Population genetic structure and life history variability in *Oncorhynchus nerka* from the Snake River Basin

Final Report of Research

by

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EXECUTIVE SUMMARY

We used protein electrophoresis to examine genetic relationships among samples of sockeye salmon and kokanee (*Oncorhynchus nerka*) from the Snake River basin. A few collections from elsewhere in the Pacific Northwest were also included to add perspective to the analysis. After combining temporal samples that did not differ statistically within and between years, 32 different populations were examined for variation at 64 gene loci scored in all populations. Thirty-five (55%) of these gene loci surveyed were polymorphic in at least one population. Average heterozygosities were relatively low (0.006-0.041), but genetic differentiation among populations was pronounced: the value of Wright's F_{ST} of 0.244 is higher than has been reported in any other study of Pacific salmon.

A detailed examination of *O. nerka* from lakes in the Sawtooth Valley of Idaho was undertaken to help guide recovery planning for the endangered Redfish Lake population and to help resolve relationships between resident and anadromous forms. In Redfish Lake, sockeye salmon that returned in 1991-93 were genetically distinct from Fishhook Creek kokanee but were similar to juvenile outmigrants and a small group of "residual" sockeye salmon discovered in the lake in 1992. This result is consistent with the hypothesis that the original sockeye salmon population was not extirpated by Sunbeam Dam early in this century. Populations of *O. nerka* that appear to be native were also found in Alturas and Stanley Lakes. Collectively, the native *O. nerka* from the Sawtooth Valley lakes form a coherent group that is well-separated genetically from all other populations of *O. nerka* in the Pacific Northwest. In contrast, the kokanee population sampled from Pettit Lake appears to be the result of an introduction of late-spawning kokanee from northern Idaho (Lake Pend Oreille).

In addition to a population of presumably native *O. nerka*, Stanley Lake also supports a population of kokanee that appears to be the result of an introduction from Wizard Falls Hatchery in Oregon. We found no evidence of permanent genetic effects from the 1980s releases into Stanley and Alturas Lakes of several million sockeye salmon eggs from the Babine Lake area in British Columbia.

It is not clear whether native populations of *O. nerka* still exist in other lakes in the Snake River basin. Samples examined from Payette and Wallowa Lakes appear to be the result of introductions of one or more exogenous gene pools. A 1990 sample from Warm Lake was quite distinctive genetically, but the lake was stocked with non-native fish in that year, and a subsequent (1992) sample from Warm Lake was genetically indistinguishable from several widely used kokanee stocks from Idaho.

INTRODUCTION

In November 1991 (Federal Register 56:58619; 20 November 1991), the National Marine Fisheries Service (NMFS) announced its final listing determination that Snake River sockeye salmon, *Oncorhynchus nerka*, was an endangered species under the U.S. Endangered Species Act (ESA). This action followed a status review by NMFS (Waples et al. 1991a) that led to a proposed listing in April 1991. The only remaining population of Snake River sockeye salmon occurs in Redfish Lake in the Sawtooth Valley[1] area near Stanley, Idaho. In 1990, no sockeye salmon were observed entering the lake to spawn, and in 1991 just four adults returned. Adult returns in subsequent years numbered 1, 8, 2, 0, and 1 in 1992, 1993, 1994, 1995, and 1996, respectively.

In addition to the anadromous sockeye population, Redfish Lake supports a native population of kokanee, or non-anadromous *O. nerka*. Whereas all recent observations of sockeye salmon spawning have been on the lake shore in October and November, the known kokanee population spawns in August and September in Fishhook Creek, the major inlet stream to Redfish Lake. Kokanee, which spend their entire life cycle in fresh water, mature at a much smaller size than anadromous sockeye salmon (about 6-8 inches vs. about 20-24 inches). In 1992, a third group of *O. nerka*, tentatively termed "residual" sockeye salmon, was identified in Redfish Lake. Residuals spawn at approximately the same time and place as the sockeye salmon but are the same size as the kokanee.

Although only Redfish Lake has supported an anadromous Snake River run in recent years, historical records indicate that sockeye salmon were also native to

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[1]Some previous reports have referred to this area as the "Stanley Basin," but that place name does not appear on USGS maps and is not in general use by local residents.

several other lakes in the Sawtooth Valley area (Alturas, Stanley, Pettit, and perhaps Yellowbelly Lakes). Currently, Alturas, Stanley, and Pettit Lakes all have kokanee populations, but the origins of these populations are uncertain because of past efforts to eradicate native populations and subsequent planting of exogenous *O. nerka* (Bjornn et al. 1968, Hall-Griswold 1990, Welsh 1991). Outside the Sawtooth Valley area, Snake River populations of sockeye salmon were also present historically in Payette Lake, Warm Lake (in the South Fork Salmon River drainage), and Wallowa Lake (in the Grande Ronde River drainage in northeast Oregon). Anadromous populations disappeared long ago from these lakes as well, and current populations of *O. nerka* consist entirely of resident forms.

This brief historical review suggests a number of interesting questions relevant to the status and recovery of Redfish Lake sockeye salmon. For example, What is the relationship between sockeye salmon and kokanee in Redfish Lake? Between anadromous and residual forms of sockeye salmon? Can either of the resident forms in Redfish Lake be used to help recover the anadromous population? What have been the effects of stock transfers of anadromous and resident *O. nerka* into Sawtooth Valley populations? What genetic lineages are represented by existing populations of *O. nerka* in Snake River lakes that originally supported sockeye salmon? If recovery efforts extend beyond Redfish Lake, which lakes and stocks would be most appropriate to use?

Each of these questions is complex and can best be addressed through a multidisciplinary approach. Genetic information can be particularly useful in making informed decisions about listing and recovery. Toward this end, NMFS conducted an extensive genetic analysis of *O. nerka* from the Pacific Northwest during the course of

its status review (summarized by Monan 1991). Unfortunately, no anadromous adults returned to Redfish Lake in 1990, so a comparison of sockeye salmon and kokanee in Redfish Lake was not possible at that time. Winans et al. (1996) summarized information that was available for Redfish Lake *O. nerka* at the time of listing and placed it in the context of genetic variability in sockeye salmon and kokanee from the Pacific Northwest as a whole.

Since completion of the 1991 status review, NMFS has analyzed a number of additional samples from Snake River *O. nerka* populations, including both anadromous and residual sockeye salmon in Redfish Lake. During the period 1 October 1993 to 30 September 1994, NMFS genetic analyses of sockeye salmon were supported in part by a grant from Bonneville Power Administration. This report summarizes results of research conducted during that period, as well as other relevant analyses conducted by NMFS both before and after the contract period. This report includes more recent information for Sawtooth Valley *O. nerka* than is contained in Winans et al. (1996), and it also includes a more comprehensive evaluation of other populations of *O. nerka* from the Snake River basin.

METHODS

Study Areas and Experimental Design

Although this study focused on populations of *O. nerka* in Redfish Lake and other nearby lakes in Idaho, a few samples from a more extensive geographic region (including British Columbia and Alaska) were included to address specific issues (such as the effects of stock transfers) or to provide a broader geographic context for interpreting the results. A total of 53 collections, differing in geographic or temporal coverage or life history type involved, were considered (Table 1). Both resident and

anadromous forms were included, as well as some collections of uncertain parental origin. In most of the analyses, temporal samples were combined to form either a 46- or 32-population dataset. Locations of the 32 population samples are identified on the map in Figure 1. A brief description of the types of collections made and their rationale follows.

Redfish Lake

At the start of this study, the most important question to resolve was the relationship between sockeye salmon and kokanee in Redfish Lake. The 13 adult sockeye salmon that returned to Redfish Lake in 1991-93 provided an opportunity for comparison with samples of spawning kokanee collected in 1990, 1991, and 1992. In the latter 2 years, both "early" and "late" spawning kokanee were collected to test whether there is evidence of genetic differentiation within the run (as life history data reported by Brannon et al. (1994) suggested might be the case).

Three other types of collections of *O. nerka* were also made in Redfish Lake. In 1990, 1992, 1993, and 1994, midwater trawls were used to collect samples of mixed-age *O. nerka*. In 1991-93, juvenile *O. nerka* outmigrating from Redfish Lake in the spring were trapped alive, and some were retained for use in a captive broodstock program (Johnson 1993, Flagg 1993). Mortalities that resulted from these trapping and rearing programs were used for genetic analysis in this study. Finally, small collections of "residual" *O. nerka* were made in 1992 and 1993.

These latter collections were prompted by two observations. First, preliminary results from this study indicated that outmigrant *O. nerka* were genetically similar to Redfish Lake sockeye salmon but had substantial allele frequency differences

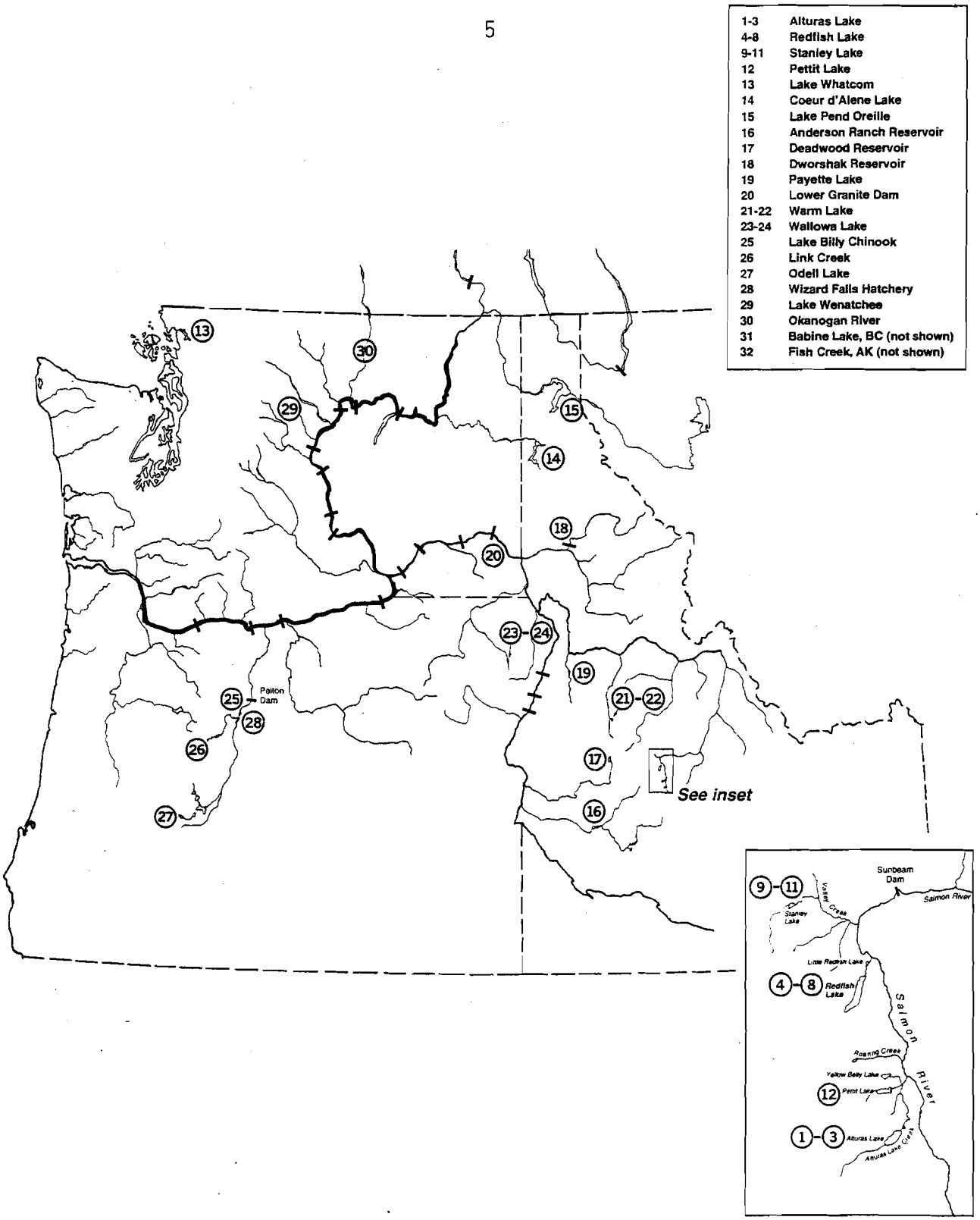

Figure 1. Map of the Pacific Northwest showing collection locations for samples included in this study. Numbers correspond to population ID numbers in Table 1.

Table 1. Collection data for 53 samples of *O. nerka* considered in this report. In some analyses, temporal samples (indented) from the same location were combined. An asterisk (*) indicates the total number of individuals in a combined sample. A = adult spawner; J = juvenile; M = mixed or unknown.

Area/Sample	N	Type	Age	Collection date	Population number[a]
Sawtooth Valley					
ALTURAS L. OUTMIGRANTS	33	Unknown	J	May-June 91	1
ALTURAS L. SPAWNERS	30	Resident	A	9/25/92	2
ALTURAS L. TRAWL	142*				3
August 1990	100	Unknown	M	8/20/90	-
August 1992	32	Unknown	M	8/28/92	-
September 1992	10	Unknown	M	9/25/92	-
REDFISH L. KOKANEE	217*				4
1990	88	Resident	A	9/15/90	-
1991 Early	40	Resident	A	8/22/91	-
1991 Late	29	Resident	A	9/05/91	-
1992 Early	30	Resident	A	8/14/92	-
1992 Late	30	Resident	A	9/08/92	-
REDFISH L. TRAWL	128*				5
August 1990	12	Unknown	M	8/20/90	-
August 1992	10	Unknown	M	8/27/92	-
September 1992	37	Unknown	M	9/24/92	-
September 1993	43	Unknown	M	9/16/93	-
September 1994	26	Unknown	M	9/06/94	-
REDFISH L. OUTMIGRANTS	181*				6
1991	138	Unknown	J	May-June 91	-
1992	17	Unknown	J	May-June 92	-
1993	26	Unknown	J	May-June 93	-
REDFISH L. SOCKEYE	13*				7
1991	4	Anadromous	A	11/05/91	-
1992	1	Anadromous	A	10/01/92	-
1993	8	Anadromous	A	10/01/93	-
REDFISH L. RESIDUALS	14*				8
1992	4	Resident	A	11/12/92	-
1993	10	Resident	A	10/01/93	-
STANLEY L. SPAWNERS 1992	60	Resident	A	8/20/92	9
STANLEY L. TRAWL 1992-94	40*				10
1992	10	Resident	M	8/28/92	-
1993	13	Resident	M	Aug-Sept 93	-
1994	17	Resident	M	9/07/94	-
STANLEY L. SPAWNERS 1994	8	Resident	A	10/05/94	11
PETTIT L. TRAWL	63*				12
1992	25	Resident	M	9/26/92	-
1994	38	Resident	M	9/01/94	-
Other Idaho					
LAKE WHATCOM (Washington)	60	Resident	A	11/05/90	13
COEUR D'ALENE LAKE	50	Resident	A	11/20/90	14
LAKE PEND OREILLE	60	Resident	A	11/20/90	15
ANDERSON RANCH RESERVOIR	12	Resident	M	8/20/90	16
DEADWOOD RESERVOIR	148*				17
1990	88	Resident	A	9/15/90	-
1992	60	Resident	A	9/17/92	-
DWORSHAK RESERVOIR	60	Resident	A	9/15/90	18
PAYETTE	120*				19
Payette Lake	60	Resident	A	9/15/90	-
N. Fork Payette River	60	Resident	A	9/18/92	-
LOWER GRANITE DAM	18	Unknown	J	3/10/92	20
WARM LAKE 1990	60	Resident	A	10/26/90	21
WARM LAKE 1992	60	Resident	A	9/12/92	22

Table 1, continued

Area/Sample	N	Type	Age	Collection date	Population number
Oregon					
WALLOWA RIVER	60	Resident	A	9/29/92	23
WALLOWA LAKE	40	Resident	A	11/04/93	24
LAKE BILLY CHINOOK	47	Resident	A	9/15/92	25
LINK CREEK	49	Resident	A	9/29/92	26
ODELL LAKE	60	Resident	A	9/24/92	27
WIZARD FALLS HATCHERY	80	Resident	J	Spring 93	28
Washington					
LAKE WENATCHEE	280*				29
Brood Year 1987	120	Anadromous	J	2/16/88	-
Brood Year 1988	160	Anadromous	J	1/05/90	-
British Columbia					
OKANOGAN RIVER	63	Anadromous	A	10/12/90	30
BABINE LAKE	60	Anadromous	A	9/29/90	31
Alaska					
FISH CREEK	40	Anadromous	A	9/01/92	32

[a]Corresponds to population numbers in Figure 1.

compared to Fishhook Creek kokanee. This result suggested that most (perhaps all) of the outmigrants came from a different gene pool than the kokanee. However, otolith microchemistry data (Kline 1994, Rieman et al. 1994) indicated that a sizeable fraction of the outmigrants had a resident female parent. This conclusion was based on a low strontium/calcium ratio in the primordium of the otoliths from many of the outmigrants, a finding that indicates the female parent had not spent time in strontium-enriched sea water (Kalish 1990, Rieman et al. 1994).

Waples (1992) hypothesized that both these results could be explained by the presence of a third group of *O. nerka* in the lake--resident fish that were genetically distinct from the kokanee. In fall 1992, as a result of concerted efforts by personnel from Idaho Department of Fish and Game, the University of Idaho, and the Shoshone-Bannock Tribes, these fish were located: individuals that are similar in size to Fishhook Creek kokanee but spawn at the same location and approximately at the same time as the sockeye salmon (Brannon et al. 1994). These fish have tentatively been termed "residual" sockeye salmon in this report.

Alturas Lake

As in Redfish Lake, collections in Alturas Lake included samples of kokanee spawners, juvenile outmigrants, and trawled mixed-age *O. nerka*. No anadromous fish have returned to Alturas Lake in recent decades, and no population comparable to the Redfish Lake "residuals" has been identified.

Other Snake River lakes

The status of extant populations of *O. nerka* in the Snake River is important to resolve before a comprehensive recovery plan can be developed for recovery of Snake

River sockeye salmon. Stanley and Pettit Lakes are both within about 20 river miles of Redfish Lake in the Sawtooth Valley area. Historical records indicate that both lakes at one time supported sockeye salmon populations, but anadromous runs disappeared long ago following erection of barriers to migration and lake poisonings to enhance opportunities for game fish. Both lakes currently support populations of resident *O. nerka*, but their origin is uncertain because both lakes have been stocked with non-native sockeye salmon and/or kokanee. Warm Lake, Payette Lake, and Wallowa Lake are other Snake River sites that at one time supported runs of sockeye salmon, but now have only resident forms of *O. nerka* of uncertain origin.

Two years of trawl samples from Pettit Lake and 3 years of trawl and spawner samples from Stanley Lake were examined in this study. In Warm Lake and Wallowa Lake, spawning fish were sampled in 2 different years.

Idaho kokanee

Kokanee have been widely planted in Idaho as well as elsewhere in the western United States. Two major stock groups occur in the state: a late-spawning group from northern Idaho, including Lake Pend Oreille and Coeur d'Alene Lake, and an early, stream-spawning group from central Idaho, including populations from Deadwood, Dworshak, and Anderson Ranch Reservoirs and Payette Lake. These stocks were included because they, or their derivatives, have been transplanted into many Snake River populations, including all of the Sawtooth Valley lakes. We also included a sample of kokanee from Lake Whatcom (near Bellingham, WA) because this stock has been widely planted throughout the Pacific Northwest, and it has been suggested (Waples 1995) that this was the original source of the northern Idaho kokanee populations. According to Bowler (1990), Kootenay Lake in British Columbia may

have been the original source for many early spawning kokanee populations in Idaho and elsewhere in the Pacific Northwest.

