
		<u>Hatchery</u>	<u>Natural</u>			
92	77	334	360	179	143	58

Number of Smolts at River Mouth with Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
		<u>Hatchery</u>	<u>Natural</u>			
4.600	1.925	8.350	9.000	2.238	1.430	580

TABLE 23 (cont.)

Number of Smolts Produced (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	155	0	4.683	492	84	0
Between 2 & 3 Dams	920	0	3.291	381	121	0
Between 3 & 4 Dams	0	0	2.446	135	299	0
Between 4 & 5 Dams	943	221	21.559	1,333	332	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	368	0	1.593	0	125	0
Between 7 & 8 Dams	724	174	858	427	150	581
Between 8 & 9 Dams	17.931	9.982	4.375	4.788	5.233	1.023
Between 9 & 10 Dams	1.816	918	0	767	405	2,130
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	22.859	11.295	38.804	8.323	6.749	3,734

TABLE 23 (cont.)

Number of Smolts at River Mouth Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	152	0	4.589	482	82	0
Between 2 & 3 Dams	884	0	3.160	366	116	0
Between 3 & 4 Dams	0	0	2.302	128	281	0
Between 4 & 5 Dams	870	204	19.885	1.229	306	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	326	0	1,411	0	111	0
Between 7 & 8 Dams	628	151	745	370	130	504
Between 8 & 9 Dams	15,255	8,493	3,722	4,073	4,452	871
Between 9 & 10 Dams	1,514	765	0	639	338	1,776
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	19,631	9,613	35.815	7,288	5,817	3,151

TABLE 23 (cont.)

Number of Adults at River Mouth Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	3	0	184	39	8	0
Between 2 & 3 Dams	18	0	126	29	12	0
Between 3 & 4 Dams	0	0	92	10	28	0
Between 4 & 5 Dams	17	8	795	98	31	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	7	0	56	0	11	0
Between 7 & 8 Dams	13	6	30	30	13	50
Between 8 & 9 Dams	305	340	149	326	445	87
Between 9 & 10 Dams	30	31	0	51	34	178
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	393	385	1,433	583	582	315

TABLE 23 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	3	0	182	38	8	0
Between 2 & 3 Dams	17	0	124	29	11	0
Between 3 & 4 Dams	0	0	89	10	27	0
Between 4 & 5 Dams	17	8	764	94	29	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	6	0	53	0	10	0
Between 7 & 8 Dams	12	6	28	28	12	47
Between 8 & 9 Dams	282	313	137	301	411	80
Between 9 & 10 Dams	28	28	0	47	31	162
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	799	2,168	2,213	778	781	2,065

All Species Total: 8,805,000

TABLE 23 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Cono</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	2	0	142	30	6	0
Between 2 & 3 Dams	11	0	76	18	7	0
Between 3 & 4 Dams	0	0	43	5	13	0
Between 4 & 5 Dams	6	3	288	36	11	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	1	0	12	0	2	0
Between 7 & 8 Dams	2	1	5	5	2	9
Between 8 & 9 Dams	40	44	19	43	58	11
Between 9 & 10 Dams	3	3	0	5	3	18
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	66	52	586	141	104	38

All Species Total: 986.000

TABLE 23 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	1	0	39	8	2	0
Between 2 & 3 Dams	7	0	48	11	4	0
Between 3 & 4 Dams	0	0	46	5	14	0
Between 4 & 5 Dams	10	5	476	59	18	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	5	0	41	0	8	0
Between 7 & 8 Dams	10	5	23	23	10	38
Between 8 & 9 Dams	242	269	118	258	353	69
Between 9 & 10 Dams	25	25	0	42	27	144
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	733	2,116	1,628	638	678	2,027

All Species Total: 7,819,000

TABLE 23 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	1	0	35	7	2	0
Between 2 & 3 Dams	6	0	43	10	4	0
Between 3 & 4 Dams	0	0	41	5	13	0
Between 4 & 5 Dams	9	4	424	52	16	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	4	0	36	0	7	0
Between 7 & 8 Dams	9	4	20	20	9	34
Between 8 & 9 Dams	215	239	105	230	314	61
Between 9 & 10 Dams	22	22	0	37	24	128
Above Chief Joseph Dam	196	545	254	213	93	1,620
Above Hells Canyon Dam	111	611	280	0	70	7
Totals:	572	1,425	1,238	574	552	1,851

All Species Total: 6,213,000

**VARIATION 5:
STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
USING CURRENT POTENTIAL RUN SIZE AS A BASIS¹**

(Numbers of Smolts Produced by Area)

Areas of Production	Spring Chinook		Summer Chinook		Fall Chinook		Coho		Steelhead		Sockeye	
	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural
Between 1 & 2 Dams	4,917,000	864,000	---	---	4,431,000	---	1,750,000	269,000	160,000	197,000	---	---
Between 2 & 3 Dams	765,000	1,407,000	---	---	---	2,057,000	---	331,000	130,000	105,000	---	---
Between 3 & 4 Dams	---	4,273,000	---	---	2,580,000	2,025,000	---	---	48,000	456,000	---	---
Between 4 & 5 Dams	514,000	3,112,000	---	---	8,520,000	21,938,000	---	---	359,000	355,000	---	---
Between 5 & 6 Dams	---	---	---	---	---	---	---	---	---	---	---	---
Between 6 & 7 Dams	---	---	---	---	840,000	---	---	---	220,000	1,000	---	---
Between 7 & 8 Dams	1,640,000	887,000	---	556,000	---	---	---	---	---	94,000	---	316,000
Between 8 & 9 Dams	6,251,000	16,905,000	1,364,000	14,159,000	360,000	24,000	320,000	232,000	4,472,000	1,885,000	---	460,000
Above Wells and Below Chief Joseph dams	800,000	1,266,000	1,344,000	1,295,000	---	---	---	---	368,000	78,000	---	748,000

¹ This variation assumes a natural downstream and upstream mortality without dams. Mortality is assumed to be two percent for downstream migrants and one percent for upstream migrants per each section of the river where dams now stand.

TABLE 24 (cont.)

Number of Smolts Produced (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	5,781	0	4,431	2,019	357	0
Between 2 & 3 Dams	2,172	0	2,057	331	235	0
Between 3 & 4 Dams	4,273	0	4,605	0	506	0
Between 4 & 5 Dams	3,626	0	30,458	0	714	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	840	0	221	0
Between 7 & 8 Dams	2,527	556	0	0	94	316
Between 8 & 9 Dams	23,156	15,523	384	552	6,357	460
Above Wells and Below Chief Joseph	2,066	2,639	0	0	446	748
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	43,601	18,718	42,775	2,902	8,930	1,524

All Species Total: 118,450,000

TABLE 24 (cont.)

Smolts to River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	4,625	0	3,545	1,615	286	0
Between 2 & 3 Dams	1,390	0	1,316	212	150	0
Between 3 & 4 Dams	2,188	0	2,358	0	259	0
Between 4 & 5 Dams	1,485	0	12,476	0	292	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	220	0	58	0
Between 7 & 8 Dams	530	117	0	0	20	66
Between 8 & 9 Dams	3,885	2,604	64	93	1,067	77
Above Wells and Below Chief Joseph	277	354	0	0	60	100
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	14,380	3,075	19,979	1,920	2,192	244

All Species Total: 41,789,000

TABLE 24 (cont.)

Smolts to River Mouth Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	5.665	0	4.342	1.979	350	0
Between 2 & 3 Dams	2.086	0	1.976	318	226	0
Between 3 & 4 Dams	4.022	0	4.334	0	476	0
Between 4 & 5 Dams	3.345	0	28.093	0	659	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	744	0	196	0
Between 7 & 8 Dams	2.194	483	0	0	82	274
Between 8 & 9 Dams	19.700	13.206	327	470	5.408	391
Above Wells and Below Chief Josephn	1.723	2.200	0	0	372	624
Above Chief Josephn Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	38.734	15.889	39.816	2.766	7.768	1.289

All Species Total: 106.263.000

TABLE 24 (cont.)

Number of Adults at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	92	0	142	129	29	0
Between 2 & 3 Dams	28	0	53	17	15	0
Between 3 & 4 Dams	44	0	94	0	26	0
Between 4 & 5 Dams	30	0	499	0	29	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	9	0	6	0
Between 7 & 8 Dams	11	5	0	0	2	7
Between 8 & 9 Dams	78	104	3	7	107	8
Above Wells and Below Chief Joseph	6	14	0	0	6	10
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	288	123	799	154	219	24

All Species Total: 1,607,000

TABLE 24 (cont.)

Number of Adults at River Mouth Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	113	0	174	158	35	0
Between 2 & 3 Dams	42	0	79	25	23	0
Between 3 & 4 Dams	80	0	173	0	48	0
Between 4 & 5 Dams	67	0	1,124	0	66	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	30	0	20	0
Between 7 & 8 Dams	44	19	0	0	8	27
Between 8 & 9 Dams	394	528	13	38	541	39
Above Wells and Below Chief Joseph	34	88	0	0	37	62
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	775	636	1,593	221	777	129

All Species Total: 4,130,000

TABLE 24 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Cono</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	88	0	135	123	27	0
Between 2 & 3 Dams	25	0	48	15	14	0
Between 3 & 4 Dams	38	0	81	0	22	0
Between 4 & 5 Dams	24	0	406	0	24	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	6	0	4	0
Between 7 & 8 Dams	7	3	0	0	1	5
Between 8 & 9 Dams	52	69	2	5	71	5
Above Wells and Below Chief Joseph	3	9	0	0	4	6
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	237	81	678	143	167	16

All Species Total: 1,322,000

TABLE 24 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	112	0	172	157	35	0
Between 2 & 3 Dams	41	0	77	25	22	0
Between 3 & 4 Dams	78	0	168	0	46	0
Between 4 & 5 Dams	64	0	1,079	0	63	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	28	0	18	0
Between 7 & 8 Dams	41	18	0	0	8	26
Between 8 & 9 Dams	364	487	12	35	499	36
Above Wells and Below Chief Joseph	31	80	0	0	34	57
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	1,166	2,399	2,373	448	966	1,894