Columbia River sockeye salmon

Apart from those in Redfish Lake, the only remaining sockeye salmon populations in the Columbia River basin are from Lake Wenatchee and Lake Osoyoos on the Okanogan River. Samples from these populations were included to provide a more complete picture of genetic variability within the Columbia River basin.

Deschutes River basin *O. nerka*

Historically, a run of sockeye salmon spawned in Link Creek and reared in Suttle Lake in the Deschutes River basin of Oregon. This run was dramatically affected by construction of a dam at the mouth of Suttle Lake in 1930 and construction of Pelton Dam on the Deschutes River in 1959. Although a few anadromous fish have returned to Pelton Dam in most recent years, there is no provision for fish passage. We obtained three samples of resident *O. nerka* from this river system, as well as from a hatchery stock (Wizard Falls) that has been the source for numerous stock transfers within the region.

Other samples

Three other samples of *O. nerka* were included in this study. In the 1980s, sockeye salmon eggs from the Babine Lake system in British Columbia were outplanted in Alturas and Stanley Lakes, and a sample from Babine Lake provided an opportunity to evaluate effects of these stock transfers. An Alaskan sample (from a hatchery on Fish Creek in Cook Inlet) served as an outlier to provide a sense of geographic perspective to the genetic data for other U.S. populations. Finally, during a

test in March 1992 of the feasibility of drawing down Columbia River reservoirs to speed migration of juvenile salmon (USACE 1993), a number of *O. nerka* were unexpectedly found in the vicinity of Lower Granite Dam. We examined a sample of 18 individuals to determine whether there was evidence that these fish were from the listed Redfish Lake population.

Sampling Methods

A variety of collection methods were employed to sample natural populations. In most localities, post-spawning adults were collected by net or beach seine. Because of the large adult size difference between resident and anadromous forms, this method provided the most reliable means of discriminating between the two forms in areas where they co-occur. In the Sawtooth Valley lakes (Redfish, Alturas, Pettit, and Stanley), midwater trawls were also used to collect *O. nerka* from a mixture of age classes. Resident adult *O. nerka* (referred to as "residuals" in this report) were collected in Redfish Lake using a floating Lake Merwin trap net. Finally, traps were used in the outlet streams of Redfish and Alturas Lakes to collect *O. nerka* migrating out of the lake in the spring. Adult Redfish Lake sockeye salmon that returned to spawn in 1991-93 were trapped for use in a captive broodstock program (Johnson 1993), and tissue samples for genetic analysis were obtained from the carcasses after the fish had spawned.

Whole fish or tissues were frozen in the field and transported on dry ice to the National Marine Fisheries Service (NMFS) laboratory in Seattle, where they were transferred to an ultracold (-80°C) freezer for storage prior to electrophoretic analysis. Procedures for starch gel electrophoresis followed descriptions in Aebersold et al. (1987). Four tissues (skeletal muscle, liver, heart, and retinal tissue) were sampled

from each fish, and extracts were loaded onto starch gels utilizing seven different buffer systems. Most of these buffers are described by Aebersold et al. (1987), with modifications described by Waples et al. (1991b).

The 7 electrophoretic buffers used in combination with the 4 tissues resulted in a screening protocol involving 16 gels for each 40 fish analyzed. Appendix Table 1 lists the enzymes used, the loci scored, the tissue(s) and buffer(s) used to resolve each locus, and the number of stocks that were polymorphic for each marker.

Locus names and abbreviations used the American Fisheries Society nomenclature guidelines established by Shaklee et al. (1990). In general, when multiple gene loci occur for a single enzyme, higher numbers correspond to gene products that migrate farther from the origin on an electrophoretic gel. At each gene locus, one allele (generally the most common) was designated the "100" allele and additional alleles (if any) were designated by numbers reflecting the electrophoretic mobility of their homomer relative to the "100" allele. Positive numbers represent anodal mobility and negative numbers represent cathodal mobility.

Data Analysis

Electrophoretic phenotypes visualized on starch gels were interpreted as genotypes according to guidelines discussed by Utter et al. (1987). Allelic frequencies, genetic distance values, and tests of Hardy-Weinberg genotypic proportions were obtained using the BIOSYS program (Swofford and Selander 1981). Standard chi-square tests are problematical for Hardy-Weinberg tests in many salmon studies, such as this one, that include some small sample sizes and have a substantial number of loci with low levels of variability in some samples. To avoid difficulties with departure

of the test statistic from the chi-square distribution, we used Fisher's exact probability test for all Hardy-Weinberg tests. At loci with more than two alleles expressed in a sample, all alleles but the most common were pooled to yield a test involving two alleles and three genotypic classes.

The unweighted pair-group method with arithmetic averages (UPGMA) was used with Cavalli Sforza and Edwards' (1967) chord distance and Nei's (1978) unbiased genetic distance values to generate dendrograms depicting genetic affinities among the samples. The program Numerical Taxonomy and Multivariate Analysis System (NTSYS; Rohlf 1993) was used to generate multidimensional scaling (MDS) plots of genetic distance values. Multidimensional scaling plots allow one to view in two or more dimensions the pattern of relationships among populations; in contrast, a dendrogram is essentially a one-dimensional representation of the data. In general, two-dimensional MDS plots result in less distortion of the relationships among populations than do dendrograms, and the fit becomes increasingly better as more dimensions are added. However, the degree of improvement in fit with each new dimension added typically drops quickly, and in any case it is problematical to illustrate more than three dimensions in a single plot. NTSYS was also used to generate minimum-length spanning trees (MSTs) that can be superimposed on MDS plots. An MST helps to identify pairs or groups of populations that appear to be similar (because of the limitations in presenting multidimensional data) but actually are not if other dimensions are taken into consideration.

Another approach used to evaluate the pattern of genetic relationships was principal component analysis (PCA), using a variance-covariance matrix constructed from allele frequency data using NTSYS (Rohlf 1993). In the PCA, rare alleles

(frequency < 0.01) were pooled with other allele classes, and "K - 1" allele classes were analyzed per locus, where K is the number of alleles at that locus.

In *O. nerka*, as in other salmonids, several pairs of duplicated gene loci occur that form allelic products with identical electrophoretic mobility. These loci are termed "isoloci" (Allendorf and Thorgaard 1984). Isoloci present special problems for interpretation and data analysis because genotypes of individual fish cannot be determined unambiguously. Waples (1988) developed a maximum likelihood method to estimate the allele frequencies at the individual loci of an isolocus pair, and the chi-square test he described was used to test for agreement of observed and expected phenotypic proportions at isoloci that were polymorphic. This test is the two-locus equivalent of the Hardy-Weinberg test for individual gene loci; it is particularly useful in evaluating whether the observed data are consistent with the presumed genetic model. However, for reasons discussed by Waples (1988), allele frequency estimates for the individual loci of an isolocus pair may not be suitable for comparison among populations. Therefore, the allele frequencies for isoloci presented in Appendix Table 2 are mean frequencies computed over both loci of an isolocus pair.

There is another class of gene loci that requires special consideration: individual gene loci for which not all genotypes can be resolved. Typically, gene loci detected by protein electrophoresis show codominant expression, meaning that both alleles in an individual contribute equally to the observed phenotype. For example, a heterozygote for a codominant locus will exhibit bands corresponding to both alleles, whereas a homozygote will show only a single band. In practice, however, some loci do not consistently exhibit codominant phenotypes. In sockeye salmon, overlapping bands from other gene loci make it difficult to score all phenotypes at *LDH-A1** and *PGM-1**.

For these loci, only two phenotypic classes are scored: one class that includes only the individuals that are homozygous for the variant allele (genotype denoted by "22"), and another class that includes both heterozygotes (genotype "12") and homozygotes for the common allele (genotype "11"). Allele frequency of the variant "2" allele can be estimated as the square root of the frequency of the "22" phenotype, with frequency of the common "1" allele estimated as 1.0 minus the estimated frequency of the "2" allele. Under the assumption of random mating, this procedure produces the "best" estimate of allele frequencies, but the variance of this estimate is much higher than the variance for a locus where all genotypes can be identified. In particular, if the "22" genotypes are rare, estimated allele frequencies are very sensitive to small changes in the number of "22" genotypes observed (see Waples et al. 1991b for discussion). In this study, as in Winans et al. (1996), we recorded observed frequencies of the two phenotypes at these loci and used those observed frequencies in temporal and geographic comparisons among populations.

RESULTS

Preliminary Analyses

A total of 76 presumptive gene loci were scored in at least 75% (i.e., 40 or more) of the 53 samples analyzed. Of these, 41 loci were polymorphic (two or more alleles segregating in at least one sample) and 35 were monomorphic (fixed for the same allele in all samples). Allele frequencies for the polymorphic loci appear in Appendix Table 2.

Table 2. Levels of genetic variability in 32 populations of *O. nerka*. H_o = observed heterozygosity; H_e = expected heterozygosity. Values for sample size and percent polymorphic loci are based on 64 gene loci, including 29 that were monomorphic in all samples. In computing heterozygosities, data for the isolocus *mAH-1,2** and the phenotypic loci *LDH-A1** and *PGM-1** were not used.

Population	Year(s)	Mean sample size	Percent loci polymorphic	Mean heterozygosity	
				H_o	H_e
Alturas L. outmigrants	1991	26.5	10.9	.018	.015
Alturas L. spawners	1992	29.9	12.5	.019	.020
Alturas L. trawl	1990,92	135.0	15.6	.023	.022
Redfish L. kokanee	1990-92	208.5	15.6	.021	.021
Redfish L. trawl	1990-94	114.7	15.6	.022	.022
Redfish L. outmigrants	1991-93	172.5	12.5	.011	.012
Redfish L. sockeye	1991-93	12.7	4.7	.010	.010
Redfish L. residuals	1992-93	13.8	6.3	.013	.011
Stanley L. spawners	1992	58.5	6.3	.012	.012
Stanley L. trawl	1992-94	36.4	10.9	.015	.016
Stanley L. spawners	1994	7.4	15.6	.041	.038
Pettit Lake	1992,94	60.0	9.4	.015	.018
Lake Whatcom	1990	59.0	18.8	.023	.021
Coeur d'Alene Lake	1990	49.3	10.9	.021	.021
Lake Pend Oreille	1990	59.1	14.1	.020	.020
Anderson Ranch Reservoir	1990	11.6	10.9	.029	.028
Deadwood Reservoir	1990,92	138.1	18.8	.026	.027
Dworshak Reservoir	1990	56.2	15.6	.025	.027
Payette Lake/River	1990,92	115.9	14.1	.031	.032
Lower Granite Dam	1992	17.7	10.9	.022	.028
Warm Lake	1990	57.7	9.4	.006	.006
Warm Lake	1992	59.7	14.1	.029	.029
Wallowa River	1992	59.4	17.2	.029	.027
Wallowa Lake	1993	38.3	15.6	.023	.022
Lake Billy Chinook	1992	47.2	14.1	.027	.028
Link Creek	1992	48.0	14.1	.024	.028
Odell Lake	1992	59.1	17.2	.025	.025
Wizard Falls Hatchery	1993	79.9	23.4	.033	.035
Lake Wenatchee	1987-88	256.0	20.3	.019	.020
Okanogan River	1990	61.7	17.2	.034	.032
Babine Lake	1990	57.6	14.1	.015	.016
Fish Creek	1992	39.9	12.5	.027	.028

Five of the polymorphic loci (*mAH-1,2*; G3PDH-1,2*; GPI-B1,2*; sMDH-A1,2**; and *SMDH-B1,2**) are generally considered to be isoloci in sockeye salmon. However, only *mAH-1,2** was strongly variable in this study, and this was the only isolocus for which any individuals had three or more doses of variant alleles (indicating that both loci must be variable in that population). Because variation at the remaining four isoloci was consistent with patterns expected from variation at a single locus (see also Hardy-Weinberg results, below), we treated each of these pairs of loci as one variable locus and one monomorphic locus.

Four of the collections shown in Table 1 included more than one sample in the same year (August and September trawl samples from Alturas Lake and Redfish Lake in 1992; and early and late kokanee samples from Redfish Lake in 1991 and 1992). In each case, contingency chi-square tests indicated that overall allele frequencies did not differ between pairs of samples; therefore, these samples were combined in future analyses. Because of the small number of individuals involved, we also combined 3 years of samples of adult sockeye salmon from Redfish Lake (total N = 13) and 2 years of samples of "residual" sockeye salmon from Redfish Lake (total N = 14). These combinations resulted in 46 samples that were considered in the following two types of analyses.

Tests of Genotypic and Phenotypic Proportions

The number of polymorphic gene loci in the 46 samples ranged from 3 (Redfish Lake sockeye and 1993 Redfish lake outmigrants) to 16 (Wizard Falls Hatchery kokanee). A total of 272 exact probability tests were performed to compare expected and observed genotypic frequencies at the polymorphic gene loci in these 46 samples; of these, 11 (4.0%) had probabilities less than 0.05, and 2 of these (0.74%) had

probabilities less than 0.01. The 11 significant tests occurred at 7 different gene loci, and no population had more than a single locus that failed to conform to expected Hardy-Weinberg genotypic frequencies. We concluded that the genotypic data were consistent with expectations from simple Mendelian inheritance of genetic traits. These results are also consistent with the hypotheses that the gene loci considered here are not strongly affected by selection, and that the samples analyzed represented approximately random samples from single populations. It should be noted, however, that the power to detect selection, population admixture, and/or non-random mating using this test often will not be very high.

Non-significant results were found for all but one of the 29 tests involving isoloci that were treated here as individual gene loci. The exception was for a test at *sMDH-B2** in the 1990 sample of Redfish Lake kokanee, which showed a significant deficiency of heterozygotes (exact probability = 0.034) We concluded that the decision to treat this and the other four isoloci as individual gene loci was reasonable and was not likely to lead to any serious bias in the results.

Of the 46 samples examined, 43 were polymorphic at the isolocus *mAH-1,2**. In each of the 43 polymorphic samples, observed phenotypic distributions agreed with two-locus Hardy Weinberg expectations, based on the test developed by Waples (1988). This result supports the hypothesis that allelic dosages can reliably be scored at this locus in sockeye salmon.

Temporal Comparisons

At nine different locations (Alturas Lake, Redfish Lake, Pettit Lake, Stanley Lake, Warm Lake, Wallowa Lake, Deadwood Reservoir, Payette Lake, and Lake Wenatchee), samples from multiple years were available for comparison. For the

following groups of collections, allele frequency differences between years were not statistically significant ($P > 0.05$, combined test): 1990 and 1992 trawl samples from Alturas Lake; 1990, 1991, and 1992 samples of kokanee from Redfish Lake; 1992 and 1994 trawl samples from Pettit Lake; 1992, 1993, and 1994 trawl samples from Stanley Lake; 1990 and 1992 spawner samples from Deadwood Reservoir; and a 1990 sample from Payette Lake and a 1992 sample from the North Fork Payette River.

Although none of the overall tests comparing different years of Redfish Lake kokanee were significant, the 1990 sample was distinctive in having a much higher frequency (0.103) of the "-49" allele at *ADH** than was found in any other sample in this study. The differences in allele frequency at this locus between the 1990 kokanee sample and the 1991 and 1992 samples was highly significant ($P < 0.01$). Because ADH is not expressed in adult salmon, data for this locus are missing from many populations, and this locus was not used in most of the subsequent analyses.

In two locations, allele frequency differences between some temporal samples were statistically significant but can probably be explained by normal interannual variability. In Lake Wenatchee, allele frequencies at one locus (*ALAT**) out of 15 differed significantly ($P < 0.01$) between the 1987 and 1988 brood-year samples, and the overall test for all loci was also significant at the 0.05 level (see Winans et al. 1996 for discussion). In Redfish Lake, no significant differences were observed between trawl samples from 1990, 1992, and 1993, but the 1994 trawl sample differed significantly ($P < 0.05$, combined test) from the 1990 and 1992 samples. Also in Redfish Lake, the 1991 and 1992 samples of outmigrants were statistically homogeneous, but the 1993 sample differed significantly from each of the earlier collections ($P < 0.01$ and $P < 0.05$, respectively, for the overall chi-square test).

Significant differences in the overall tests involving outmigrants can be attributed to the unusually high frequency of the "75" allele at the isolocus *mAH-1,2** in the 1993 sample.

At the remaining two localities, differences between samples were large enough to suggest the existence of multiple populations. The 1990 and 1992 Warm Lake samples were so dramatically different (combined chi square over 9 loci = 285, 14 df) that it is not plausible they were drawn from the same gene pool. Highly significant ($P < 0.01$, combined test over 11 loci) differences were also found between a 1992 sample from the Wallowa River and a 1993 sample from Wallowa Lake.

Guided by results of these temporal comparisons, in some of the subsequent analyses we combined samples from different years as follows: trawl samples in Alturas, Redfish, Stanley, and Pettit Lakes; collections of kokanee and outmigrants in Redfish Lake; collections of sockeye salmon from Lake Wenatchee; and collections of spawners from Deadwood Reservoir and Payette Lake/River. Temporal samples from Warm and Wallowa Lakes were not pooled in any analyses.

Levels of Genetic Variability

Pooling temporal samples as described above yielded a dataset with 32 different localities and/or types of collections (see Table 1). A total of 64 gene loci were scored in all 32 collections (these loci can be identified in Appendix Table 1). Of these 64 loci, 35 (55%) were polymorphic in at least one collection, and the remaining 29 (44%) were monomorphic in all collections.

Table 2 summarizes information on patterns of genetic variability found in this analysis. Average observed heterozygosities were low, as is typical for sockeye salmon, ranging from 0.006 in the 1990 Warm Lake sample to 0.041 in the 1994 Stanley Lake

spawners. This latter value should be interpreted with caution, since the 1994 sample of Stanley Lake spawners included only 8 individuals. In general, low values were found for collections of Redfish Lake sockeye salmon/outmigrants/residuals, and relatively high values were found in many of the kokanee collections as well as in sockeye salmon from the Okanogan River. As also has been previously reported for sockeye salmon, the polymorphic gene loci differed considerably in the overall level of variability. A few loci (for example, *mAH-1,2*, mAAT-1*, ALAT*, MPI*, PGM-1*,* and *PGM-2**) were polymorphic in most or all samples and often had high frequencies of variant alleles. Many other loci were variable in only one or a few populations, with variant alleles being rare even in populations in which they did occur.

The heterozygosity values reported in Table 2 are biased downward somewhat because they do not include data for three polymorphic loci (the isolocus *mAH-1,2** and the phenotypic loci *LDH-A1** and *PGM-1**). Genotypes cannot be unambiguously assigned to individual loci at isolocus pairs, and heterozygotes cannot be distinguished from alternate homozygotes at the other two loci. Both *mAH-1,2** and *PGM-1** are highly variable, being polymorphic in most or all of the collections. Although we cannot provide a quantitative estimate of heterozygosity that would include these three loci, there is no doubt that the overall values would be higher for most populations if the actual heterozygosities could be measured at these loci.