All Species Total: 9,247,000

TABLE 24 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	24	0	37	34	8	0
Between 2 & 3 Dams	16	0	30	10	9	0
Between 3 & 4 Dams	41	0	87	0	24	0
Between 4 & 5 Dams	40	0	673	0	39	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	22	0	14	0
Between 7 & 8 Dams	33	15	0	0	6	21
Between 8 & 9 Dams	312	418	10	30	428	31
Above Wells and Below Chief Joseph	28	71	0	0	30	51
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	929	2,318	1,695	305	799	1,878

All Species Total: 7,924,000

TABLE 24 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	22	0	33	30	7	0
Between 2 & 3 Dams	14	0	27	9	8	0
Between 3 & 4 Dams	36	0	78	0	21	0
Between 4 & 5 Dams	36	0	599	0	35	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	19	0	13	0
Between 7 & 8 Dams	30	13	0	0	6	19
Between 8 & 9 Dams	278	372	9	26	381	28
Above Wells and Below Chief Joseph	25	64	0	0	27	45
Above Chief Joseph Dam	196	545	254	213	93	1,620
Above Hells Canyon Dam	111	611	280	0	70	7
Totals:	747	1,604	1,299	279	660	1,718

All Species Total: 6,307,000

TABLE 25

VARIATION 6:
 STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES¹
 USING PRE-1850 RUN SIZE AS A BASIS

Fish Distribution (Percentage)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0.151	0.000	0.248	0.437	0.171	0.000
Between 1 & 2 Dams	0.009	0.000	0.010	0.049	0.022	0.000
Between 2 & 3 Dams	0.033	0.000	0.004	0.000	0.041	0.001
Between 3 & 4 Dams	0.045	0.000	0.004	0.000	0.052	0.000
Between 4 & 5 Dams	0.061	0.018	0.029	0.135	0.061	0.021
Between 5 & 6 Dams	0.000	0.000	0.022	0.000	0.000	0.000
Between 6 & 7 Dams	0.007	0.000	0.064	0.021	0.011	0.000
Between 7 & 8 Dams	0.026	0.012	0.022	0.027	0.011	0.008
Between 8 & 9 Dams	0.325	0.420	0.174	0.139	0.359	0.016
Between 9 & 10 Dams	0.042	0.041	0.000	0.020	0.020	0.303
Above Chief Joseph Dam	0.147	0.508	0.140	0.173	0.105	0.647
Above Hells Canyon Dam	0.153	0.000	0.284	0.000	0.146	0.005

¹ Assumes all summer chinook production occurred above the site of Grand Coulee Dam.

TABLE 25 (cont.)

Calculation Parameters

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Total Adult Production (thousands)	1,449	3,569	1,971	1,342	959	2,722
Ocean Survival	0.02	0.04	0.04	0.08	0.10	0.10
Juvenile Down- stream Survival (per dam passed)	0.80	0.80	0.80	0.80	0.80	0.80
Adult Down- stream Survival (per dam passed)	0.95	0.95	0.95	0.95	0.95	0.95

CALCULATIONS

Number of Adults Without Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
1,449	3,569	1,971	1,342	959	2,722

Number of Smolts Without Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
72,450	89,225	49,275	16,775	9,590	27,220

TABLE 25 (cont.)

Numerical Distribution of Smolts Produced Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	10,940	0	12,220	7,331	1,640	0
Between 1 & 2 Dams	652	0	493	822	211	0
Between 2 & 3 Dams	2,391	0	197	0	393	27
Between 3 & 4 Dams	3,260	0	197	0	499	0
Between 4 & 5 Dams	4,419	1,606	1,429	2,265	585	572
Between 5 & 6 Dams	0	0	1,084	0	0	0
Between 6 & 7 Dams	507	0	3,154	352	105	0
Between 7 & 8 Dams	1,884	1,071	1,084	453	105	218
Between 8 & 9 Dams	23,546	37,475	8,574	2,332	3,443	436
Between 9 & 10 Dams	3,043	3,658	0	336	192	8,248
Above Chief Joseph Dam	10,650	45,326	6,899	2,902	1,007	17,611
Above Hells Canyon Dam	11,085	0	13,994	0	1,400	136
Totals:	72,378	89,136	49,324	16,792	9,580	27,247

TABLE 25 (cont.)

Number of Smolts at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	10,940	0	12,220	7,331	1,640	0
Between 1 & 2 Dams	522	0	394	658	169	0
Between 2 & 3 Dams	1,530	0	126	0	252	17
Between 3 & 4 Dams	1,669	0	101	0	255	0
Between 4 & 5 Dams	1,810	658	585	928	240	234
Between 5 & 6 Dams	0	0	355	0	0	0
Between 6 & 7 Dams	133	0	827	92	28	0
Between 7 & 8 Dams	395	225	227	95	22	46
Between 8 & 9 Dams	3,950	6,287	1,438	391	578	73
Between 9 & 10 Dams	408	491	0	45	26	1,107
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	21,358	7,661	16,274	9,539	3,208	1,477

TABLE 25 (cont.)