The percentage of loci that were polymorphic within each collection was also relatively low, ranging from 4-6% in some Redfish and Stanley Lake collections to over 23% at Wizard Falls Hatchery. This result contrasts with the relatively high percentage (over 50%) of loci that were polymorphic over the entire dataset. As

discussed below, this indicates that in many cases, different populations were polymorphic for different gene loci

Variation Between Life-history Forms and Collection Types

Multiple types of collections from Redfish, Alturas, and Stanley Lakes provided the opportunity to compare data for what represent (or may represent) different life history forms within a geographic location. In Alturas Lake, no significant differences were found between samples of outmigrants, spawners, and trawled fish.

In Redfish Lake, pooled kokanee samples did not differ significantly from pooled trawl samples (chi square = 24.86, 17 df, $P > 0.05$). The pooled sockeye salmon, pooled outmigrant, and pooled residual samples were also statistically homogenous. However, the latter three forms had highly significant ($P < 0.01$) differences compared to the kokanee and trawled samples. Samples of sockeye/outmigrants/residuals were characterized by a higher mean frequency (over both loci) of the "75" allele at *mAH-1,2** (about 0.28 for the sockeye/outmigrant/residual vs. about 0.08 for the kokanee/trawl), a lower frequency of the "-100" allele at *mAAT-1** (about 0.1 vs. about 0.5), a lower frequency of the "91" allele at *ALAT** (rare or missing vs. about 0.15), the presence of the "88" allele at *PEPLT**, and absence of (or very low levels of) variation at *ADH*, ADA-1*, sMDH-B2*, MPI**, and *PGM-2**.

In Stanley Lake, no individual loci showed significant frequency differences in the comparison of 1992 spawners with the combined 1992-94 trawl samples, but the overall test was marginally significant (chi square 18.57, 9 df, $P < 0.05$). The 1994 sample ($N = 8$) of spawners was very divergent from the other two collections (chi-square values 145 with 12 df and 76 with 11 df for comparisons with 1992 spawners and combined trawl samples, respectively). The 1994 spawner sample was

distinguished by unusually high frequencies of variant alleles at *mIDHP-2*, LDH-A1*, PGM-1*,* and *PGM-2**.

Geographic Variation

We also used the 32-population dataset to examine patterns of differentiation among populations. Genetic distances, F-statistics, PCA, and heterogeneity chi-square tests were used in these analyses. An average (over both loci) allele frequency was used for the isolocus *mAH-1,2**, and phenotypic frequencies were used for the loci *LDH-A1** and *PGM-1**.

Considerable genetic diversity among populations was found, as evident from an examination of Table 3. F_{ST} values at nine loci (*ADA-1*, mAAT-1*, ALAT*, G3PDH-2*, mIDHP-1*, mIDHP-2*, PEPLT*, MPI*,* and *PGM-2**) were greater than 0.1, and the overall value (0.244) is larger than has been reported in any study of anadromous Pacific salmonids. At three loci (*mAAT-1*, ALAT*,* and *PGM-1**), alleles that were rare or absent in some populations were common or fixed in other populations.

Figure 2, which is a dendrogram of genetic relationships based on Nei's (1978) unbiased genetic distance, indicates that two major genetic groups of *O. nerka* can be identified, as well as a number of individual populations that are genetic outliers.

Table 3. Summary of genetic variability indices at 35 polymorphic gene loci that were scored in all 32 populations in Table 1. F_{IS}, F_{IT}, and F_{ST} are Wright's (1978) fixation indices.

Locus	Number of alleles	F_{IS}	F_{IT}	F_{ST}	Frequency range of common allele
*mAAT-1**	2	.002	.483	.483	.039 - 1
*mAAT-2**	2	-.006	.000	.006	.994 - 1
*ADA-1**	3	-.073	.054	.119	.763 - 1
*ADA-2**	2	-.020	-.001	.018	.975 - 1
*mAH-3**	2	-.013	.000	.012	.987 - 1
*sAH**	2	-.007	.000	.006	.992 - 1
*ALAT**	5	.011	.203	.194	.103 - .950
*CK-A1**	2	-.001	.001	.002	.998 - 1
*CK-A2**	2	-.013	.000	.012	.987 - 1
*CK-B**	2	-.044	-.005	.038	.949 - 1
*CK-C2**	2	-.008	.000	.007	.991 - 1
*βGALA**	2	-.006	.000	.006	.994 - 1
*G3PDH-2**	2	-.126	-.004	.108	.875 - 1
*GPI-B2**	3	-.033	-.003	.029	.937 - 1
*GPI-A**	3	-.033	-.007	.025	.950 - 1
*βHEX**	2	-.006	.000	.006	.994 - 1
*mIDHP-1**	2	-.094	.018	.103	.873 - 1
*mIDHP-2**	2	.183	.356	.212	.688 - 1
*sIDHP-1**	2	.658	.666	.024	.975 - 1
*LDH-B1**	3	-.021	-.002	.019	.970 - 1
*LDH-B2**	2	-.065	-.004	.057	.913 - 1
*LDH-C**	3	.096	.130	.037	.929 - 1
*sMDH-A2**	3	-.023	-.001	.021	.969 - 1
*sMDH-B2**	3	.133	.175	.049	.905 - 1
*MPI**	3	.014	.128	.115	.667 - 1
*PEPA**	2	-.010	.000	.010	.990 - 1
*PEPC**	2	-.080	-.004	.070	.900 - 1
*PEPLT**	2	-.059	.090	.141	.813 - 1
*PGDH**	2	-.022	-.001	.020	.975 - 1
*PGM-2**	2	-.016	.108	.122	.512 - 1
*sSOD-1**	3	-.015	-.001	.014	.980 - 1
*TPI-4**	2	-.009	.000	.008	.991 - 1
Mean		.001	.244	.244	
Other loci:					
*mAH-1,2**	4	-	-	-	.552 - 1
*LDH-A1**	2	-	-	-	.875 - 1
*PGM-1**	2	-	-	-	.025 - 1

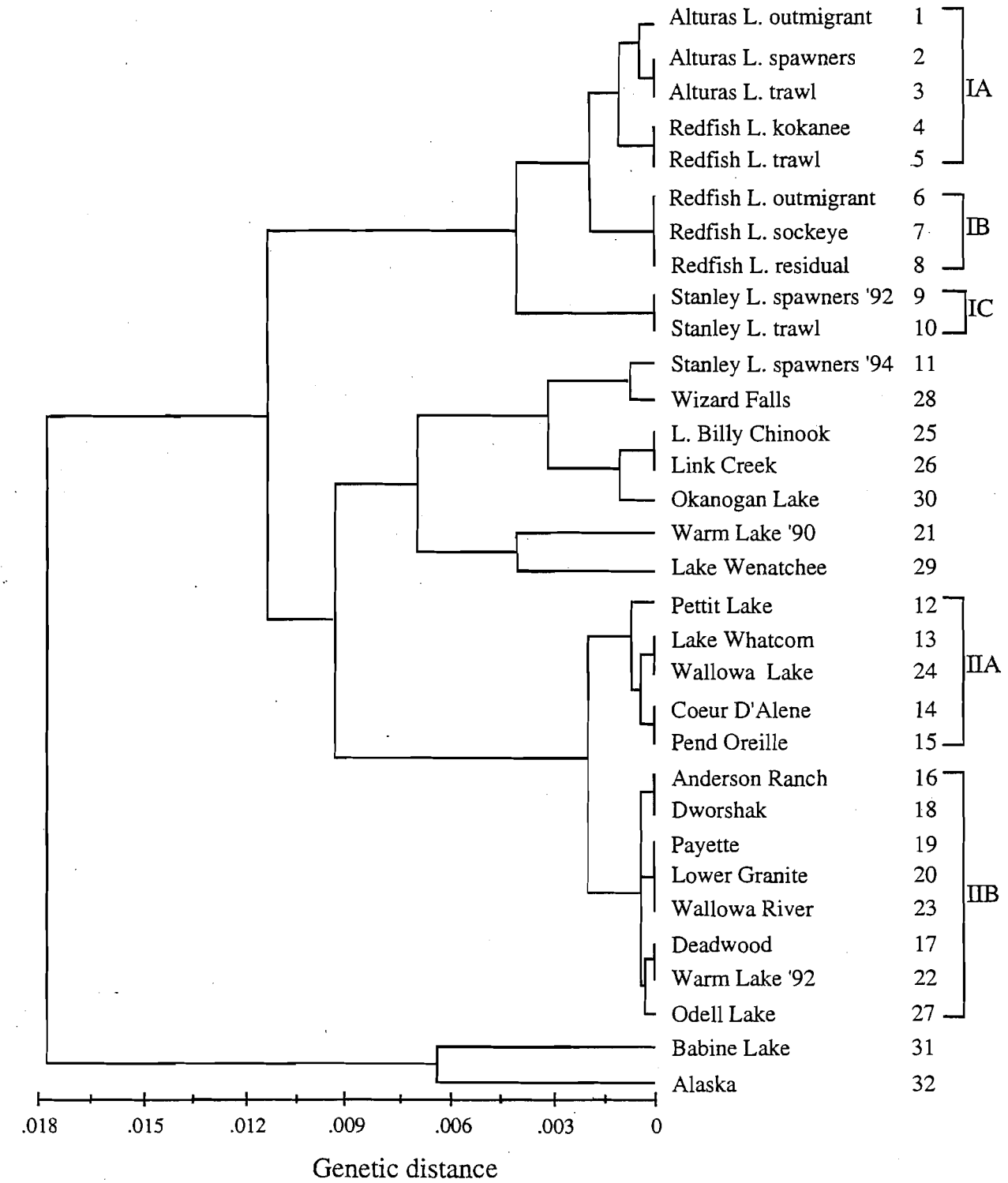

Figure 2. Dendrogram of genetic relationships among 32 populations of *O. nerka* from the Pacific Northwest, based on variation at 64 gene loci. Clustering used the UPGMA method based on a matrix of Nei's (1978) unbiased estimates of genetic distance between each pair of samples. Numbers correspond to population ID numbers in Table 1. See text for discussion of major genetic groups I and II.

Group I includes all of the *O. nerka* samples from Redfish, Alturas, and Stanley Lakes, with the exception of the 1994 sample of spawners from Stanley Lake. Three subgroups can be identified within this area: Redfish and Alturas Lakes kokanee and trawl samples and Alturas Lake outmigrants (IA); Redfish Lake sockeye salmon, outmigrants, and residuals (IB); and Stanley Lake trawl samples and 1992 spawners (IC).

Group II includes all the samples of Idaho kokanee from outside the Sawtooth Valley area. Two subgroups can be identified: a northern-Idaho (Columbia River drainage) kokanee group (IIA); and a Deadwood Reservoir (Snake River drainage) kokanee group (IIB). In addition to the Lake Pend Oreille and Coeur d'Alene Lake populations, group IIA also includes samples from Lake Whatcom and Pettit Lake and the 1993 sample from Wallowa Lake. Group IIB includes samples from the Deadwood, Dworshak, Anderson Ranch, and Lower Granite Dam Reservoirs, Payette Lake/River, the 1992 samples from Warm Lake and the Wallowa River, and the sample from Odell Lake.

Also apparent in Figure 2 is a third, loosely affiliated group that includes Lake Wenatchee and Okanogan River sockeye salmon, the 1994 Stanley Lake spawners, the 1990 Warm Lake sample, and three samples of kokanee from the Deschutes River drainage in Oregon. The samples from the British Columbia coast (Babine Lake) and Alaska (Fish Creek) were genetic outliers in this analysis. A cluster analysis of Cavalli-Sforza and Edwards' (1967) chord genetic distance (not shown) revealed most of the same major features, including 2 major genetic groups and 2-3 subgroups each within each of the major groups.

Figure 3 shows another representation of the pairwise genetic distance values, this time by multidimensional scaling. The same major genetic groups, subgroups, and outliers that were identified in the dendrograms are evident here as well. Note that the minimum-length spanning tree in Figure 3 indicates the genetic affinity of the 1994 spawner sample from Stanley Lake with the sample from Wizard Falls Hatchery.

Most of the same features of population genetic structure can be seen in the PCA analysis (Fig. 4). The Sawtooth Valley samples (Group I) are well differentiated from all other *O. nerka* sampled, and the inset shows detail of the two subgroups of kokanee, primarily from Idaho (Groups IIA and IIB). One difference between the PCA and the genetic distance analyses was that the sample from Lower Granite Dam was more similar to Group IIB populations in the dendrogram and MDS plot, whereas it was more closely affiliated with Group IIA in the PCA.

To provide a more focused look at genetic relationships within the Sawtooth Valley, we repeated these analyses using only Sawtooth Valley samples, as well as samples from two exogenous hatchery populations that are the presumed sources of populations sampled in Pettit and Stanley Lakes. Several points are worth noting from an examination of the results of these analyses, which are shown in Figures 5 and 6. First, the Pettit Lake and 1994 Stanley Lake spawner samples were quite divergent from all other *O. nerka* in the Sawtooth Valley, but they were quite similar to the Lake Whatcom and Wizard Falls Hatchery stocks, respectively. Second, on this scale, four separate genetic groups of presumably native *O. nerka* are evident in Sawtooth Valley Lakes: Redfish Lake kokanee; Alturas Lake kokanee and outmigrants; Redfish Lake sockeye/residuals/outmigrants; and Stanley Lake kokanee (except the spawners sampled in 1994). Of these groups, the most similar pair were

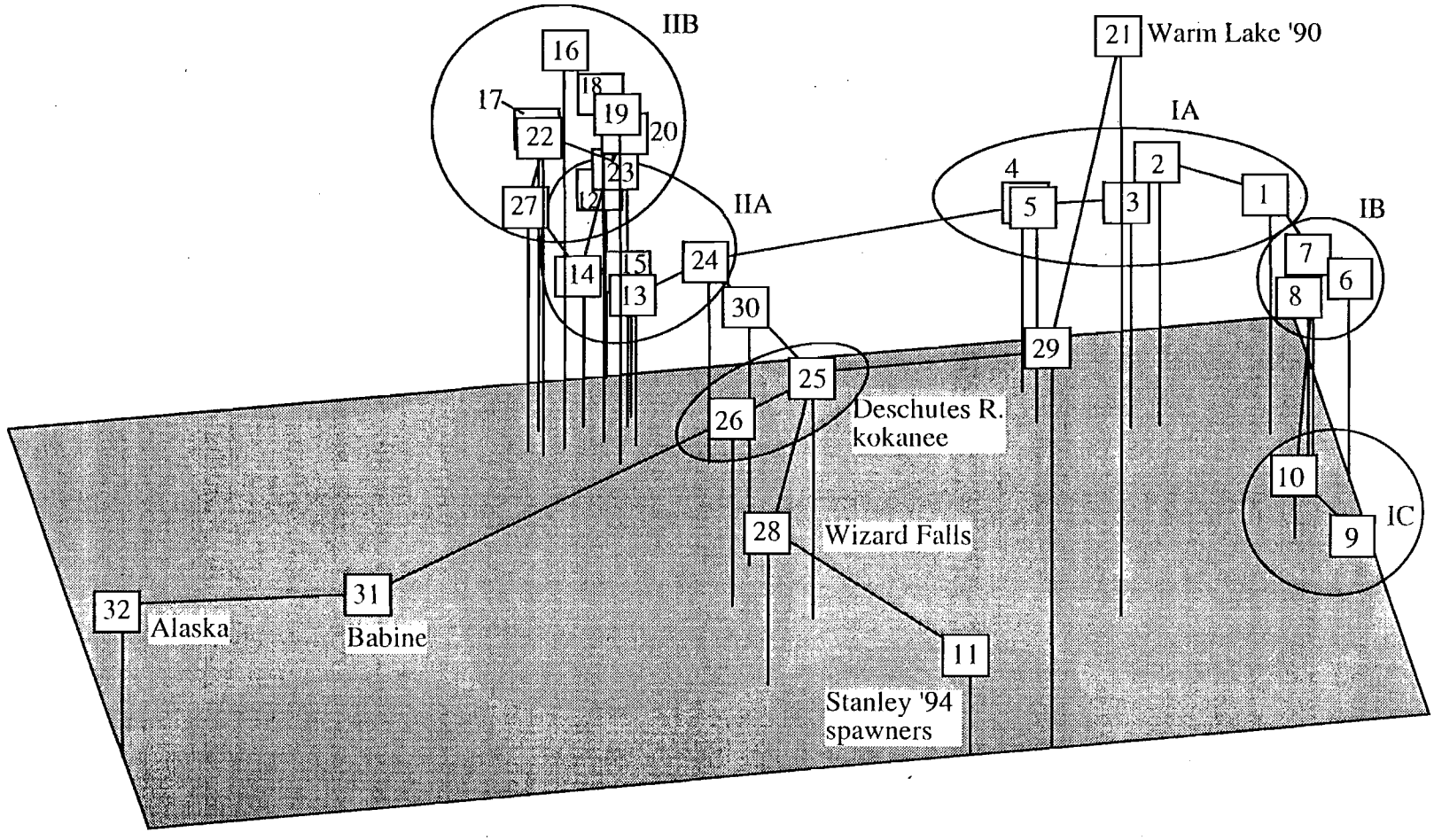

Figure 3. Multidimensional scaling (MDS) plot of genetic relationships among 32 populations of *O. nerka* from the Pacific Northwest, with a minimum-spanning tree superimposed. This figure is another way of representing the same genetic distance data depicted in Figure 2. Major genetic groups I and II from Figure 2 are identified here.

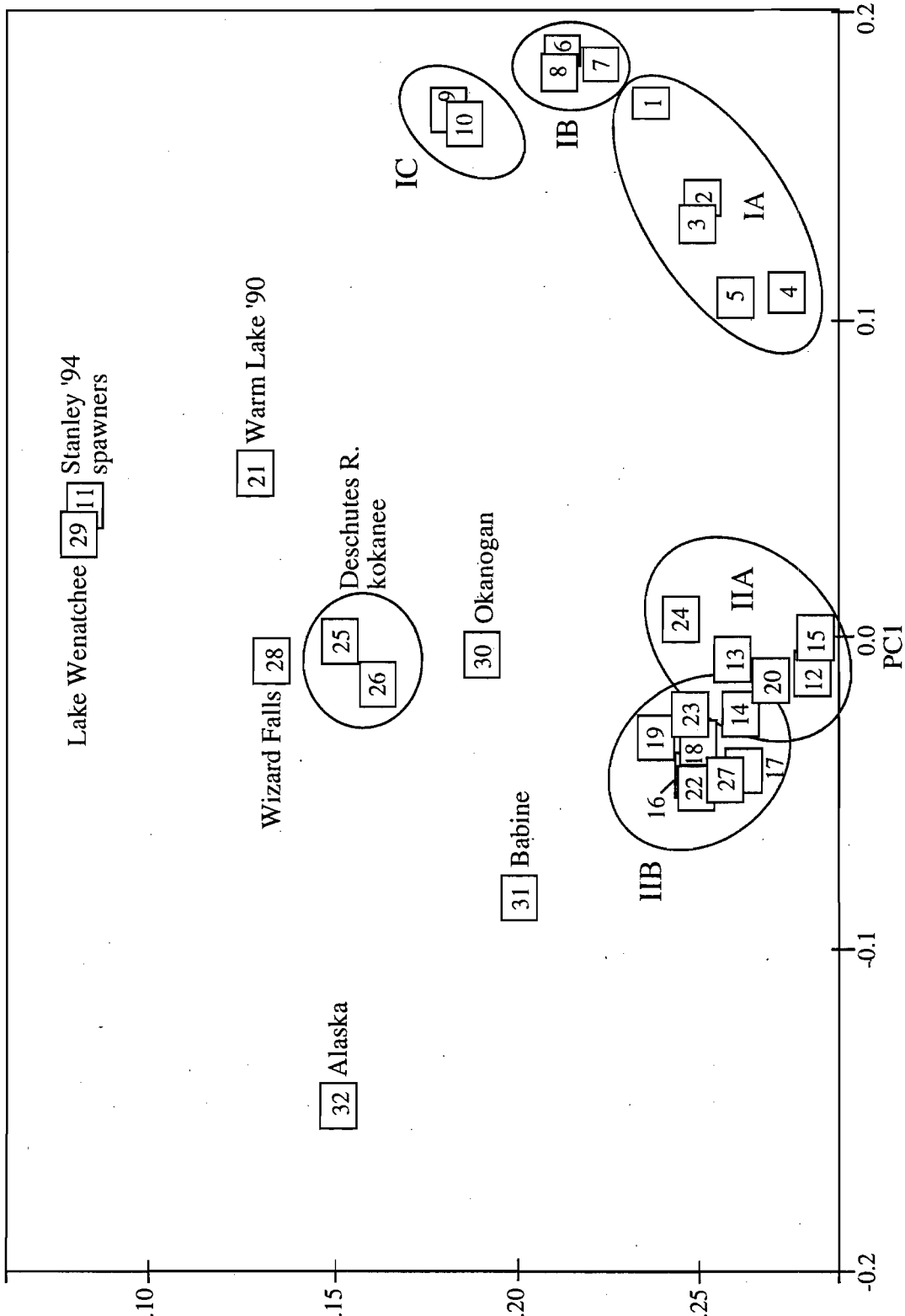

Figure 4. Principal components analysis (PCA) of genetic relationships among 32 populations of *O. nerka* from the Pacific Northwest. The PCA analysis used the same samples and the same raw data as were used in Figures 2 and 3.

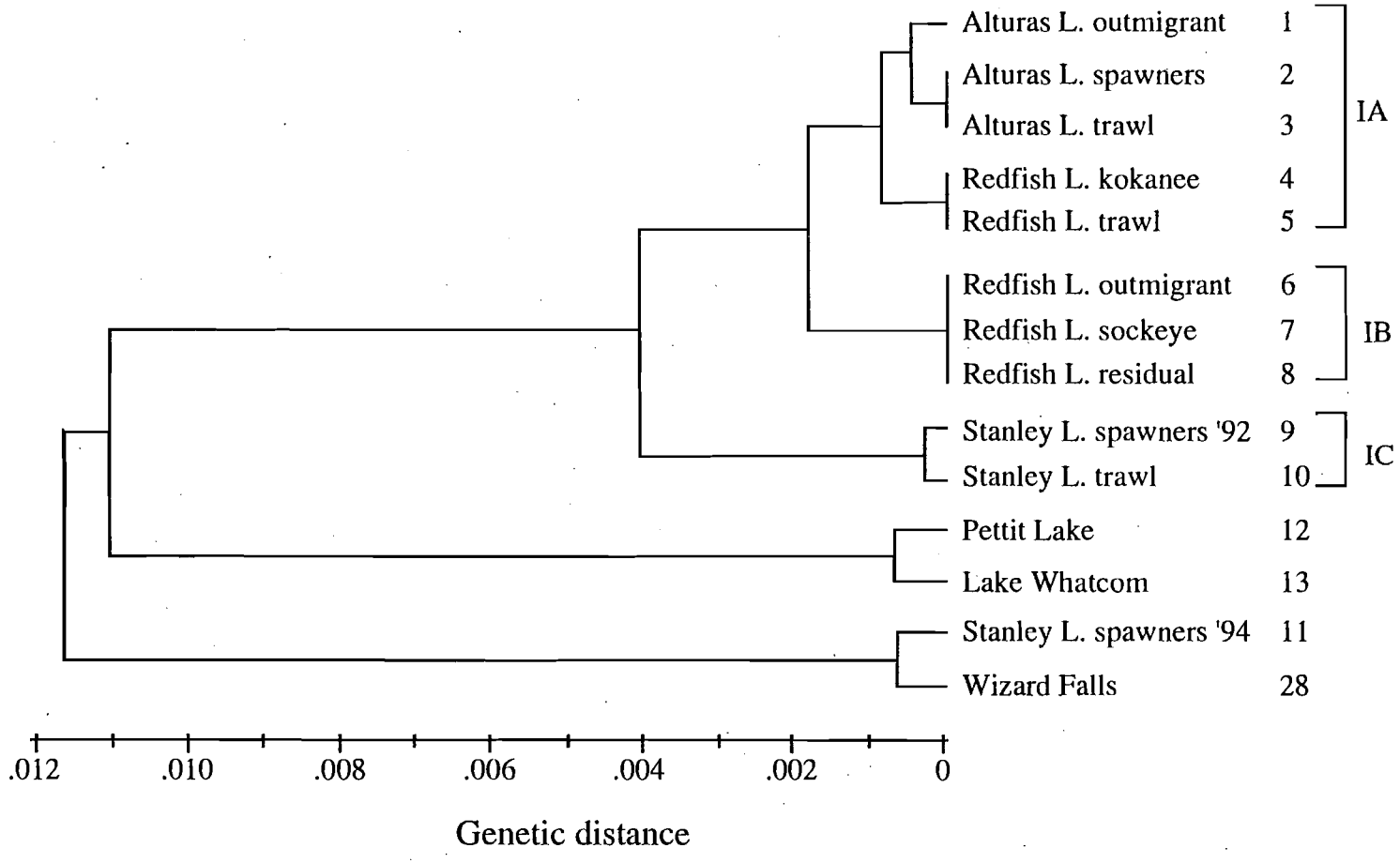

Figure 5. As in Figure 2, but using only 12 populations from the Sawtooth Valley in Idaho and two exogenous populations.

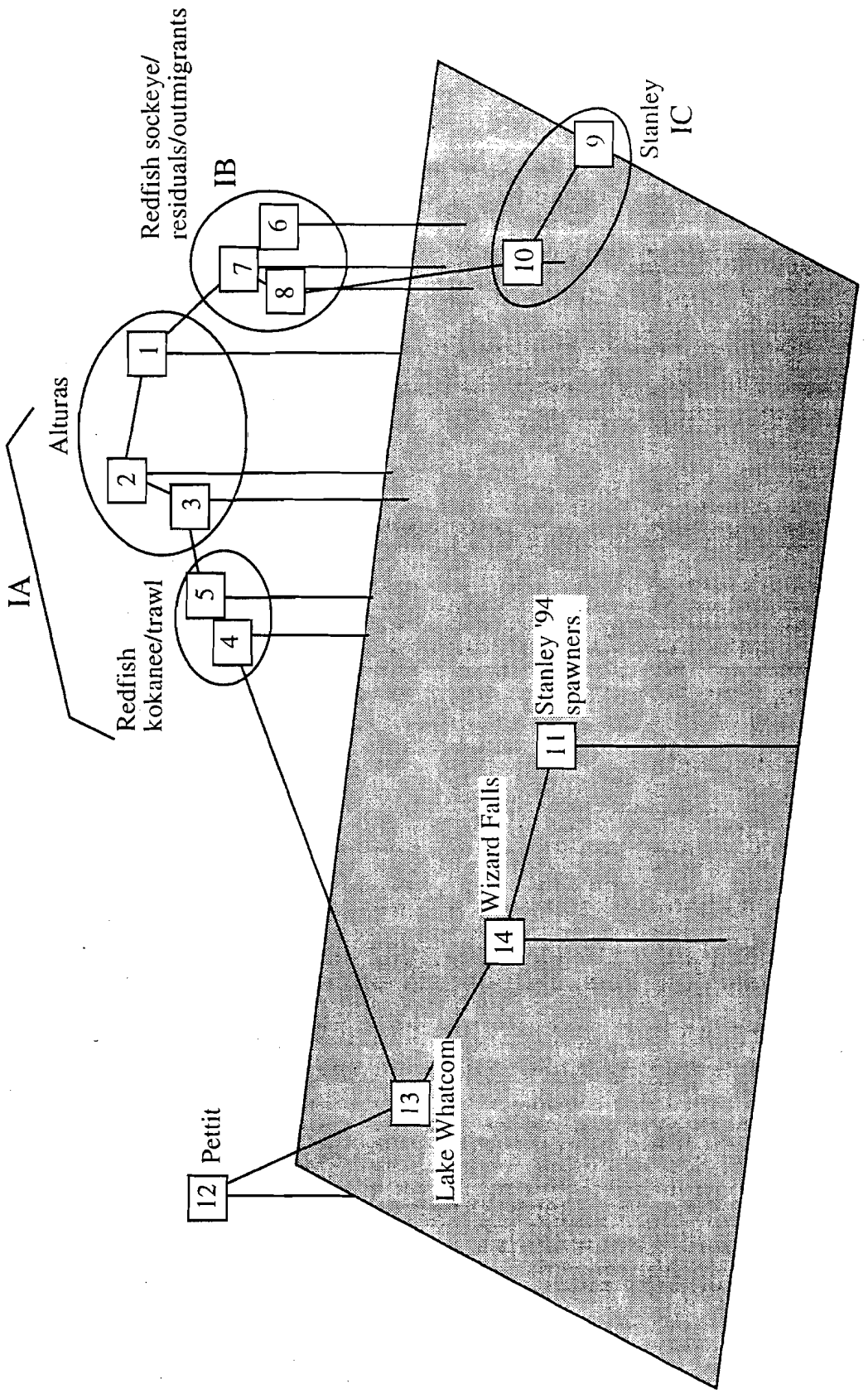

Figure 6. As in Figure 3, but using only 14 populations from the Sawtooth Valley in Idaho and two exogenous populations.

Redfish Lake kokanee and Alturas Lake *O. nerka*, and the most divergent are Stanley Lake kokanee. This figure also shows the intermediate position of the 1991 outmigrant sample from Alturas Lake, which exhibited some genetic affinity to the Redfish Lake sockeye salmon group as well as to the other samples of *O. nerka* from Alturas Lake.

The heterogeneity chi-square tests provided an opportunity to evaluate more fine scale patterns of genetic differentiation within several geographic regions and genetic clusters.

Sawtooth Valley

As described above, we have seen evidence for one genetic group of *O. nerka* in Alturas Lake, two groups (kokanee/trawl and sockeye/outmigrant/residual) in Redfish Lake, and two groups in Stanley Lake. We also found evidence for a significant degree of differentiation among the lakes. All of the Alturas Lake samples considered together differed significantly from all other samples in the Sawtooth Valley lakes. Uncommon alleles at *GPI-A** and *LDH-C** that occurred in multiple samples from Alturas Lake were not found in other Sawtooth Valley collections. Although statistically significant, the allele frequency differences between Redfish Lake kokanee and Alturas Lake *O. nerka* were not large. Relatively modest allele frequency differences between the groups at *ADH*, mAAT-1*, *ALAT**, *GPI-A**, and *LDH-C** resulted in a highly significant ($P < 0.001$) overall test because of the large combined sample sizes involved. All of the Redfish Lake *O. nerka* samples also differed significantly from the Stanley Lake samples.

Because the genetic distance analyses suggested that the 1991 outmigrant sample from Alturas Lake was genetically intermediate between the Alturas

Lake/Redfish Lake kokanee and the Redfish Lake sockeye/outmigrants/residuals, we examined these samples in more detail. Based on the overall chi-square test, the Alturas Lake outmigrants had statistically significant allele frequency differences compared to combined Redfish Lake kokanee (chi-square = 30.5, 14 df, $P < 0.01$; 1 of 11 loci significant), combined Redfish Lake trawl samples (chi-square = 24.0, 14 df, $P < 0.05$; 1 of 12 loci significant), and combined Redfish Lake outmigrants (chi-square = 56.6, 14 df, $P < 0.001$; 2 of 10 loci with significant differences). The Alturas Lake outmigrants also differed statistically from the combined Redfish Lake residuals (chi-square = 15.7, 7 df, $P < 0.05$; 1 of 6 loci with significant differences) but not from the combined Redfish Lake sockeye salmon (chi-square = 13.74, 8 df, $P > 0.05$). However, these latter two comparisons had limited power because of the small sample sizes of the Redfish Lake sockeye salmon and residuals.

Because allele frequencies in the Redfish Lake sockeye salmon and residual samples were similar to those in the Redfish Lake outmigrants, we believe that very different sample sizes were responsible for the different results in the heterogeneity chi-square tests comparing these samples with the Alturas Lake outmigrants. For example, the Redfish Lake outmigrants, sockeye salmon, and residual samples were similar in having a very low frequency (0-0.008) of the "94" allele at *ADA-1**, whereas the Alturas Lake outmigrant sample had a relatively high frequency (0.107). Nevertheless, because of the large size of the combined Redfish Lake outmigrant sample (N = 181) compared to the other two samples (N = 13 for sockeye salmon and N = 14 for residuals), the *ADA-1** comparison with Alturas Lake outmigrants was significant for the Redfish Lake outmigrants but not for the sockeye salmon or residuals.

Examination of the allele frequencies shown in Appendix Table 2 suggests that the intermediate genetic affinities of the Alturas Lake outmigrant sample were due primarily to frequencies at *mAAT-1**. At this locus, the Redfish Lake kokanee and trawl samples (frequency for the "-82" allele about 0.4-0.5) were well differentiated from the Redfish Lake outmigrant, sockeye salmon, and residual samples (allele frequency about 0.8-0.9). Frequencies in the Alturas Lake spawner and trawl samples (about 0.6) were similar to those in Redfish Lake kokanee. The Alturas Lake outmigrant sample, however, had a frequency (0.8) that was closer to the Redfish Lake sockeye/outmigrant/residual profile. At the other key loci (*ADA-1** and *mAH-1,2**), frequencies in the Alturas Lake outmigrants were closer to those in the other Alturas Lake samples.

Idaho kokanee

Waples (1995) and Winans et al. (1996) previously noted a close genetic affinity between samples from the Lake Whatcom stock and from late-spawning kokanee populations in the Columbia River basin in northern Idaho (Lake Pend Oreille and Coeur d'Alene Lake). None of the pairwise comparisons of these three samples were statistically significant in the overall test. At the *CK-B** locus, these three samples had an allele ("102") at a frequency of about 0.05 that was missing in all other samples of *O. nerka* except Lake Wenatchee and Wizard Falls Hatchery, where it was rare (frequency less than 0.01). It is possible that the presence of this allele in Lake Wenatchee sockeye salmon is due to the release of over 20 million kokanee from Lake Whatcom into Lake Wenatchee over a 30-year period (Mullan 1986). It is also possible

that its presence in the Wizard Falls Hatchery population is due to incorporation of Lake Wenatchee *O. nerka* into Wizard Falls broodstock several decades ago (Kostow[2]).

The combined Pettit Lake samples differed significantly from the Lake Whatcom, Coeur d'Alene, and Pend Oreille samples ($P < 0.01$ for overall test; 3 individual loci with significant differences in each comparison). However, the allele frequency differences at these loci were not large, and the Pettit Lake samples shared some of the genetic traits that characterize the late-spawning kokanee populations from Lake Whatcom and northern Idaho: low frequency of the "-100" allele at *mAAT-1**, absence of variation at *MPI**; relatively high frequencies of the "136" allele at *PGM-2**, and approximately equal frequencies of three different alleles ("100," "91," and "95") at *ALAT**. The 1993 Wallowa Lake sample also shared this genetic profile, except that it had slightly higher frequencies of the "-100" allele at *mAAT-1**. This was the only locus at which the Wallowa Lake sample differed significantly from the Lake Whatcom, Coeur d'Alene, and Pend Oreille samples.

The second genetic group of Idaho kokanee also showed a high degree of homogeneity among populations. Of all the pairwise comparisons among samples from Anderson Ranch, Deadwood, and Dworshak Reservoirs and Payette River/Lake, only that for Deadwood/Payette was statistically significant. Three other samples (Lower Granite Dam, Warm Lake 1992, and Wallowa River 1992) also showed a close genetic affinity to this group. Of the pairwise comparisons involving those samples, only those for Wallowa/Payette, Wallowa/Deadwood, and Warm/Payette were statistically significant. The sample from Odell Lake was more loosely affiliated with this group; it

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[2]K. Kostow, Oregon Department of Fish and Wildlife, 2501 SW First Ave., Portland, OR 97207. Pers. commun., March 1997.

had allele frequencies characteristic of the group at several loci (e.g., *ALAT*, ADA-1*, GPI-A*, MPI*,* and *PGM-1**) but differed somewhat at several other loci.

Two other pairs of samples showed a relatively high genetic affinity. The samples of kokanee from Link Creek and Lake Billy Chinook, both from the Deschutes River in Oregon, did not differ significantly. The Wizard Falls Hatchery population shared with the 1994 sample of Stanley Lake spawners unusual allele frequencies at a number of loci, including *ALAT*, mIDHP-2*, LDH-A1*, LDH-C*, PGM-1*,* and *PGM-2**.

The remaining samples considered in this study were all genetically distinct from one another. Even the closest populations geographically had highly significant allele frequency differences at some loci. For example, the two closest sockeye salmon populations in the Columbia River basin, in Lake Wenatchee and the Okanogan River, differed substantially in frequencies of the "-100" allele at *mAAT-1** (near zero to 0.583, respectively). Lake Wenatchee sockeye salmon were further distinguished by the presence of an allele ("77" at *mIDHP-1**) at a frequency of about 0.13 that is rare or absent in all other populations. The 1990 Warm Lake sample was a genetic outlier, and the samples from the Babine River and Alaska were quite distinct from each other as well as from all other U.S. populations.

DISCUSSION

Redfish Lake *O. nerka*

At the time a listing determination had to be made for Redfish Lake sockeye salmon (April 1991), there remained substantial uncertainty about the relationship between anadromous and resident forms in the lake (Waples et al. 1991). An important historical factor complicating the situation was Sunbeam Dam, which was

built on the Salmon River downstream from Redfish Lake in 1910 and remained in place until at least 1934 (Jones 1991). By all accounts Sunbeam Dam was a major impediment to upstream migration of anadromous fish, and it may have been a complete block, at least in some years.

According to one hypothesis (Chapman et al. 1990), the original sockeye salmon population was extirpated by Sunbeam Dam, and anadromous fish returning in recent years were simply the progeny of seaward-drift of kokanee from the relatively abundant Fishhook Creek population. An alternative hypothesis is that the original sockeye salmon population survived Sunbeam Dam, either by achieving limited passage, by spawning in downstream areas and recolonizing Redfish Lake after the dam was partially breached in 1934, or by residualizing in the lake and later restoring anadromy. Information available at the time of the 1991 status review was not sufficient to determine with any certainty which of these hypotheses was correct (Waples et al. 1991). In spite of this uncertainty, NMFS proposed that Snake River sockeye salmon be listed as endangered in April 1991, and the listing was finalized later that year.

Information reported here strongly supports the second hypothesis (as well as the decision to list the species under the ESA)--that the original sockeye salmon gene pool persisted in spite of the effects of Sunbeam Dam. There are clearly two distinct gene pools of *O. nerka* in Redfish Lake: one consisting of Redfish Lake kokanee, the other of anadromous and "residual" fish from the lake. Outmigrants collected in 1991-93 appear to be mostly (if not entirely) from the anadromous/residual gene pool, while the 1992-94 trawls appear to have taken almost entirely fish from the kokanee gene pool. The genetic similarity of the trawl and kokanee spawner samples is

reasonable, given that no anadromous fish have spawned in the lake since 1989, and that the Fishhook Creek kokanee population is believed to be many times larger than any other resident population in the lake.