Number of Adults at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	10	0	16	53	17	0
Between 2 & 3 Dams	31	0	5	0	25	2
Between 3 & 4 Dams	33	0	4	0	26	0
Between 4 & 5 Dams	36	26	23	74	24	23
Between 5 & 6 Dams	0	0	14	0	0	0
Between 6 & 7 Dams	3	0	33	7	3	0
Between 7 & 8 Dams	8	9	9	8	2	5
Between 8 & 9 Dams	79	251	58	31	58	7
Between 9 & 10 Dams	8	20	0	4	3	111
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	427	306	651	763	321	148

TABLE 25 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	10	0	15	50	16	0
Between 2 & 3 Dams	28	0	5	0	23	2
Between 3 & 4 Dams	29	0	3	0	22	0
Between 4 & 5 Dams	29	21	19	60	20	19
Between 5 & 6 Dams	0	0	11	0	0	0
Between 6 & 7 Dams	2	0	24	5	2	0
Between 7 & 8 Dams	6	6	6	5	2	3
Between 8 & 9 Dams	52	167	38	21	38	5
Between 9 & 10 Dams	5	12	0	2	2	70
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	379	207	611	731	288	98

All Species Total: 2,314,000

TABLE 25 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	13	0	20	66	21	0
Between 2 & 3 Dams	48	0	8	0	39	3
Between 3 & 4 Dams	65	0	8	0	50	0
Between 4 & 5 Dams	88	64	57	181	58	57
Between 5 & 6 Dams	0	0	43	0	0	0
Between 6 & 7 Dams	10	0	126	28	11	0
Between 7 & 8 Dams	38	43	43	36	11	22
Between 8 & 9 Dams	471	1,499	343	187	344	44
Between 9 & 10 Dams	61	146	0	27	19	825
Above Chief Joseph Dam	213	1,813	276	232	101	1,761
Above Hells Canyon Dam	222	0	560	0	140	14
Totals:	1,448	3,565	1,973	1,343	958	2,725

All Species Total: 12,012,000

TABLE 25 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0	0	0	0	0	0
Between 1 & 2 Dams	3	0	5	16	5	0
Between 2 & 3 Dams	20	0	3	0	17	1
Between 3 & 4 Dams	37	0	4	0	28	0
Between 4 & 5 Dams	59	43	38	121	39	38
Between 5 & 6 Dams	0	0	32	0	0	0
Between 6 & 7 Dams	8	0	102	23	9	0
Between 7 & 8 Dams	32	37	37	31	9	19
Between 8 & 9 Dams	419	1,332	305	166	306	39
Between 9 & 10 Dams	56	134	0	25	18	755
Above Chief Joseph Dam	213	1,813	276	232	101	1,761
Above Hells Canyon Dam	222	0	560	0	140	14
Totals:	1,068	3,359	1,362	613	670	2,626

All Species Total: 9,698,000

TABLE 25 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0	0	0	0	0	0
Between 1 & 2 Dams	3	0	4	14	5	0
Between 2 & 3 Dams	18	0	3	0	15	1
Between 3 & 4 Dams	33	0	4	0	25	0
Between 4 & 5 Dams	52	38	34	107	35	34
Between 5 & 6 Dams	0	0	29	0	0	0
Between 6 & 7 Dams	7	0	91	20	8	0
Between 7 & 8 Dams	29	33	33	28	8	17
Between 8 & 9 Dams	372	1,186	271	148	272	34
Between 9 & 10 Dams	50	119	0	22	16	672
Above Chief Joseph Dam	196	1,668	254	214	93	1,620
Above Hells Canyon Dam	111	0	280	0	70	7
Totals:	871	3,043	1,002	552	545	2,385

All Species Total: 8,399,000

TABLE 26

VARIATION 7:
**STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
 USING PRE-1850 RUN SIZE AS A BASIS¹**

Fish Distribution (Percentage)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0.151	0.000	0.248	0.437	0.171	0.000
Between 1 & 2 Dams	0.009	0.000	0.010	0.049	0.022	0.000
Between 2 & 3 Dams	0.033	0.000	0.004	0.000	0.041	0.001
Between 3 & 4 Dams	0.045	0.000	0.004	0.000	0.052	0.000
Between 4 & 5 Dams	0.061	0.018	0.029	0.135	0.061	0.021
Between 5 & 6 Dams	0.000	0.000	0.022	0.000	0.000	0.000
Between 6 & 7 Dams	0.007	0.000	0.064	0.021	0.011	0.000
Between 7 & 8 Dams	0.026	0.012	0.022	0.027	0.011	0.008
Between 8 & 9 Dams	0.325	0.420	0.174	0.139	0.359	0.016
Between 9 & 10 Dams	0.042	0.041	0.000	0.020	0.020	0.303
Above Chief Joseph Dam	0.147	0.166	0.140	0.173	0.105	0.647
Above Hells Canyon Dam	0.153	0.342	0.284	0.000	0.146	0.005

¹ Assumes that all chinook loss above the site of Hells Canyon Dam is hydropower cost.