As a result, in part, of information provided by this study, NMFS has refined the definition of the Evolutionarily Significant Unit (ESU) for Snake River sockeye salmon. The Fishhook Creek kokanee population, which appears to have been strongly isolated from the anadromous population for a substantial period of time, is not included in the ESU and not protected under the ESA. The residual population, on the other hand, appears to be closely linked genetically to the anadromous population and is considered part of the listed ESU. With the small samples of anadromous and residual fish available (N = 13 and 12, respectively), it is not possible to draw definitive conclusions about their relationship, except to say that no significant genetic differences were observed between the two forms. One possible scenario is that there is some regular or intermittent exchange between the life history forms, with anadromous fish occasionally producing offspring that remain in the lake until maturity, and/or resident fish occasionally producing offspring that migrate to sea and back. This hypothesis is consistent with preliminary microchemistry analysis of otoliths from residuals and returning adults (Kline[3]).

We have used the term "residual" to describe resident *O. nerka* in Redfish Lake that are genetically similar to the sockeye salmon. These resident fish have many of the features typically associated with "residual" sockeye salmon: they spawn at the same place and approximately the same time (October-November) as all recent

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[3]P. Kline, Idaho Department of Fish and Game, Eagle Fish Health Laboratory, 1800 Trout Road, Eagle, ID 83616. Pers. commun., May 1997.

observations of anadromous *O. nerka* spawning in Redfish Lake, and they are similar in size to kokanee but have a much more drab (greenish) spawning coloration than the Fishhook Creek kokanee. However, the Redfish Lake "residuals" differ in one important respect from the profile of "residual" sockeye salmon as originally defined by Ricker (1940): whereas residual sockeye salmon are almost exclusively male, the limited information available for the Redfish Lake population indicates that females are present (for example, some were included among the fish we analyzed), and the sex ratio may be approximately equal. It is not clear, therefore, what is the best term to use in referring to these fish. It is possible that they represent another kokanee population, albeit one that is much more closely linked to the anadromous population than are the Fishhook Creek kokanee. In this report, we prefer not to use the term kokanee for these resident fish to avoid confusion with the Fishhook Creek kokanee. We have used instead the term "residuals," recognizing that it may not be literally correct, at least as the term is usually understood.

In any case, it appears that the situation involving life history forms of *O. nerka* in Redfish Lake is unusually complex for the species. Although a number of lake/river systems support both sockeye salmon and kokanee, and others have both sockeye salmon and residuals, there has apparently never been a report of a system that supports all three forms (Foote[4]).

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[4]C. Foote, School of Fisheries, WH-10, University of Washington, Seattle, WA 98195. Pers. commun., May 1997.

Effects of Stock Transfers

Because the ESA focusses on conserving native populations in their natural ecosystems, it is important to consider the effects on population genetic structure of the numerous stock transfers recorded into or between key populations in the Snake River basin (summarized in Table 4). Although efforts have been made to include all known stock transfers into historic sockeye-bearing lakes in the Snake River basin, the list in Table 4 is not necessarily comprehensive. Some stock transfers are poorly documented or never recorded at all, and when records were kept they may now be missing or incomplete. For example, according to Bowler (1990), Idaho stocking records for 1946-50 have been lost. In other cases, the hatchery that reared the transplanted fish is known but the original source of the stock is difficult to determine.

Of particular interest is evidence regarding the effects of recent (1980-83) releases of sockeye salmon fry from Babine Lake into Alturas and Stanley Lakes. Although a rigorous evaluation of this stocking program was never conducted, no adult returns were observed, and it is generally believed to have been a failure (Hall-Griswold 1990). Genetic data collected in this study support that conclusion. For example, the "-100" allele at *mAAT-1** was nearly fixed (frequency 0.942) in the Babine Lake sample but was rare or uncommon in all the samples from Stanley Lake (range 0.05-0.192). Similarly, at *ALAT**, the "91" allele occurred at high frequency (0.650) in Babine Lake but was rare in each of the samples from Alturas Lake (range 0.033-0.069). In fact, excluding the sample from Alaska, the genetic distances between the samples from Alturas and Stanley Lakes and the sample from Babine Lake were larger than those found between the Sawtooth Valley populations and any other

populations we examined in this study. (This was not true for the 1994 sample of spawners from Stanley Lake, which is discussed below.)

We also found no evidence that stock transfers of kokanee into Redfish and Alturas Lakes have had a substantial genetic impact on extant populations. However, the strength of this conclusion is limited somewhat by two factors. First, power to detect genetic effects of stock transfers is greatest if the donor population is known and has been characterized. Unfortunately, some of the introductions were from unknown sources, and others were from stocks that may have changed in composition over time. For example, although our recent sample from Anderson Ranch Reservoir was genetically similar to samples from Deadwood Reservoir, Payette Lake/River, and Dworshak Reservoir, there are indications that at one time Anderson Ranch was stocked with late-spawning kokanee from northern Idaho (Hall-Griswold 1990). Second, we lack historical data on the genetic composition of *O. nerka* in Alturas or Redfish Lake, so we do not know whether or how much those characteristics have changed over time. Although relatively large and highly significant allele frequency differences were found between the Redfish and Alturas Lake samples and both the early-spawning Anderson Ranch/Payette/Deadwood/Dworshak kokanee complex and the late-spawning northern Idaho kokanee complex, it is possible that *O. nerka* in Redfish and Alturas Lakes were even more distinctive prior to those introductions.

In contrast, data for the Pettit Lake trawl samples from 1992 and 1994 showed a strong genetic affinity with the late-spawning kokanee populations from northern Idaho. Presumably, the current population in Pettit Lake is derived from northern Idaho kokanee obtained from Anderson Ranch Reservoir that were planted in the lake in 1968 (Table 4). If any *O. nerka* native to Pettit Lake survived overharvests, the

Table 4. Records of transplants of sockeye salmon and kokanee into selected Snake River populations. These records are not necessarily complete, particularly prior to 1968. Releases of local stocks are not included. Sources: a = Bowler 1990; b = Howell et al. 1985; c = Corley 1966; d = Hall-Griswold 1990; e = Welsh 1991; f = Chapman et al. 1990; g = Cramer 1990; h = Natural Resources Consultants (NRC) 1995; i = Kostow 1996; j = D. Anderson, Idaho Department of Fish and Game, 555 Deinhard Lane, McCall, ID 83638, pers. commun., April 1997; k = IDFG 1997.

Year	Source	Number	Lifestage	Type	Source
	Alturas Lake				
1921	Unknown	40,300	yearling	sockeye[1]	d
1930-52	Unknown	655,500	fry, yearling	kokanee	a
1941	Bull River, Montana	> 10^6	eggs	kokanee	f
1966	Anderson Ranch Res.	59,332	fry	kokanee	d
1968	Anderson Ranch Res.	196,000	fry	kokanee[6]	d
1983	Babine Lake, B.C.	480,000	fry	sockeye	b
1984	Babine Lake, B.C.	63,000	fry	sockeye	b
	Payette Lake				
1940-47	Unknown	1,480,066	fry	sockeye	h
1946[3]	Unknown	102,000	fry	sockeye	h
1968-71	Eagle Hatchery	618,485	fry, fingerling	kokanee[6]	k
1970	Hayspur Hatchery	89,577	fry	kokanee[6]	k
1972[7]	Eagle Hatchery	119,880	fry	kokanee[6]	k
1972[7]	Hayspur Hatchery	84,000	fry	kokanee[6]	k
1975[7]	McCall Hatchery	82,800	fry	kokanee[6]	k
1975	McCall Hatchery	138,000	fry	kokanee[6]	k
1976[7]	American Falls Hatchery	87,500	fry	kokanee[6]	k
1976	American Falls Hatchery	87,500	fry	kokanee[6]	k
1988	Eagle Hatchery	300,266	fingerling	kokanee[5]	k
1989-93	Deadwood Reservoir	1,068,500	fingerling	kokanee[5]	k
	Pettit Lake				
1932-33	Unknown	18,400	yearling	kokanee	a
1965	Unknown	29,600	fingerling	-	c
1968	North Idaho	79,100	fry	kokanee[6]	a
1995	Redfish Lake	8,572	fingerling	sockeye	k
	Redfish Lake				
1930	Kootenay Lake, B.C?	17,500	-	kokanee	e
1930-45	Unknown	225,900	fry, yearling	kokanee	a
1940-47	Unknown	325,320	fingerling	sockeye	h
1941	Bull River, Montana	> 10^6	eggs	kokanee	f
1962	Anderson Ranch Res.	43,251	fry	kokanee	d
1968[2]	Unknown[9]	10,440	fingerling	sockeye	k
1971[2]	Anderson Ranch Res.	50,344	fry	kokanee[6]	d
1971	Anderson Ranch Res.	45,900	fry	kokanee[6]	d
1972	Anderson Ranch Res.	51,435	yearling	kokanee[6]	d

Table 4, continued

Year	Source	Number	Lifestage	Type	Source
	Stanley Lake				
1923	Unknown	1,000	-	kokanee?	d
pre-1935	Unknown	numerous	-	kokanee	d
1946	Unknown	379,000	-	sockeye	h
1981	Babine Lake, B.C.	173,880	fry	sockeye	b
1982	Babine Lake, B.C.	260,393	fry	sockeye	b
1983	Babine Lake, B.C.	150,015	fry	sockeye	b
1984	Babine Lake, B.C.	147,000	fry	sockeye	b
1988	Deadwood Reservoir	49,926	yearling[10]	kokanee[5]	a
1989	Deadwood Reservoir	60,000	yearling[10]	kokanee[5]	a
1990	Deadwood Reservoir	52,800	fingerling	kokanee[5]	k
1991	Roaring Judy H., CO	56,250	fingerling	kokanee[6]	k
1991	Deadwood Reservoir	34,500	fingerling	kokanee[5]	k
	Streams of Sawtooth Mountains				
1921	Hayspur Hatchery	15,000	yearling	kokanee	d
	Wallowa Lake				
1914	Alaska	380,500	-	sockeye	h
1916-19	Unknown	5,144,300	-	sockeye	h
1922-37	Unknown	21,784,521	fry, fingerling	sockeye	h
1925-26[4]	Unknown	2,443,600	fry, fingerling	kokanee	g
1926-50	Unknown	1,041,200	-	kokanee	g
1953-54	Unknown	147,910	-	kokanee	g
1955-70	Montana	2,588,513	fry, fingerling	kokanee	g
1962-63	Washington	304,269	fry, fingerling	kokanee	g
1964-66	British Columbia	615,550	fry, fingerling	kokanee	g
1981-94	Wizard Falls Hatchery	136,000	fry, fingerling	kokanee	i
	Warm Lake				
1938	Evergreen Hatchery	25,000	-	sockeye	d
1940-52	McCall Hatchery	248,490	fry	kokanee?[8]	k
1946	McCall Hatchery	118,000	fry, fingerling	sockeye	k
1948	North Idaho	20,000	fry	kokanee?[8]	k
1950-62	McCall Hatchery	831,000	fry	kokanee	j
1990	Deadwood Reservoir	49,980	fingerling	kokanee[5]	j

[1] Recorded as kokanee by Bowler 1990
[2] Released into Fishhook Creek, a tributary of Redfish Lake
[3] Released into Payette River
[4] Released into the Wallowa River
[5] Recorded as "early spawner" by IDFG (1997)
[6] Recorded as "October spawner" by IDFG (1997)
[7] Released into Little Payette Lake
[8] Recorded as "blueback salmon"
[9] Source may have been Redfish Lake stock
[10] Recorded as fingerling by IDFG (1997)

effects of Sunbeam Dam and other barriers to migration, and poisoning of the lake in 1960 (Hall-Griswold 1990), they have yet to be found.

The situation regarding stock transfers and extant populations of *O. nerka* in Stanley Lake is more complex, as this lake apparently supports both indigenous and introduced populations. Four of the five samples from Stanley Lake (1992 spawners and 1992, 1993, and 1994 trawled fish) appear to be from a common gene pool that is more similar to *O. nerka* from Redfish and Alturas Lakes than it is to any other populations we examined. We believe that the most likely explanation is that this gene pool is native to Stanley Lake. Again, we cannot rule out some effects on this gene pool from stock transfers, but it appears that at least substantial native components remain. In contrast, the gene pool represented by the eight spawners collected in 1994 is radically different from other Stanley Basin *O. nerka*. These fish spawn somewhat later than the spawners sampled in 1992, and the most plausible explanation is that they are the result of an introduction, either directly or indirectly, from the Wizard Falls Hatchery stock. The close similarities in allele frequencies to the Wizard Falls population at several key gene loci are too striking to be explained by chance. Table 4 shows a release into Stanley Lake of 56,250 October-spawning kokanee fingerlings from Roaring Judy Hatchery in Colorado, and it is possible that this was the source of the spawners sampled in 1994. However, the Roaring Judy Hatchery stock was initiated with an egg take in 1950 from Flathead Lake in Montana, and there is no record of use of Wizard Falls stock at the hatchery (Weiler[5]).

[5]B. Weiler, Colorado Division of Wildlife, 6060 Broadway, Denver, CO 80216. Pers. commun., May 1997.

Historically, Payette Lake may have supported the largest run of sockeye salmon in the Snake River basin, but access for anadromous fish was blocked by impassable dams early in this century (Chapman et al. 1990). The recent samples from Payette Lake and River were genetically similar to samples of introduced kokanee from reservoirs throughout Idaho. This close genetic similarity suggests that all these populations share a common heritage, but it is not clear whether this has resulted from 1) planting of Payette Lake with the same stock used in the reservoirs, or 2) use of native Payette Lake stock in forming the early-spawning kokanee stock that has been widely spread throughout Idaho. A late December, beach-spawning population of kokanee has recently been observed in Payette Lake (Anderson[6]). This may be a remnant, native population of *O. nerka,* but it has not been sampled or genetically characterized.

The genetic data also provided considerable insight into the effects of stock transfers into two other Snake River lakes that historically supported populations of sockeye salmon: Warm Lake and Wallowa Lake. The 1990 sample from Warm Lake was quite distinctive, bearing little genetic similarity to any of the stocks known or likely to have been planted there. The distinctiveness and the low level of genetic variability found in this sample are consistent with the hypothesis that it represents a native gene pool that has been isolated and has experienced severe and/or prolonged bottlenecks in the past. In contrast, the spawners sampled in Warm Lake in 1992 appear to be derived from the stocking in 1990 of fingerlings from Deadwood Reservoir (Table 4). Survivors from that release would have been 3 years old in 1992, a typical

[6]D. Anderson, Idaho Department of Fish and Game, 555 Deinhard Lane, McCall, ID 83638. Pers. commun., May 1997.

age for maturity in kokanee. It is not clear, however, whether these spawners will have a permanent genetic impact on the population. The presumably native fish sampled in 1990 are part of a beach spawning population, whereas the Deadwood Reservoir stock spawns in tributaries. There is little suitable habitat in Warm Lake tributaries for stream spawning kokanee (Anderson[7]), which may help explain why we found no genetic evidence for transfers into the lake that occurred prior to 1990.

The situation is also complex in Wallowa Lake, where we found evidence for two separate gene pools--one spawning in the river and one in the lake. The stream spawners were genetically similar to the Deadwood/Dworshak/Anderson Ranch/Payette group of stream-spawning kokanee, and the lake spawners were genetically similar to late-spawning kokanee from northern Idaho. These genetic affinities suggest that neither of these populations is native to Wallowa Lake. However, these results do not prove that a native gene pool does not persist in the lake; results for Stanley Lake indicate that native and introduced gene pools of *O. nerka* can coexist in Snake River lakes, at least in the short term. Furthermore, the failure of either of the samples from Wallowa Lake to show an affinity to the Wizard Falls stock that has been planted there in recent years is interesting and suggests that the population genetic structure in Wallowa Lake may be complex, and additional sampling might yield more information.

The population in Odell Lake, which is isolated from access by anadromous fish by a lava dam 5-6 thousand years old (USDA 1994), appears to be the result of an

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[7]D. Anderson, Idaho Department of Fish and Game, 555 Deinhard Lane, McCall, ID 83638. Pers. commun., April 1997.

introduction of kokanee from the Deadwood/Dworshak/Anderson Ranch/Payette complex, perhaps with some influence from other stocks as well.

It is notable that all the genetic evidence for successful stock transfers of *O. nerka* found in this study involve kokanee. We found no evidence for genetic effects of transfers of anadromous fish, including several million sockeye salmon from British Columbia that were released into Sawtooth Valley lakes in the 1980s. This result is consistent with Wood's (1995) report of finding many records of successful transplants of kokanee but very few for sockeye salmon. Presumably this reflects the more complicated life history of anadromous *O. nerka* and much greater opportunity for local adaptations to develop.

Amount and Patterns of Genetic Variability

We found relatively low levels of heterozygosity within populations of *O. nerka* considered in this study (range 0.006 to 0.041), a result that is consistent with findings of previous studies (e.g., Utter et al. 1984, Wood 1995). Winans et al. (1996) reviewed available data and concluded that levels of allozyme variability in *O. nerka* are the lowest among the species of Pacific salmon. Any of a variety of factors might be responsible for this result, but the latter authors speculated that the strong association of sockeye salmon with discrete freshwater habitats may have led to isolation and repeated bottlenecks of local populations, which in turn could have eroded levels of genetic variation.

We found no consistent pattern in the levels of genetic variability between resident and anadromous forms. Both of the extreme heterozygosity values noted above were for kokanee populations, but the range of values for the five anadromous populations (Redfish Lake, Lake Wenatchee, Okanogan River, Babine Lake, and Fish

Creek, Alaska) was also fairly large (0.011-0.032), and mean values were similar for the two forms (0.022 for sockeye salmon vs. 0.025 for kokanee).

In Redfish Lake, the samples of kokanee and trawled *O. nerka* had higher heterozygosities (0.021-0.022) than did the samples of sockeye salmon, outmigrants, and residuals (0.010-0.013). This result could be due to any (or a combination) of several factors, the most likely of which are 1) one or more bottlenecks in the anadromous population, which would reduce genetic variability in the sockeye/outmigrants/residuals, and 2) partially successful stock transfers of kokanee, which could inflate levels of genetic variability in the Fishhook Creek population. The effects of a bottleneck(s) can be evaluated quantitatively, based on the relationship that in a single generation bottleneck, heterozygosity declines by approximately the fraction $1/(2N_e)$, where N_e is the effective size of the population. For longer time periods, the following formula is useful (Crow and Kimura 1970):

$$H_t = H_0 (1 - 1/(2N_e))^t.$$

Here, H_0 and H_t are heterozygosities at times 0 and t, respectively, and t is time in generations. In the present case, we have an observed reduction in heterozygosity of the sockeye/outmigrant/residual gene pool of almost 50% compared to the Fishhook Creek kokanee. A bottleneck of $N_e = 2$ for 2 generations could cause a loss almost this large, as could a longer but less severe bottleneck (e.g., $N_e = 10$ for 13-14 generations) or any of a number of more complex scenarios. For example, it is possible that the sockeye salmon gene pool went through a bottleneck during the period that Sunbeam Dam was in operation, and there is good evidence for a recent bottleneck in the population.

Nevertheless, some caution must be used in invoking the bottleneck hypothesis for two reasons. First, a generation for Redfish Lake sockeye salmon is 4-5 years (based on age at maturity data reported by Bjornn et al. 1968), so even with adult returns in single digits every year since at least 1990, the total number over a whole generation is larger (e.g., N = 15 for 1991-95). This is not a number that lends great comfort to conservation biologists, and the effective size is almost certainly somewhat lower, but it still would require a number of generations at this bottleneck size to reduce heterozygosity by 50%. Second, the population size of N = 15 applies only to returning anadromous fish. Although the residual population is poorly understood and believed to be relatively small, it still may number in the hundreds of spawners per year. If the anadromous and resident populations are in fact closely linked genetically, then it is much more difficult to explain the lower heterozygosity levels by severe bottlenecks in recent times.

In contrast to the low levels of within-population genetic variability, the *O. nerka* samples we examined were characterized by unusually large differences between populations. At several loci (*mAAT-1**, *ALAT**, and *PGM-1**), nearly fixed allelic differences were found between some populations. These differences were reflected in Wright's F_{ST}, which is a measure of the proportion of total genetic diversity that is found between (as opposed to within) populations. The mean value in this study (0.244) is larger than has been reported for any study of anadromous Pacific salmonids. This result can be attributed at least in part to the unusually broad geographic coverage of the samples (inland Snake and Columbia River basins to Alaska). Nevertheless, it emphasizes the tendency of sockeye salmon to form discrete,

isolated populations that, apparently, only rarely experience gene flow from other populations.

Captive Broodstock Program

As noted above, a captive broodstock program was initiated in 1991 due to the high risk of extinction faced by Redfish Lake sockeye salmon (Flagg 1993, Johnson 1993). This program was started with collection of juveniles in spring 1991 as they outmigrated from Redfish Lake, and later was supplemented by anadromous adults that returned in fall 1991 and subsequent years. Initially, a major concern regarding the outmigrants was whether they were progeny of sockeye salmon, kokanee, or a mixture of the two. The program wanted to avoid artificially mixing these gene pools in captivity if in fact they were isolated in their natural habitat.

Results from this study have been useful in resolving the origin of 1991 and subsequent outmigrant samples from Redfish Lake. Analysis of early mortalities associated with 1991 trapping operations showed large frequency differences in comparison to Fishhook Creek kokanee, and analysis of the four adults that returned later that year showed a close similarity between outmigrants and anadromous sockeye. As discussed above, this result (in conjunction with the observation based on otolith microchemistry that a large fraction of the outmigrants had a resident female parent) suggested that a third population of *O. nerka* might exist in the lake--resident fish that were genetically distinct from Fishhook Creek kokanee. A concerted effort to search for these fish in 1992 led to the discovery of the "residual" population at the sockeye salmon spawning grounds in the lake. Subsequent sampling and analyses supported the conclusion that, at most, a small fraction of the outmigrants could have come from the Fishhook Creek kokanee population. Based on these results and other

lines of information, outmigrants that matured in captivity have been spawned and their progeny incorporated into the restoration program for Redfish Lake sockeye salmon.

Comparison with Results of DNA Studies

Results of DNA analyses of Snake River *O. nerka* have been reported by Brannon et al. (1994) and Thorgaard et al. (1995). Thorgaard et al. used five multilocus nuclear DNA probes to examine population structure in 14 samples of *O. nerka* from the Pacific Northwest. All but two of these samples were included in the present study. They pooled individuals within populations and computed a distance matrix between populations based on the number of shared bands. On a regional basis, they found that kokanee and sockeye salmon from the same area tended to show some genetic affinity--a pattern consistent with that previously reported for allozymes (Foote et al. 1989, Winans et al. 1996). Thorgaard et al. (1995) also found a relatively close genetic similarity among several Snake River kokanee samples from the Deadwood Reservoir group.

Brannon et al. (1994) used both nuclear and mitochondrial (mtDNA) markers to examine collections from all four Sawtooth Valley lakes discussed in this report. Their results agree with the allozyme data in showing similarity between Redfish Lake sockeye salmon, residuals, and outmigrants, but significant differences between these groups and Fishhook Creek kokanee. Brannon et al. (1994) suggested that the high mtDNA variability they observed in Fishhook Creek kokanee can be attributed in part to stock transfers into Redfish Lake. As discussed above, we found substantial allele frequency differences between Fishhook Creek kokanee and all known sources of stock transfers, but we cannot rule out some effects of past stocking efforts.

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APPENDIX TABLES

Appendix Table 1. List of enzymes surveyed, enzyme numbers, new and old abbreviations for each presumptive gene locus, tissues sampled (M = muscle, L = liver, H = heart; E = eye), and buffers used. All loci scored in at least 40 (75%) of the 53 total samples are included. The numbers of samples shown (with data and polymorphic) are based on the 32 population dataset obtained by pooling of temporal samples (see Table 1). Locus names and abbreviations follow the nomenclature guidelines provided by Shaklee et al. (1990a). Descriptions of the buffer systems are found in Aebersold et al. (1987), with modifications described by Waples et al. (1991).

Enzyme name	Number	Locus	Previous Abbrev.	Tissue	Buffer	Number of samples	
						With data	Polymorphic
Aspartate aminotransferase	2.6.1.1	*sAAT-2**	GOT-2	MH	TBCLE	32	6
		*sAAT-3**	GOT-3 AAT-3	E	TBE	32	0
		*sAAT-4**	AAT-4	L	TBE	32	0
		*mAAT-1**		HME	ACE7	32	31
		*mAAT-2**		HME	ACE7	32	1
Acid phosphatase	3.1.3.2	*ACP-1**		L	TBE	31	0
Adenosine deaminase	3.5.4.4	*ADA-1**		E	TBE	32	20
		*ADA-2**		E	TBE	32	3
Alcohol dehydrogenase	1.1.1.1	*ADH**		L	ACE7	27	1
Aconitate hydratase	4.2.1.3	*sAH**	ACON-2,AH	L	ACE7	32	2
		*mAH-1,2**		HME	ACE7	32	31
		*mAH-3**		HME	ACE7	32	1
		*mAH-4**		HME	ACE7	32	0
Adenylate kinase	2.7.4.3	*AK**		ME	ACE7	32	0
Alanine aminotransferase	2.6.1.2	*ALAT**	GPT	M	TBE	32	32
Creatine kinase	2.7.3.2	*CK-A1**	CK-1	M	TBCLE	32	1
		*CK-A2**	CK-2	M	TBCLE	32	1
		*CK-B**	CK-5	E	TBCLE	32	5
		*CK-C1**	CK-3	E	TBCLE	32	0
		*CK-C2**	CK-4	E	TBCLE	32	2
Esterase-D	3.1.-.-	*ESTD**		M	TBCLE	32	0
Fructose-bisphosphate aldolase	4.1.2.13	*FBALD-3**	ALD-3	E	ACEN7	32	0
		*FBALD-4**	ALD-4	E	ACEN7	29	4
Formaldehyde dehydrogenase (glutathione)	1.2.1.1	*FDHG**	HAGH	L	TBE	31	2
Fumarate hydratase	4.2.1.2	*FH**	FUM	M	ACEN7	32	0
β-N-Acetylgalactosaminidase	3.2.1.53	*βGALA**		L	ACE7	32	1
Glyceraldehyde-3-phosphate dehydrogenase	1.2.1.12	*GAPDH-1**	GAP-1	M	ACEN7	32	0
		*GAPDH-2**	GAP-3	H	ACEN7	32	0
		*GAPDH-3**	GAP-4	MH	ACEN7	32	0
		*GAPDH-4**	GAP-5	E	ACEN7	28	1
		*GAPDH-5**	GAP-6	E	ACEN7	28	0

Appendix Table 1, continued

Enzyme name	Number	Locus	Previous Abbrev.	Tissue	Buffer	Number of samples: With data	Number of samples: Polymorphic
Glycerol-3-phosphate dehydrogenase	1.1.1.8	*G3PDH-1**	AGP-1	MH	ACEN7	32	0
		*G3PDH-2**	AGP-2	MH	ACEN7	32	2
		*G3PDH-3**	AGP-3	H	ACEN7	30	0
		*G3PDH-4**	AGP-4	H	ACEN7	32	0
Glucose-6-phosphate isomerase	5.3.1.9	*GPI-B1**	GPI-1	M	TBCLE	32	0
		*GPI-B2**	GPI-2	M	TBCLE	32	7
		*GPI-A**	GPI-3	M	TBCLE	32	9
Glutathione reductase	1.6.4.2	*GR**		E	TBCLE	32	0
β-N-Acetylhexosaminidase	3.2.1.52	*βHEX**	βGLUA,bGA	L	TC4	32	1
L-Iditol 2-dehydrogenase	1.1.1.14	*IDDH-1**	SDH-1	L	TBCL	32	0
		*IDDH-2**	SDH-2	L	TBCL	32	0
Isocitrate dehydrogenase ($NADP^+$)	1.1.1.42	*mIDHP-1**	IDH-1	MH	ACE7	32	3
		*mIDHP-2**	IDH-2	MH	ACE7	32	6
		*sIDHP-1**	IDH-3	LE	ACE7	32	1
		*sIDHP-2**	IDH-4	LE	ACE7	32	0
L-Lactate dehydrogenase	1.1.1.27	*LDH-A1**	LDH-1	M	TBCLE	32	2
		*LDH-A2**	LDH-2	M	TBCLE	32	0
		*LDH-B1**	LDH-3	MEH	TBCLE	32	4
		*LDH-B2**	LDH-4	LMEH	TBCLE	32	4
		*LDH-C**	LDH-5	E	TC4	32	8
Lactoylglutathione lyase	4.4.1.5	*LGL**	GLO-I	M	TBCLE	30	0
α-Mannosidase	3.2.1.24	*αMAN**		L	TC4	31	0
Malate dehydrogenase	1.1.1.37	*sMDH-A1**	MDH-1	LH	ACE7	32	0
		*sMDH-A2**	MDH-2	LH	ACE7	32	4
		*sMDH-B1**	MDH-3	MH	ACE7	32	0
		sMDH-B2	MDH-4	MH	ACE7	32	9
		*mMDH-2**		HM	ACEN7	32	0
Mannose-6-phosphate isomerase	5.3.1.8	*MPI**		EHL	TBE	32	18
Nucleoside-triphosphate pyrophosphatase	3.6.1.19	*NTP**	ITP	M	TBCLE	32	0
Cytosol non-specific dipeptidase	3.4.13.18	*PEPA**	DPEP-1 GL-1	ME	TBE	32	1
Tripeptide aminopeptidase	3.4.11.4	*PEPB-1**	PEP-3 PEP-LGG TAPEP-1	ME	TBCLE TC4	32	0
Peptidase-C	3.4.-.-	*PEPC**	DPEP-2 GL-2	E	TBE	32	6
X-Pro dipeptidase	3.4.13.9	*PEPD-1**	PDPEP-1 PHAP-1	M	TBE	32	0
Leucyl-tyrosine peptidase	3.4.-.-	*PEPLT**		ML	TBE	32	5

Appendix Table 1, continued

Enzyme name	Number	Locus	Previous Abbrev.	Tissue	Buffer	Number of samples	
						With data	Polymorphic
Phosphogluconate dehydrogenase	1.1.1.44	*PGDH**	6PG	ME	ACE7	32	2
Phosphoglycerate kinase	2.7.2.3	*PGK-1**		EM	ACE7	30	0
		*PGK-2**		EM	ACE7	31	2
Phosphoglucomutase	5.4.2.2	*PGM-1**		MEH	ACE7	32	28
		*PGM-2**		MEH	ACE7	32	27
Pyruvate kinase	2.7.1.40	*PK-2**		H	ACE7	31	2
Purine-nucleoside phosphorylase	2.4.2.1	*PNP-1**	NP-1	E	ACE7	32	0
Superoxide dismutase	1.15.1.1	*sSOD-1**	SOD-1	L	TBE	32	2
Triose-phosphate isomerase	5.3.1.1	*TPI-1**	TPI-1.1	EM	TBCLE	32	0
		*TPI-2**	TPI-1.2	EM	TBCLE	32	0
		*TPI-3**	TPI-2.1	EM	TG	32	0
		*TPI-4**	TPI-2.2	EM	TG	32	1

Appendix Table 2. Allele frequencies for samples of *Oncorhynchus nerka* considered in this study. Data are shown for all polymorphic loci identified in Appendix Table 1. Allele designations are mobilities relative to the "100" allele. Frequencies are shown for all alleles screened, even if no variability was found in this study. "Year" is the year(s) of collection; N is the number of fish scored for each gene locus. Frequencies are reported separately for all geographic and temporal samples except Redfish Lake sockeye salmon and residuals, which were combined across years because of small sample sizes. See Table 1 for sample information.

sAAT-2*	Year	2N	100	77	122	64	109
Alturas L. outmigrant	91	66	1.000	.000	.000	.000	.000
Alturas L. spawners	92	60	1.000	.000	.000	.000	.000
Alturus L. trawl	90	200	1.000	.000	.000	.000	.000
Alturas L. trawl	92	84	1.000	.000	.000	.000	.000
Redfish L. kokanee	90	176	1.000	.000	.000	.000	.000
Redfish L. kokanee	91	138	1.000	.000	.000	.000	.000
Redfish L. kokanee	92	120	1.000	.000	.000	.000	.000
Redfish L. trawl	90	24	1.000	.000	.000	.000	.000
Redfish L. trawl	92	92	1.000	.000	.000	.000	.000
Redfish L. trawl	93	84	1.000	.000	.000	.000	.000
Redfish L. trawl	94	48	1.000	.000	.000	.000	.000
Redfish L. outmigrant	91	274	1.000	.000	.000	.000	.000
Redfish L. outmigrant	92	32	1.000	.000	.000	.000	.000
Redfish L. outmigrant	93	52	1.000	.000	.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000	.000	.000
Stanley L. spawners	92	120	1.000	.000	.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000	.000	.000
Stanley L. trawl	93	26	1.000	.000	.000	.000	.000
Stanley L. trawl	94	32	1.000	.000	.000	.000	.000
Stanley L. spawners	94	16	1.000	.000	.000	.000	.000
Pettit Lake	92	50	1.000	.000	.000	.000	.000
Pettit Lake	94	76	1.000	.000	.000	.000	.000
Lake Whatcom	90	116	1.000	.000	.000	.000	.000
Lake Coeur d'Alene	90	100	1.000	.000	.000	.000	.000
Pend Oreille Lake	90	120	1.000	.000	.000	.000	.000
Anderson Ranch Res.	90	24	.958	.000	.000	.000	.042
Deadwood Reservoir	90	176	.909	.000	.000	.000	.091
Deadwood Reservoir	92	120	1.000	.000	.000	.000	.000
Dworshak Reservoir	90	120	.958	.000	.000	.000	.042
Payette Lake	90	120	.967	.000	.000	.000	.033
NF Payette River	92	118	1.000	.000	.000	.000	.000
Lower Granite	92	36	1.000	.000	.000	.000	.000
Warm Lake	90	120	1.000	.000	.000	.000	.000
Warm Lake	92	120	1.000	.000	.000	.000	.000
Wallowa River	92	120	.992	.008	.000	.000	.000
Wallowa Lake	93	80	1.000	.000	.000	.000	.000
Lake Billy Chinook	92	96	1.000	.000	.000	.000	.000
Link Creek	92	98	1.000	.000	.000	.000	.000
Odell Lake	92	120	1.000	.000	.000	.000	.000
Wizard Falls Hatchery	93	160	1.000	.000	.000	.000	.000
Lake Wenatchee	87	240	.996	.000	.004	.000	.000
Lake Wenatchee	88	320	1.000	.000	.000	.000	.000
Okanogan River	90	126	1.000	.000	.000	.000	.000
Babine Lake	90	120	1.000	.000	.000	.000	.000
Fish Creek (Alaska)	92	80	1.000	.000	.000	.000	.000

mAAT-1*

	Year	2N	-100	-82
Alturas L. outmigrant	91	30	.200	.800
Alturas L. spawners	92	60	.350	.650
Alturus L. trawl	90	200	.360	.640
Alturas L. trawl	92	84	.417	.583
Redfish L. kokanee	90	166	.566	.434
Redfish L. kokanee	91	136	.559	.441
Redfish L. kokanee	92	120	.492	.508
Redfish L. trawl	90	24	.292	.708
Redfish L. trawl	92	94	.489	.511
Redfish L. trawl	93	84	.571	.429
Redfish L. trawl	94	52	.481	.519
Redfish L. outmigrant	91	268	.112	.888
Redfish L. outmigrant	92	34	.176	.824
Redfish L. outmigrant	93	52	.077	.923
Redfish L. sockeye	91-93	26	.154	.846
Redfish L. residual	92-93	28	.143	.857
Stanley L. spawners	92	118	.042	.958
Stanley L. trawl	92	20	.050	.950
Stanley L. trawl	93	26	.192	.808
Stanley L. trawl	94	34	.059	.941
Stanley L. spawners	94	16	.125	.875
Pettit Lake	92	50	.960	.040
Pettit Lake	94	74	.986	.014
Lake Whatcom	90	120	.908	.092
Lake Coeur d'Alene	90	100	.950	.050
Pend Oreille Lake	90	120	.958	.042
Anderson Ranch Res.	90	24	.875	.125
Deadwood Reservoir	90	162	.938	.062
Deadwood Reservoir	92	120	.917	.083
Dworshak Reservoir	90	114	.868	.132
Payette Lake	90	120	.792	.208
NF Payette River	92	116	.819	.181
Lower Granite	92	36	.889	.111
Warm Lake	90	120	.125	.875
Warm Lake	92	120	.908	.092
Wallowa River	92	120	.858	.142
Wallowa Lake	93	78	.795	.205
Lake Billy Chinook	92	96	.448	.552
Link Creek	92	98	.541	.459
Odell Lake	92	120	.967	.033
Wizard Falls Hatchery	93	160	.456	.544
Lake Wenatchee	87	172	.017	.983
Lake Wenatchee	88	240	.054	.946
Okanogan River	90	120	.583	.417
Babine Lake	90	120	.942	.058
Fish Creek (Alaska)	92	80	1.000	.000

mAAT-2*

	Year	2N	-100	-10
Alturas L. outmigrant	91	30	1.000	.000
Alturas L. spawners	92	60	1.000	.000
Alturus L. trawl	90	178	1.000	.000
Alturas L. trawl	92	84	1.000	.000
Redfish L. kokanee	90	172	1.000	.000
Redfish L. kokanee	91	138	1.000	.000
Redfish L. kokanee	92	120	1.000	.000
Redfish L. trawl	90	22	1.000	.000
Redfish L. trawl	92	94	1.000	.000
Redfish L. trawl	93	36	1.000	.000
Redfish L. trawl	94	52	1.000	.000
Redfish L. outmigrant	91	266	1.000	.000
Redfish L. outmigrant	92	34	1.000	.000
Redfish L. outmigrant	93	52	1.000	.000
Redfish L. sockeye	91-93	26	1.000	.000
Redfish L. residual	92-93	28	1.000	.000
Stanley L. spawners	92	118	1.000	.000
Stanley L. trawl	92	20	1.000	.000
Stanley L. trawl	93	12	1.000	.000
Stanley L. trawl	94	34	1.000	.000
Stanley L. spawners	94	10	1.000	.000
Pettit Lake	92	50	1.000	.000
Pettit Lake	94	74	1.000	.000
Lake Whatcom	90	116	1.000	.000
Lake Coeur d'Alene	90	100	1.000	.000
Pend Oreille Lake	90	120	1.000	.000
Anderson Ranch Res.	90	22	1.000	.000
Deadwood Reservoir	90	148	1.000	.000
Deadwood Reservoir	92	120	1.000	.000
Dworshak Reservoir	90	118	1.000	.000
Payette Lake	90	120	1.000	.000
NF Payette River	92	116	1.000	.000
Lower Granite	92	32	1.000	.000
Warm Lake	90	110	1.000	.000
Warm Lake	92	120	1.000	.000
Wallowa River	92	118	1.000	.000
Wallowa Lake	93	78	1.000	.000
Lake Billy Chinook	92	96	1.000	.000
Link Creek	92	98	1.000	.000
Odell Lake	92	120	1.000	.000
Wizard Falls Hatchery	93	160	.994	.006
Lake Wenatchee	87	114	1.000	.000
Lake Wenatchee	88	120	1.000	.000
Okanogan River	90	116	1.000	.000
Babine Lake	90	120	1.000	.000
Fish Creek (Alaska)	92	80	1.000	.000