TABLE 26 (cont.)

Calculation Parameters

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Total Adult Production (thousands)	1,449	3,569	1,971	1,342	959	2,722
Ocean Survival	0.02	0.04	0.04	0.08	0.10	0.10
Juvenile Down- stream Survival (per dam passed)	0.80	0.80	0.80	0.80	0.80	0.80
Adult Down- stream Survival (per dam passed)	0.95	0.95	0.95	0.95	0.95	0.95

CALCULATIONS

Number of Adults Without Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
1,449	3,569	1,971	1,342	959	2,722

Number of Smolts Without Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
72,450	89,225	49,275	16,775	9,590	27,220

TABLE 26 (cont.)

Numerical Distribution of Smolts Produced Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	10,940	0	12,220	7,331	1,640	0
Between 1 & 2 Dams	652	0	493	822	211	0
Between 2 & 3 Dams	2,391	0	197	0	393	27
Between 3 & 4 Dams	3,260	0	197	0	499	0
Between 4 & 5 Dams	4,419	1,606	1,429	2,265	585	572
Between 5 & 6 Dams	0	0	1,084	0	0	0
Between 6 & 7 Dams	507	0	3,154	352	105	0
Between 7 & 8 Dams	1,884	1,071	1,084	453	105	218
Between 8 & 9 Dams	23,546	37,475	8,574	2,332	3,443	436
Between 9 & 10 Dams	3,043	3,658	0	336	192	8,248
Above Chief Joseph Dam	10,650	14,811	6,899	2,902	1,007	17,611
Above Hells Canyon Dam	11,085	30,515	13,994	0	1,400	136
Totals:	72,378	89,136	49,324	16,792	9,580	27,247

TABLE 26 (cont.)

Number of Smolts at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	10,940	0	12,220	7,331	1,640	0
Between 1 & 2 Dams	522	0	394	658	169	0
Between 2 & 3 Dams	1,530	0	126	0	252	17
Between 3 & 4 Dams	1,669	0	101	0	255	0
Between 4 & 5 Dams	1,810	658	585	928	240	234
Between 5 & 6 Dams	0	0	355	0	0	0
Between 6 & 7 Dams	133	0	827	92	28	0
Between 7 & 8 Dams	395	225	227	95	22	46
Between 8 & 9 Dams	3,950	6,287	1,438	391	578	73
Between 9 & 10 Dams	408	491	0	45	26	1,107
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	21,358	7,661	16,274	9,539	3,208	1,477

TABLE 26 (cont.)

Number of Adults at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Conc</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	10	0	16	53	17	0
Between 2 & 3 Dams	31	0	5	0	25	2
Between 3 & 4 Dams	33	0	4	0	26	0
Between 4 & 5 Dams	36	26	23	74	24	23
Between 5 & 6 Dams	0	0	14	0	0	0
Between 6 & 7 Dams	3	0	33	7	3	0
Between 7 & 8 Dams	8	9	9	8	2	5
Between 8 & 9 Dams	79	251	58	31	58	7
Between 9 & 10 Dams	8	20	0	4	3	111
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	427	306	651	763	321	148

TABLE 26 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	10	0	15	50	16	0
Between 2 & 3 Dams	28	0	5	0	23	2
Between 3 & 4 Dams	29	0	3	0	22	0
Between 4 & 5 Dams	29	21	19	60	20	19
Between 5 & 6 Dams	0	0	11	0	0	0
Between 6 & 7 Dams	2	0	24	5	2	0
Between 7 & 8 Dams	6	6	6	5	2	3
Between 8 & 9 Dams	52	167	38	21	38	5
Between 9 & 10 Dams	5	12	0	2	2	70
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	379	207	611	731	288	98

All Species Total: 2,314,000

TABLE 26 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	219	0	489	586	164	0
Between 1 & 2 Dams	13	0	20	66	21	0
Between 2 & 3 Dams	48	0	8	0	39	3
Between 3 & 4 Dams	65	0	8	0	50	0
Between 4 & 5 Dams	88	64	57	181	58	57
Between 5 & 6 Dams	0	0	43	0	0	0
Between 6 & 7 Dams	10	0	126	28	11	0
Between 7 & 8 Dams	38	43	43	36	11	22
Between 8 & 9 Dams	471	1,499	343	187	344	44
Between 9 & 10 Dams	61	146	0	27	19	825
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	1,448	3,565	1,973	1,343	958	2,725

All Species Total: 12,012,000

TABLE 26 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0	0	0	0	0	0
Between 1 & 2 Dams	3	0	5	16	5	0
Between 2 & 3 Dams	20	0	3	0	17	1
Between 3 & 4 Dams	37	0	4	0	28	0
Between 4 & 5 Dams	59	43	38	121	39	38
Between 5 & 6 Dams	0	0	32	0	0	0
Between 6 & 7 Dams	8	0	102	23	9	0
Between 7 & 8 Dams	32	37	37	31	9	19
Between 8 & 9 Dams	419	1,332	305	166	306	39
Between 9 & 10 Dams	56	134	0	25	18	755
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
<hr/>						
Totals:	1,068	3,359	1,362	613	670	2,626

All Species Total: 9,698,000

TABLE 26 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Below Bonneville	0	0	0	0	0	0
Between 1 & 2 Dams	3	0	4	14	5	0
Between 2 & 3 Dams	18	0	3	0	15	1
Between 3 & 4 Dams	33	0	4	0	25	0
Between 4 & 5 Dams	52	38	34	107	35	34
Between 5 & 6 Dams	0	0	29	0	0	0
Between 6 & 7 Dams	7	0	91	20	8	0
Between 7 & 8 Dams	29	33	33	28	8	17
Between 8 & 9 Dams	372	1,186	271	148	272	34
Between 9 & 10 Dams	50	119	0	22	16	672
Above Chief Joseph Dam	196	545	254	214	93	1,620
Above Hells Canyon Dam	111	610	560	0	70	7
Totals:	871	2,531	1,282	552	545	2,385

All Species Total: 8,166,000

TABLE 27

VARIATION 7:
 STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
 USING CURRENT RUN SIZE AS A BASIS

Fish Distribution (Percentage)

Area of Production	Spring Chinook	Summer Chinook	Fall Chinook		Coho	Steelhead	Sockeye
			Hatchery	Natural			
Between 1 & 2 Dams	0.027	0.000	0.260	0.175	0.176	0.047	0.000
Between 2 & 3 Dams	0.128	0.000	0.000	0.234	0.109	0.054	0.000
Between 3 & 4 Dams	0.000	0.000	0.150	0.000	0.031	0.107	0.000
Between 4 & 5 Dams	0.084	0.047	0.510	0.508	0.244	0.095	0.000
Between 5 & 6 Dams	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Between 6 & 7 Dams	0.021	0.000	0.050	0.000	0.000	0.023	0.000
Between 7 & 8 Dams	0.033	0.019	0.000	0.020	0.040	0.022	0.210
Between 8 & 9 Dams	0.654	0.870	0.020	0.063	0.359	0.614	0.296
Between 9 & 10 Dams	0.053	0.064	0.000	0.000	0.046	0.038	0.493
Above Chief Joseph Dam	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Above Hells Canyon Dam	0.000	0.000	0.000	0.000	0.000	0.000	0.000

¹ Assumes that all chinook loss above the site of Hells Canyon Dam is hydropower cost.

TABLE 27 (cont.)

Calculation Parameters

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
			<u>Hatchery</u>	<u>Natural</u>			
Total Adult Production (thousands)	92	77	334	360	179	143	58
Ocean Survival	0.02	0.04	0.04	0.04	0.08	0.10	0.10
Juvenile Down- stream Survival (per dam passed)	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adult Down- stream Survival (per dam passed)	0.95	0.95	0.95	0.95	0.95	0.95	0.95

CALCULATIONS

Number of Adults at River Mouth with Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
		<u>Hatchery</u>	<u>Natural</u>			
92	77	334	360	179	143	58

Number of Smolts at River Mouth with Dams (Thousands)

<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>		<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
		<u>Hatchery</u>	<u>Natural</u>			
4,600	1,925	8,350	9,000	2,238	1,430	580

TABLE 27 (cont.)

Number of Smolts at River Mouth Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	155	0	4,683	492	84	0
Between 2 & 3 Dams	920	0	3,291	381	121	0
Between 3 & 4 Dams	0	0	2,446	135	299	0
Between 4 & 5 Dams	943	221	21,559	1,333	332	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	368	0	1,593	0	125	0
Between 7 & 8 Dams	724	174	858	427	150	581
Between 8 & 9 Dams	17,931	9,982	4,375	4,788	5,233	1,023
Between 9 & 10 Dams	1,816	918	0	767	405	2,130
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	22,859	11,295	38,804	8,323	6,749	3,734

TABLE 27 (cont.)

Number of Smolts Produced (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	155	0	4,683	492	84	0
Between 2 & 3 Dams	920	0	3,291	381	121	0
Between 3 & 4 Dams	0	0	2,446	135	299	0
Between 4 & 5 Dams	943	221	21,559	1,333	332	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	368	0	1,593	0	125	0
Between 7 & 8 Dams	724	174	858	427	150	581
Between 8 & 9 Dams	17,931	9,982	4,375	4,788	5,233	1,023
Between 9 & 10 Dams	1,816	918	0	767	405	2,130
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	22,859	11,295	38,804	8,323	6,749	3,734

TABLE 27 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	3	0	187	39	8	0
Between 2 & 3 Dams	18	0	132	30	12	0
Between 3 & 4 Dams	0	0	98	11	30	0
Between 4 & 5 Dams	19	9	862	107	33	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	7	0	64	0	13	0
Between 7 & 8 Dams	14	7	34	34	15	58
Between 8 & 9 Dams	359	399	175	383	523	102
Between 9 & 10 Dams	36	37	0	61	40	213
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	892	2,265	2,388	898	916	2,148

All Species Total: 9,507,000

TABLE 27 (cont.)