ADA-1*

	Year	2N	100	94	90
Alturas L. outmigrant	91	28	.893	.107	.000
Alturas L. spawners	92	60	.983	.017	.000
Alturus L. trawl	90	200	.930	.070	.000
Alturas L. trawl	92	84	.929	.071	.000
Redfish L. kokanee	90	168	.940	.060	.000
Redfish L. kokanee	91	138	.942	.058	.000
Redfish L. kokanee	92	120	.933	.067	.000
Redfish L. trawl	90	24	1.000	.000	.000
Redfish L. trawl	92	94	.894	.096	.011
Redfish L. trawl	93	78	.962	.038	.000
Redfish L. trawl	94	52	1.000	.000	.000
Redfish L. outmigrant	91	274	.993	.007	.000
Redfish L. outmigrant	92	34	.971	.029	.000
Redfish L. outmigrant	93	52	1.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000
Stanley L. spawners	92	118	1.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000
Stanley L. trawl	93	24	.917	.083	.000
Stanley L. trawl	94	34	.971	.029	.000
Stanley L. spawners	94	16	.938	.063	.000
Pettit Lake	92	50	.960	.040	.000
Pettit Lake	94	64	1.000	.000	.000
Lake Whatcom	90	120	1.000	.000	.000
Lake Coeur d'Alene	90	100	1.000	.000	.000
Pend Oreille Lake	90	120	1.000	.000	.000
Anderson Ranch Res.	90	24	.792	.208	.000
Deadwood Reservoir	90	176	.739	.261	.000
Deadwood Reservoir	92	120	.858	.142	.000
Dworshak Reservoir	90	116	.784	.216	.000
Payette Lake	90	118	.746	.254	.000
NF Payette River	92	118	.780	.220	.000
Lower Granite	92	36	.778	.222	.000
Warm Lake	90	120	1.000	.000	.000
Warm Lake	92	120	.767	.233	.000
Wallowa River	92	120	.800	.200	.000
Wallowa Lake	93	78	1.000	.000	.000
Lake Billy Chinook	92	96	1.000	.000	.000
Link Creek	92	98	.980	.020	.000
Odell Lake	92	120	.883	.117	.000
Wizard Falls Hatchery	93	160	.981	.019	.000
Lake Wenatchee	87	240	1.000	.000	.000
Lake Wenatchee	88	320	1.000	.000	.000
Okanogan River	90	126	.984	.016	.000
Babine Lake	90	120	1.000	.000	.000
Fish Creek (Alaska)	92	80	1.000	.000	.000

ADA-2*

	Year	2N	100	107	94
Alturas L. outmigrant	91	66	1.000	.000	.000
Alturas L. spawners	92	60	1.000	.000	.000
Alturus L. trawl	90	186	1.000	.000	.000
Alturas L. trawl	92	84	1.000	.000	.000
Redfish L. kokanee	90	174	1.000	.000	.000
Redfish L. kokanee	91	138	1.000	.000	.000
Redfish L. kokanee	92	120	1.000	.000	.000
Redfish L. trawl	90	22	1.000	.000	.000
Redfish L. trawl	92	94	1.000	.000	.000
Redfish L. trawl	93	0	.000	.000	.000
Redfish L. trawl	94	48	1.000	.000	.000
Redfish L. outmigrant	91	266	1.000	.000	.000
Redfish L. outmigrant	92	22	1.000	.000	.000
Redfish L. outmigrant	93	52	1.000	.000	.000
Redfish L. sockeye	91-93	24	1.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000
Stanley L. spawners	92	118	1.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000
Stanley L. trawl	93	26	1.000	.000	.000
Stanley L. trawl	94	26	1.000	.000	.000
Stanley L. spawners	94	16	1.000	.000	.000
Pettit Lake	92	50	1.000	.000	.000
Pettit Lake	94	0	.000	.000	.000
Lake Whatcom	90	120	1.000	.000	.000
Lake Coeur d'Alene	90	100	1.000	.000	.000
Pend Oreille Lake	90	120	1.000	.000	.000
Anderson Ranch Res.	90	22	1.000	.000	.000
Deadwood Reservoir	90	176	.994	.006	.000
Deadwood Reservoir	92	120	1.000	.000	.000
Dworshak Reservoir	90	116	1.000	.000	.000
Payette Lake	90	120	1.000	.000	.000
NF Payette River	92	118	1.000	.000	.000
Lower Granite	92	36	1.000	.000	.000
Warm Lake	90	120	.992	.008	.000
Warm Lake	92	120	1.000	.000	.000
Wallowa River	92	120	1.000	.000	.000
Wallowa Lake	93	80	1.000	.000	.000
Lake Billy Chinook	92	96	1.000	.000	.000
Link Creek	92	98	1.000	.000	.000
Odell Lake	92	120	1.000	.000	.000
Wizard Falls Hatchery	93	156	1.000	.000	.000
Lake Wenatchee	87	234	1.000	.000	.000
Lake Wenatchee	88	320	1.000	.000	.000
Okanogan River	90	126	1.000	.000	.000
Babine Lake	90	120	1.000	.000	.000
Fish Creek (Alaska)	92	80	.975	.025	.000

ADH*

	Year	2N	-100	-49
Alturas L. outmigrant	91	64	1.000	.000
Alturas L. spawners	92	60	1.000	.000
Alturus L. trawl	90	188	1.000	.000
Alturas L. trawl	92	20	1.000	.000
Redfish L. kokanee	90	156	.897	.103
Redfish L. kokanee	91	138	.993	.007
Redfish L. kokanee	92	118	1.000	.000
Redfish L. trawl	90	24	1.000	.000
Redfish L. trawl	92	74	1.000	.000
Redfish L. trawl	93	36	1.000	.000
Redfish L. trawl	94	46	1.000	.000
Redfish L. outmigrant	91	270	1.000	.000
Redfish L. outmigrant	92	18	1.000	.000
Redfish L. outmigrant	93	52	1.000	.000
Redfish L. sockeye	91-93	0	.000	.000
Redfish L. residual	92-93	28	1.000	.000
Stanley L. spawners	92	118	1.000	.000
Stanley L. trawl	92	0	.000	.000
Stanley L. trawl	93	12	1.000	.000
Stanley L. trawl	94	34	1.000	.000
Stanley L. spawners	94	4	1.000	.000
Pettit Lake	92	48	1.000	.000
Pettit Lake	94	76	1.000	.000
Lake Whatcom	90	108	1.000	.000
Lake Coeur d'Alene	90	80	1.000	.000
Pend Oreille Lake	90	104	1.000	.000
Anderson Ranch Res.	90	24	1.000	.000
Deadwood Reservoir	90	32	1.000	.000
Deadwood Reservoir	92	114	1.000	.000
Dworshak Reservoir	90	82	1.000	.000
Payette Lake	90	104	1.000	.000
NF Payette River	92	40	1.000	.000
Lower Granite	92	36	1.000	.000
Warm Lake	90	120	1.000	.000
Warm Lake	92	120	1.000	.000
Wallowa River	92	110	1.000	.000
Wallowa Lake	93	76	1.000	.000
Lake Billy Chinook	92	0	.000	.000
Link Creek	92	0	.000	.000
Odell Lake	92	120	1.000	.000
Wizard Falls Hatchery	93	160	1.000	.000
Lake Wenatchee	87	240	1.000	.000
Lake Wenatchee	88	318	1.000	.000
Okanogan River	90	108	1.000	.000
Babine Lake	90	0	.000	.000
Fish Creek (Alaska)	92	0	.000	.000

sAH*

	Year	2N	100	117	83
Alturas L. outmigrant	91	64	1.000	.000	.000
Alturas L. spawners	92	60	1.000	.000	.000
Alturus L. trawl	90	186	1.000	.000	.000
Alturas L. trawl	92	20	1.000	.000	.000
Redfish L. kokanee	90	174	1.000	.000	.000
Redfish L. kokanee	91	138	1.000	.000	.000
Redfish L. kokanee	92	118	1.000	.000	.000
Redfish L. trawl	90	24	1.000	.000	.000
Redfish L. trawl	92	72	1.000	.000	.000
Redfish L. trawl	93	40	1.000	.000	.000
Redfish L. trawl	94	48	1.000	.000	.000
Redfish L. outmigrant	91	272	1.000	.000	.000
Redfish L. outmigrant	92	34	1.000	.000	.000
Redfish L. outmigrant	93	52	1.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000
Stanley L. spawners	92	120	1.000	.000	.000
Stanley L. trawl	92	0	.000	.000	.000
Stanley L. trawl	93	12	1.000	.000	.000
Stanley L. trawl	94	34	1.000	.000	.000
Stanley L. spawners	94	14	1.000	.000	.000
Pettit Lake	92	50	1.000	.000	.000
Pettit Lake	94	76	1.000	.000	.000
Lake Whatcom	90	120	1.000	.000	.000
Lake Coeur d'Alene	90	100	1.000	.000	.000
Pend Oreille Lake	90	120	1.000	.000	.000
Anderson Ranch Res.	90	22	1.000	.000	.000
Deadwood Reservoir	90	168	1.000	.000	.000
Deadwood Reservoir	92	120	1.000	.000	.000
Dworshak Reservoir	90	120	1.000	.000	.000
Payette Lake	90	116	1.000	.000	.000
NF Payette River	92	118	1.000	.000	.000
Lower Granite	92	36	1.000	.000	.000
Warm Lake	90	104	1.000	.000	.000
Warm Lake	92	120	1.000	.000	.000
Wallowa River	92	118	1.000	.000	.000
Wallowa Lake	93	78	1.000	.000	.000
Lake Billy Chinook	92	96	1.000	.000	.000
Link Creek	92	98	1.000	.000	.000
Odell Lake	92	120	1.000	.000	.000
Wizard Falls Hatchery	93	160	1.000	.000	.000
Lake Wenatchee	87	238	1.000	.000	.000
Lake Wenatchee	88	312	.997	.003	.000
Okanogan River	90	126	.992	.008	.000
Babine Lake	90	120	1.000	.000	.000
Fish Creek (Alaska)	92	80	1.000	.000	.000

mAH-1,2*

	Year	4N	100	75	133	65	111	84
Alturas L. outmigrant	91	120	.908	.092	.000	.000	.000	.000
Alturas L. spawners	92	120	.950	.050	.000	.000	.000	.000
Alturus L. trawl	90	396	.917	.078	.005	.000	.000	.000
Alturas L. trawl	92	164	.915	.085	.000	.000	.000	.000
Redfish L. kokanee	90	348	.914	.083	.003	.000	.000	.000
Redfish L. kokanee	91	264	.928	.072	.000	.000	.000	.000
Redfish L. kokanee	92	240	.887	.112	.000	.000	.000	.000
Redfish L. trawl	90	48	.938	.063	.000	.000	.000	.000
Redfish L. trawl	92	176	.920	.080	.000	.000	.000	.000
Redfish L. trawl	93	76	.908	.092	.000	.000	.000	.000
Redfish L. trawl	94	52	.865	.135	.000	.000	.000	.000
Redfish L. outmigrant	91	512	.746	.250	.004	.000	.000	.000
Redfish L. outmigrant	92	64	.719	.281	.000	.000	.000	.000
Redfish L. outmigrant	93	104	.558	.442	.000	.000	.000	.000
Redfish L. sockeye	91-93	52	.750	.231	.019	.000	.000	.000
Redfish L. residual	92-93	56	.714	.286	.000	.000	.000	.000
Stanley L. spawners	92	232	.552	.448	.000	.000	.000	.000
Stanley L. trawl	92	40	.525	.475	.000	.000	.000	.000
Stanley L. trawl	93	48	.604	.396	.000	.000	.000	.000
Stanley L. trawl	94	20	.600	.400	.000	.000	.000	.000
Stanley L. spawners	94	28	.786	.214	.000	.000	.000	.000
Pettit Lake	92	92	.913	.087	.000	.000	.000	.000
Pettit Lake	94	144	.875	.125	.000	.000	.000	.000
Lake Whatcom	90	232	.823	.177	.000	.000	.000	.000
Lake Coeur d'Alene	90	200	.825	.175	.000	.000	.000	.000
Pend Oreille Lake	90	240	.813	.188	.000	.000	.000	.000
Anderson Ranch Res.	90	44	.955	.000	.045	.000	.000	.000
Deadwood Reservoir	90	348	.963	.034	.003	.000	.000	.000
Deadwood Reservoir	92	240	.954	.033	.013	.000	.000	.000
Dworshak Reservoir	90	224	.964	.022	.013	.000	.000	.000
Payette Lake	90	236	.975	.025	.000	.000	.000	.000
NF Payette River	92	236	.945	.047	.008	.000	.000	.000
Lower Granite	92	56	.982	.018	.000	.000	.000	.000
Warm Lake	90	240	.962	.038	.000	.000	.000	.000
Warm Lake	92	240	.938	.050	.013	.000	.000	.000
Wallowa River	92	236	.898	.085	.017	.000	.000	.000
Wallowa Lake	93	156	.827	.167	.000	.006	.000	.000
Lake Billy Chinook	92	192	.885	.109	.005	.000	.000	.000
Link Creek	92	196	.878	.122	.000	.000	.000	.000
Odell Lake	92	240	.867	.121	.013	.000	.000	.000
Wizard Falls Hatchery	93	320	.828	.172	.000	.000	.000	.000
Lake Wenatchee	87	480	.996	.004	.000	.000	.000	.000
Lake Wenatchee	88	476	1.000	.000	.000	.000	.000	.000
Okanogan River	90	252	.980	.020	.000	.000	.000	.000
Babine Lake	90	232	.832	.168	.000	.000	.000	.000
Fish Creek (Alaska)	92	160	1.000	.000	.000	.000	.000	.000

mAH-3*

	Year	2N	100	114	84
Alturas L. outmigrant	91	66	1.000	.000	.000
Alturas L. spawners	92	60	1.000	.000	.000
Alturus L. trawl	90	200	1.000	.000	.000
Alturas L. trawl	92	84	1.000	.000	.000
Redfish L. kokanee	90	176	1.000	.000	.000
Redfish L. kokanee	91	134	1.000	.000	.000
Redfish L. kokanee	92	120	1.000	.000	.000
Redfish L. trawl	90	24	1.000	.000	.000
Redfish L. trawl	92	94	1.000	.000	.000
Redfish L. trawl	93	86	1.000	.000	.000
Redfish L. trawl	94	48	1.000	.000	.000
Redfish L. outmigrant	91	274	1.000	.000	.000
Redfish L. outmigrant	92	20	1.000	.000	.000
Redfish L. outmigrant	93	46	1.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000
Stanley L. spawners	92	118	1.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000
Stanley L. trawl	93	26	1.000	.000	.000
Stanley L. trawl	94	34	1.000	.000	.000
Stanley L. spawners	94	14	1.000	.000	.000
Pettit Lake	92	46	1.000	.000	.000
Pettit Lake	94	0	.000	.000	.000
Lake Whatcom	90	120	1.000	.000	.000
Lake Coeur d'Alene	90	100	1.000	.000	.000
Pend Oreille Lake	90	120	1.000	.000	.000
Anderson Ranch Res.	90	24	1.000	.000	.000
Deadwood Reservoir	90	174	1.000	.000	.000
Deadwood Reservoir	92	120	1.000	.000	.000
Dworshak Reservoir	90	114	1.000	.000	.000
Payette Lake	90	120	1.000	.000	.000
NF Payette River	92	118	1.000	.000	.000
Lower Granite	92	34	1.000	.000	.000
Warm Lake	90	120	1.000	.000	.000
Warm Lake	92	120	1.000	.000	.000
Wallowa River	92	120	1.000	.000	.000
Wallowa Lake	93	78	.987	.013	.000
Lake Billy Chinook	92	96	1.000	.000	.000
Link Creek	92	98	1.000	.000	.000
Odell Lake	92	120	1.000	.000	.000
Wizard Falls Hatchery	93	160	1.000	.000	.000
Lake Wenatchee	87	240	1.000	.000	.000
Lake Wenatchee	88	238	1.000	.000	.000
Okanogan River	90	126	1.000	.000	.000
Babine Lake	90	120	1.000	.000	.000
Fish Creek (Alaska)	92	80	1.000	.000	.000

ALAT*

	Year	2N	100	91	108	86	95
Alturas L. outmigrant	91	30	.167	.033	.000	.000	.800
Alturas L. spawners	92	60	.217	.033	.000	.000	.750
Alturus L. trawl	90	196	.219	.077	.000	.000	.704
Alturas L. trawl	92	84	.179	.095	.000	.000	.726
Redfish L. kokanee	90	176	.170	.176	.000	.000	.653
Redfish L. kokanee	91	138	.174	.138	.000	.000	.688
Redfish L. kokanee	92	120	.133	.142	.000	.000	.725
Redfish L. trawl	90	24	.375	.042	.000	.000	.583
Redfish L. trawl	92	90	.211	.200	.000	.000	.589
Redfish L. trawl	93	84	.190	.119	.000	.000	.690
Redfish L. trawl	94	50	.100	.160	.000	.000	.740
Redfish L. outmigrant	91	272	.217	.026	.000	.000	.757
Redfish L. outmigrant	92	34	.235	.029	.000	.000	.735
Redfish L. outmigrant	93	52	.327	.000	.000	.000	.673
Redfish L. sockeye	91-93	26	.231	.000	.000	.000	.769
Redfish L. residual	92-93	28	.214	.036	.000	.000	.750
Stanley L. spawners	92	116	.103	.440	.000	.000	.457
Stanley L. trawl	92	20	.200	.300	.000	.000	.500
Stanley L. trawl	93	26	.154	.385	.000	.000	.462
Stanley L. trawl	94	32	.094	.313	.000	.000	.594
Stanley L. spawners	94	16	.438	.375	.000	.000	.188
Pettit Lake	92	50	.440	.260	.000	.000	.300
Pettit Lake	94	74	.459	.122	.000	.000	.419
Lake Whatcom	90	118	.398	.271	.000	.000	.331
Lake Coeur d'Alene	90	100	.430	.340	.000	.000	.230
Pend Oreille Lake	90	120	.308	.325	.000	.000	.367
Anderson Ranch Res.	90	24	.625	.208	.000	.000	.167
Deadwood Reservoir	90	174	.466	.379	.000	.000	.155
Deadwood Reservoir	92	120	.450	.367	.000	.000	.183
Dworshak Reservoir	90	118	.610	.186	.000	.000	.203
Payette Lake	90	120	.642	.225	.000	.008	.125
NF Payette River	92	116	.526	.250	.000	.000	.224
Lower Granite	92	34	.471	.176	.000	.000	.353
Warm Lake	90	120	.950	.017	.000	.000	.033
Warm Lake	92	120	.517	.333	.000	.000	.150
Wallowa River	92	118	.542	.220	.000	.000	.237
Wallowa Lake	93	78	.462	.256	.000	.000	.282
Lake Billy Chinook	92	96	.594	.302	.021	.000	.083
Link Creek	92	98	.541	.347	.000	.000	.112
Odell Lake	92	118	.475	.347	.000	.000	.178
Wizard Falls Hatchery	93	160	.550	.306	.000	.000	.144
Lake Wenatchee	87	120	.683	.175	.100	.000	.042
Lake Wenatchee	88	120	.875	.100	.008	.000	.017
Okanogan River	90	126	.421	.246	.206	.008	.119
Babine Lake	90	120	.283	.650	.033	.000	.033
Fish Creek (Alaska)	92	80	.637	.350	.000	.000	.013