Number of Adults at River Mouth Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	3	0	187	39	8	0
Between 2 & 3 Dams	18	0	132	30	12	0
Between 3 & 4 Dams	0	0	98	11	30	0
Between 4 & 5 Dams	19	9	862	107	33	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	7	0	64	0	13	0
Between 7 & 8 Dams	14	7	34	34	15	58
Between 8 & 9 Dams	359	399	175	383	523	102
Between 9 & 10 Dams	36	37	0	61	40	213
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	892	2,265	2,388	898	916	2,148

TABLE 27 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	2	0	142	30	6	0
Between 2 & 3 Dams	11	0	76	18	7	0
Between 3 & 4 Dams	0	0	43	5	13	0
Between 4 & 5 Dams	6	3	288	36	11	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	1	0	12	0	2	0
Between 7 & 8 Dams	2	1	5	5	2	9
Between 8 & 9 Dams	40	44	19	43	58	11
Between 9 & 10 Dams	3	3	0	5	3	18
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	66	52	586	141	104	38

All Species Total: 986,000

TABLE 27 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	1	0	45	9	2	0
Between 2 & 3 Dams	8	0	56	13	5	0
Between 3 & 4 Dams	0	0	55	6	17	0
Between 4 & 5 Dams	13	6	575	71	22	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	6	0	51	0	10	0
Between 7 & 8 Dams	12	6	29	29	13	50
Between 8 & 9 Dams	319	355	156	340	465	91
Between 9 & 10 Dams	33	34	0	56	37	195
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	826	2,213	1,802	757	812	2,111

All Species Total: 8,522,000

TABLE 27 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	1	0	40	8	2	0
Between 2 & 3 Dams	7	0	49	11	5	0
Between 3 & 4 Dams	0	0	49	5	15	0
Between 4 & 5 Dams	11	5	511	63	20	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	5	0	46	0	9	0
Between 7 & 8 Dams	11	5	26	26	11	44
Between 8 & 9 Dams	284	316	138	303	414	81
Between 9 & 10 Dams	30	30	0	50	33	174
Above Chief Joseph Dam	196	545	254	213	93	1,620
Above Hells Canyon Dam	111	611	560	0	70	7
Totals:	655	1,511	1,674	681	671	1,926

All Species Total: 7,118,000

TABLE 28

**VARIATION 7:
STAFF ESTIMATE OF HYDROPOWER-RELATED LOSSES
USING CURRENT POTENTIAL RUN SIZE AS A BASIS¹**

(Numbers of Smolts Produced by Area)

Areas of Production	Spring Chinook		Summer Chinook		Fall Chinook		Coho		Steelhead		Sockeye	
	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural
Between 1 & 2 Dams	4,917,000	864,000	---	---	4,431,000	---	1,750,000	269,000	160,000	197,000	---	---
Between 2 & 3 Dams	765,000	1,407,000	---	---	---	2,057,000	---	331,000	130,000	105,000	---	---
Between 3 & 4 Dams	---	4,273,000	---	---	2,580,000	2,025,000	---	---	48,000	458,000	---	---
Between 4 & 5 Dams	514,000	3,112,000	---	---	8,520,000	21,938,000	---	---	359,000	355,000	---	---
Between 5 & 6 Dams	---	---	---	---	---	---	---	---	---	---	---	---
Between 6 & 7 Dams	---	---	---	---	840,000	---	---	---	220,000	1,000	---	---
Between 7 & 8 Dams	1,640,000	887,000	---	556,000	---	---	---	---	---	94,000	---	316,000
Between 8 & 9 Dams	6,251,000	16,905,000	1,364,000	14,159,000	360,000	24,000	320,000	232,000	4,472,000	1,885,000	---	460,000
Above Wells and Below Chief Joseph dams	800,000	1,266,000	1,344,000	1,295,000	---	---	---	---	368,000	78,000	---	748,000

¹ Assumes that all chinook loss above the site of Hells Canyon Dam is hydropower cost

TABLE 28 (cont.)

Calculation Parameters

	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Ocean Survival	0.02	0.04	0.04	0.08	0.10	0.10
Juvenile Down- stream Survival (per dam passed)	0.80	0.80	0.80	0.80	0.80	0.80
Adult Down- stream Survival (per dam passed)	0.95	0.95	0.95	0.95	0.95	0.95
% Hydropower Loss						
Operational	0.89	0.89	0.89	0.89	0.89	0.89
Above Chief Joseph	0.92	0.92	0.92	0.92	0.92	0.92
Above Hells Canyon	0.50	0.50	1.00	0.50	0.50	0.50

TABLE 28 (cont.)

Smolts to River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	4.625	0	3,545	1,615	286	0
Between 2 & 3 Dams	1.390	0	1,316	212	150	0
Between 3 & 4 Dams	2.188	0	2,358	0	259	0
Between 4 & 5 Dams	1.485	0	12,476	0	292	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	220	0	58	0
Between 7 & 8 Dams	530	117	0	0	20	66
Between 8 & 9 Dams	3.885	2,604	64	93	1,067	77
Above Wells and Below Chief Joseph	277	354	0	0	60	100
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	14,380	3,075	19,979	1,920	2,192	244

All Species Total: 41,789,000

TABLE 28 (cont.)

Number of Smolts Produced (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	5.781	0	4.431	2.019	357	0
Between 2 & 3 Dams	2.172	0	2.057	331	235	0
Between 3 & 4 Dams	4.273	0	4.605	0	506	0
Between 4 & 5 Dams	3.626	0	30.458	0	714	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	840	0	221	0
Between 7 & 8 Dams	2.527	556	0	0	94	316
Between 8 & 9 Dams	23,156	15,523	384	552	6,357	460
Above Wells and Below Chief Joseph	2,066	2,639	0	0	446	748
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	43,601	18,718	42,775	2,902	8,930	1,524

All Species Total: 118,450,000

TABLE 28 (cont.)

Number of Adults at Spawning Grounds With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	88	0	135	123	27	0
Between 2 & 3 Dams	25	0	48	15	14	0
Between 3 & 4 Dams	38	0	81	0	22	0
Between 4 & 5 Dams	24	0	406	0	24	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	6	0	4	0
Between 7 & 8 Dams	7	3	0	0	1	5
Between 8 & 9 Dams	52	69	2	5	71	5
Above Wells and Below Chief Joseph	3	9	0	0	4	6
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	237	81	678	143	167	16

All Species Total: 1,322,000

TABLE 28 (cont.)

Number of Adults at River Mouth With Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	92	0	142	129	29	0
Between 2 & 3 Dams	28	0	53	17	15	0
Between 3 & 4 Dams	44	0	94	0	26	0
Between 4 & 5 Dams	30	0	499	0	29	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	9	0	6	0
Between 7 & 8 Dams	11	5	0	0	2	7
Between 8 & 9 Dams	78	104	3	7	107	8
Above Wells and Below Chief Joseph	6	14	0	0	6	10
Above Chief Joseph Dam	0	0	0	0	0	0
Above Hells Canyon Dam	0	0	0	0	0	0
Totals:	288	123	799	154	219	24

All Species Total: 1,607,000

TABLE 28 (cont.)

Number of Adults at Spawning Grounds Without Dams (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	116	0	177	162	36	0
Between 2 & 3 Dams	43	0	82	26	24	0
Between 3 & 4 Dams	85	0	184	0	51	0
Between 4 & 5 Dams	73	0	1,218	0	71	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	34	0	22	0
Between 7 & 8 Dams	51	22	0	0	9	32
Between 8 & 9 Dams	463	621	15	44	636	46
Above Wells and Below Chief Joseph	41	106	0	0	45	75
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	1,307	2,562	2,547	464	1,134	1,927
All Species Total: 9,941,000						

TABLE 28 (cont.)

Dam Produced Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	28	0	43	39	9	0
Between 2 & 3 Dams	18	0	35	11	10	0
Between 3 & 4 Dams	48	0	103	0	28	0
Between 4 & 5 Dams	48	0	812	0	48	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	27	0	18	0
Between 7 & 8 Dams	43	19	0	0	8	27
Between 8 & 9 Dams	412	552	14	39	565	41
Above Wells and Below Chief Joseph	38	97	0	0	41	68
Above Chief Joseph Dam	213	592	276	232	101	1,761
Above Hells Canyon Dam	222	1,221	560	0	140	14
Totals:	1,070	2,480	1,869	321	967	1,911

All Species Total: 8,619,000

TABLE 28 (cont.)

Hydropower-Related Salmon and Steelhead Loss (Thousands)

<u>Area of Production</u>	<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Fall Chinook</u>	<u>Coho</u>	<u>Steelhead</u>	<u>Sockeye</u>
Between 1 & 2 Dams	25	0	38	35	8	0
Between 2 & 3 Dams	16	0	31	10	9	0
Between 3 & 4 Dams	43	0	92	0	25	0
Between 4 & 5 Dams	43	0	723	0	42	0
Between 5 & 6 Dams	0	0	0	0	0	0
Between 6 & 7 Dams	0	0	24	0	16	0
Between 7 & 8 Dams	38	17	0	0	7	24
Between 8 & 9 Dams	366	491	12	35	503	36
Above Wells and Below Chief Joseph	34	86	0	0	36	61
Above Chief Joseph Dam	196	545	254	213	93	1,620
Above Hells Canyon Dam	111	611	560	0	70	7
Totals:	872	1,749	1,734	293	809	1,748

All Species Total: 7,205,000