CKA-1*

	Year	2N	100	113
Alturas L. outmigrant	91	66	1.000	.000
Alturas L. spawners	92	60	1.000	.000
Alturus L. trawl	90	198	1.000	.000
Alturas L. trawl	92	84	1.000	.000
Redfish L. kokanee	90	176	1.000	.000
Redfish L. kokanee	91	138	1.000	.000
Redfish L. kokanee	92	120	1.000	.000
Redfish L. trawl	90	24	1.000	.000
Redfish L. trawl	92	88	1.000	.000
Redfish L. trawl	93	74	1.000	.000
Redfish L. trawl	94	42	1.000	.000
Redfish L. outmigrant	91	274	1.000	.000
Redfish L. outmigrant	92	34	1.000	.000
Redfish L. outmigrant	93	52	1.000	.000
Redfish L. sockeye	91-93	26	1.000	.000
Redfish L. residual	92-93	26	1.000	.000
Stanley L. spawners	92	118	1.000	.000
Stanley L. trawl	92	20	1.000	.000
Stanley L. trawl	93	26	1.000	.000
Stanley L. trawl	94	32	1.000	.000
Stanley L. spawners	94	16	1.000	.000
Pettit Lake	92	50	1.000	.000
Pettit Lake	94	76	1.000	.000
Lake Whatcom	90	120	1.000	.000
Lake Coeur d'Alene	90	100	1.000	.000
Pend Oreille Lake	90	120	1.000	.000
Anderson Ranch Res.	90	24	1.000	.000
Deadwood Reservoir	90	164	1.000	.000
Deadwood Reservoir	92	120	1.000	.000
Dworshak Reservoir	90	112	1.000	.000
Payette Lake	90	118	1.000	.000
NF Payette River	92	118	1.000	.000
Lower Granite	92	36	1.000	.000
Warm Lake	90	118	1.000	.000
Warm Lake	92	120	1.000	.000
Wallowa River	92	120	1.000	.000
Wallowa Lake	93	78	1.000	.000
Lake Billy Chinook	92	96	1.000	.000
Link Creek	92	98	1.000	.000
Odell Lake	92	118	1.000	.000
Wizard Falls Hatchery	93	160	1.000	.000
Lake Wenatchee	87	240	.996	.004
Lake Wenatchee	88	318	1.000	.000
Okanogan River	90	126	1.000	.000
Babine Lake	90	116	1.000	.000
Fish Creek (Alaska)	92	80	1.000	.000

CKA-2*

	Year	2N	100	122
Alturas L. outmigrant	91	66	1.000	.000
Alturas L. spawners	92	60	1.000	.000
Alturus L. trawl	90	200	1.000	.000
Alturas L. trawl	92	84	1.000	.000
Redfish L. kokanee	90	176	1.000	.000
Redfish L. kokanee	91	138	1.000	.000
Redfish L. kokanee	92	120	1.000	.000
Redfish L. trawl	90	24	1.000	.000
Redfish L. trawl	92	88	1.000	.000
Redfish L. trawl	93	74	1.000	.000
Redfish L. trawl	94	42	1.000	.000
Redfish L. outmigrant	91	274	1.000	.000
Redfish L. outmigrant	92	34	1.000	.000
Redfish L. outmigrant	93	52	1.000	.000
Redfish L. sockeye	91-93	26	1.000	.000
Redfish L. residual	92-93	28	1.000	.000
Stanley L. spawners	92	118	1.000	.000
Stanley L. trawl	92	20	1.000	.000
Stanley L. trawl	93	26	1.000	.000
Stanley L. trawl	94	32	1.000	.000
Stanley L. spawners	94	16	1.000	.000
Pettit Lake	92	50	1.000	.000
Pettit Lake	94	76	1.000	.000
Lake Whatcom	90	120	1.000	.000
Lake Coeur d'Alene	90	100	1.000	.000
Pend Oreille Lake	90	120	1.000	.000
Anderson Ranch Res.	90	24	1.000	.000
Deadwood Reservoir	90	162	1.000	.000
Deadwood Reservoir	92	120	1.000	.000
Dworshak Reservoir	90	110	1.000	.000
Payette Lake	90	110	1.000	.000
NF Payette River	92	118	1.000	.000
Lower Granite	92	36	1.000	.000
Warm Lake	90	120	1.000	.000
Warm Lake	92	120	1.000	.000
Wallowa River	92	120	1.000	.000
Wallowa Lake	93	78	.987	.013
Lake Billy Chinook	92	96	1.000	.000
Link Creek	92	98	1.000	.000
Odell Lake	92	118	1.000	.000
Wizard Falls Hatchery	93	160	1.000	.000
Lake Wenatchee	87	240	1.000	.000
Lake Wenatchee	88	318	1.000	.000
Okanogan River	90	126	1.000	.000
Babine Lake	90	118	1.000	.000
Fish Creek (Alaska)	92	80	1.000	.000

CK-B*

	Year	2N	100	102
Alturas L. outmigrant	91	56	1.000	.000
Alturas L. spawners	92	60	1.000	.000
Alturus L. trawl	90	200	1.000	.000
Alturas L. trawl	92	84	1.000	.000
Redfish L. kokanee	90	174	1.000	.000
Redfish L. kokanee	91	134	1.000	.000
Redfish L. kokanee	92	120	1.000	.000
Redfish L. trawl	90	22	1.000	.000
Redfish L. trawl	92	94	1.000	.000
Redfish L. trawl	93	86	1.000	.000
Redfish L. trawl	94	50	1.000	.000
Redfish L. outmigrant	91	262	1.000	.000
Redfish L. outmigrant	92	34	1.000	.000
Redfish L. outmigrant	93	52	1.000	.000
Redfish L. sockeye	91-93	26	1.000	.000
Redfish L. residual	92-93	28	1.000	.000
Stanley L. spawners	92	118	1.000	.000
Stanley L. trawl	92	20	1.000	.000
Stanley L. trawl	93	26	1.000	.000
Stanley L. trawl	94	34	1.000	.000
Stanley L. spawners	94	14	1.000	.000
Pettit Lake	92	50	1.000	.000
Pettit Lake	94	76	1.000	.000
Lake Whatcom	90	118	.958	.042
Lake Coeur d'Alene	90	98	.949	.051
Pend Oreille Lake	90	120	.958	.042
Anderson Ranch Res.	90	24	1.000	.000
Deadwood Reservoir	90	176	1.000	.000
Deadwood Reservoir	92	120	1.000	.000
Dworshak Reservoir	90	120	1.000	.000
Payette Lake	90	120	1.000	.000
NF Payette River	92	116	1.000	.000
Lower Granite	92	36	1.000	.000
Warm Lake	90	120	1.000	.000
Warm Lake	92	118	1.000	.000
Wallowa River	92	118	1.000	.000
Wallowa Lake	93	74	1.000	.000
Lake Billy Chinook	92	96	1.000	.000
Link Creek	92	98	1.000	.000
Odell Lake	92	120	1.000	.000
Wizard Falls Hatchery	93	160	.994	.006
Lake Wenatchee	87	232	.996	.004
Lake Wenatchee	88	320	.994	.006
Okanogan River	90	126	1.000	.000
Babine Lake	90	110	1.000	.000
Fish Creek (Alaska)	92	80	1.000	.000

CKC-2*

	Year	2N	100	102	95
Alturas L. outmigrant	91	56	1.000	.000	.000
Alturas L. spawners	92	60	1.000	.000	.000
Alturus L. trawl	90	194	1.000	.000	.000
Alturas L. trawl	92	84	1.000	.000	.000
Redfish L. kokanee	90	130	1.000	.000	.000
Redfish L. kokanee	91	132	1.000	.000	.000
Redfish L. kokanee	92	120	1.000	.000	.000
Redfish L. trawl	90	18	1.000	.000	.000
Redfish L. trawl	92	88	1.000	.000	.000
Redfish L. trawl	93	82	1.000	.000	.000
Redfish L. trawl	94	50	1.000	.000	.000
Redfish L. outmigrant	91	244	1.000	.000	.000
Redfish L. outmigrant	92	32	1.000	.000	.000
Redfish L. outmigrant	93	52	1.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000
Stanley L. spawners	92	118	1.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000
Stanley L. trawl	93	22	1.000	.000	.000
Stanley L. trawl	94	30	1.000	.000	.000
Stanley L. spawners	94	14	1.000	.000	.000
Pettit Lake	92	44	1.000	.000	.000
Pettit Lake	94	72	1.000	.000	.000
Lake Whatcom	90	116	.991	.009	.000
Lake Coeur d'Alene	90	94	1.000	.000	.000
Pend Oreille Lake	90	120	1.000	.000	.000
Anderson Ranch Res.	90	22	1.000	.000	.000
Deadwood Reservoir	90	90	1.000	.000	.000
Deadwood Reservoir	92	120	1.000	.000	.000
Dworshak Reservoir	90	92	1.000	.000	.000
Payette Lake	90	24	1.000	.000	.000
NF Payette River	92	116	1.000	.000	.000
Lower Granite	92	36	1.000	.000	.000
Warm Lake	90	120	1.000	.000	.000
Warm Lake	92	118	1.000	.000	.000
Wallowa River	92	120	1.000	.000	.000
Wallowa Lake	93	74	1.000	.000	.000
Lake Billy Chinook	92	96	1.000	.000	.000
Link Creek	92	98	1.000	.000	.000
Odell Lake	92	120	1.000	.000	.000
Wizard Falls Hatchery	93	160	.994	.006	.000
Lake Wenatchee	87	232	1.000	.000	.000
Lake Wenatchee	88	320	1.000	.000	.000
Okanogan River	90	118	1.000	.000	.000
Babine Lake	90	96	1.000	.000	.000
Fish Creek (Alaska)	92	80	1.000	.000	.000

FBALD-4*

	Year	2N	100	87
Alturas L. outmigrant	91	56	1.000	.000
Alturas L. spawners	92	60	1.000	.000
Alturus L. trawl	90	194	.974	.026
Alturas L. trawl	92	84	1.000	.000
Redfish L. kokanee	90	174	1.000	.000
Redfish L. kokanee	91	134	1.000	.000
Redfish L. kokanee	92	120	1.000	.000
Redfish L. trawl	90	18	.944	.056
Redfish L. trawl	92	78	1.000	.000
Redfish L. trawl	93	0	.000	.000
Redfish L. trawl	94	0	.000	.000
Redfish L. outmigrant	91	258	.996	.004
Redfish L. outmigrant	92	28	1.000	.000
Redfish L. outmigrant	93	52	1.000	.000
Redfish L. sockeye	91-93	26	1.000	.000
Redfish L. residual	92-93	28	1.000	.000
Stanley L. spawners	92	116	1.000	.000
Stanley L. trawl	92	20	1.000	.000
Stanley L. trawl	93	0	.000	.000
Stanley L. trawl	94	0	.000	.000
Stanley L. spawners	94	0	.000	.000
Pettit Lake	92	48	1.000	.000
Pettit Lake	94	0	.000	.000
Lake Whatcom	90	0	.000	.000
Lake Coeur d'Alene	90	96	1.000	.000
Pend Oreille Lake	90	120	1.000	.000
Anderson Ranch Res.	90	20	1.000	.000
Deadwood Reservoir	90	176	1.000	.000
Deadwood Reservoir	92	80	1.000	.000
Dworshak Reservoir	90	76	1.000	.000
Payette Lake	90	116	1.000	.000
NF Payette River	92	78	1.000	.000
Lower Granite	92	36	1.000	.000
Warm Lake	90	0	.000	.000
Warm Lake	92	118	1.000	.000
Wallowa River	92	118	1.000	.000
Wallowa Lake	93	74	1.000	.000
Lake Billy Chinook	92	96	1.000	.000
Link Creek	92	98	1.000	.000
Odell Lake	92	120	1.000	.000
Wizard Falls Hatchery	93	158	1.000	.000
Lake Wenatchee	87	240	1.000	.000
Lake Wenatchee	88	314	.997	.003
Okanogan River	90	126	1.000	.000
Babine Lake	90	104	1.000	.000
Fish Creek (Alaska)	92	80	1.000	.000

FDGH*

	Year	2N	100	108	128
Alturas L. outmigrant	91	52	1.000	.000	.000
Alturas L. spawners	92	54	1.000	.000	.000
Alturus L. trawl	90	164	1.000	.000	.000
Alturas L. trawl	92	20	1.000	.000	.000
Redfish L. kokanee	90	144	1.000	.000	.000
Redfish L. kokanee	91	128	1.000	.000	.000
Redfish L. kokanee	92	120	1.000	.000	.000
Redfish L. trawl	90	24	1.000	.000	.000
Redfish L. trawl	92	74	1.000	.000	.000
Redfish L. trawl	93	40	1.000	.000	.000
Redfish L. trawl	94	48	1.000	.000	.000
Redfish L. outmigrant	91	222	1.000	.000	.000
Redfish L. outmigrant	92	34	1.000	.000	.000
Redfish L. outmigrant	93	52	1.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000
Stanley L. spawners	92	120	1.000	.000	.000
Stanley L. trawl	92	0	.000	.000	.000
Stanley L. trawl	93	12	1.000	.000	.000
Stanley L. trawl	94	34	1.000	.000	.000
Stanley L. spawners	94	14	1.000	.000	.000
Pettit Lake	92	50	1.000	.000	.000
Pettit Lake	94	76	1.000	.000	.000
Lake Whatcom	90	116	1.000	.000	.000
Lake Coeur d'Alene	90	94	1.000	.000	.000
Pend Oreille Lake	90	120	1.000	.000	.000
Anderson Ranch Res.	90	0	.000	.000	.000
Deadwood Reservoir	90	156	1.000	.000	.000
Deadwood Reservoir	92	120	.992	.000	.008
Dworshak Reservoir	90	116	1.000	.000	.000
Payette Lake	90	68	1.000	.000	.000
NF Payette River	92	118	1.000	.000	.000
Lower Granite	92	36	1.000	.000	.000
Warm Lake	90	120	1.000	.000	.000
Warm Lake	92	118	1.000	.000	.000
Wallowa River	92	118	1.000	.000	.000
Wallowa Lake	93	78	1.000	.000	.000
Lake Billy Chinook	92	96	1.000	.000	.000
Link Creek	92	98	1.000	.000	.000
Odell Lake	92	120	.992	.000	.008
Wizard Falls Hatchery	93	160	1.000	.000	.000
Lake Wenatchee	87	218	1.000	.000	.000
Lake Wenatchee	88	286	1.000	.000	.000
Okanogan River	90	80	1.000	.000	.000
Babine Lake	90	116	1.000	.000	.000
Fish Creek (Alaska)	92	80	1.000	.000	.000

βGALA*

	Year	2N	100	69
Alturas L. outmigrant	91	6	1.000	.000
Alturas L. spawners	92	60	1.000	.000
Alturus L. trawl	90	174	1.000	.000
Alturas L. trawl	92	18	1.000	.000
Redfish L. kokanee	90	140	1.000	.000
Redfish L. kokanee	91	138	1.000	.000
Redfish L. kokanee	92	118	1.000	.000
Redfish L. trawl	90	24	1.000	.000
Redfish L. trawl	92	74	1.000	.000
Redfish L. trawl	93	20	.950	.050
Redfish L. trawl	94	42	1.000	.000
Redfish L. outmigrant	91	212	1.000	.000
Redfish L. outmigrant	92	24	1.000	.000
Redfish L. outmigrant	93	40	1.000	.000
Redfish L. sockeye	91-93	26	1.000	.000
Redfish L. residual	92-93	24	1.000	.000
Stanley L. spawners	92	118	1.000	.000
Stanley L. trawl	92	0	.000	.000
Stanley L. trawl	93	12	1.000	.000
Stanley L. trawl	94	34	1.000	.000
Stanley L. spawners	94	14	1.000	.000
Pettit Lake	92	50	1.000	.000
Pettit Lake	94	72	1.000	.000
Lake Whatcom	90	100	1.000	.000
Lake Coeur d'Alene	90	80	1.000	.000
Pend Oreille Lake	90	94	1.000	.000
Anderson Ranch Res.	90	20	1.000	.000
Deadwood Reservoir	90	26	1.000	.000
Deadwood Reservoir	92	120	1.000	.000
Dworshak Reservoir	90	84	1.000	.000
Payette Lake	90	92	1.000	.000
NF Payette River	92	118	1.000	.000
Lower Granite	92	36	1.000	.000
Warm Lake	90	34	1.000	.000
Warm Lake	92	118	1.000	.000
Wallowa River	92	114	1.000	.000
Wallowa Lake	93	74	1.000	.000
Lake Billy Chinook	92	90	1.000	.000
Link Creek	92	76	1.000	.000
Odell Lake	92	118	1.000	.000
Wizard Falls Hatchery	93	160	1.000	.000
Lake Wenatchee	87	240	1.000	.000
Lake Wenatchee	88	240	1.000	.000
Okanogan River	90	104	1.000	.000
Babine Lake	90	100	1.000	.000
Fish Creek (Alaska)	92	78	1.000	.000

GAPDH-4*

	Year	2N	100	107
Alturas L. outmigrant	91	20	1.000	.000
Alturas L. spawners	92	60	1.000	.000
Alturus L. trawl	90	196	1.000	.000
Alturas L. trawl	92	84	1.000	.000
Redfish L. kokanee	90	174	1.000	.000
Redfish L. kokanee	91	134	1.000	.000
Redfish L. kokanee	92	120	1.000	.000
Redfish L. trawl	90	24	1.000	.000
Redfish L. trawl	92	94	1.000	.000
Redfish L. trawl	93	0	.000	.000
Redfish L. trawl	94	0	.000	.000
Redfish L. outmigrant	91	260	1.000	.000
Redfish L. outmigrant	92	0	.000	.000
Redfish L. outmigrant	93	0	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000
Redfish L. residual	92-93	28	1.000	.000
Stanley L. spawners	92	118	1.000	.000
Stanley L. trawl	92	20	1.000	.000
Stanley L. trawl	93	0	.000	.000
Stanley L. trawl	94	0	.000	.000
Stanley L. spawners	94	0	.000	.000
Pettit Lake	92	50	1.000	.000
Pettit Lake	94	0	.000	.000
Lake Whatcom	90	0	.000	.000
Lake Coeur d'Alene	90	98	1.000	.000
Pend Oreille Lake	90	120	.992	.008
Anderson Ranch Res.	90	20	1.000	.000
Deadwood Reservoir	90	176	1.000	.000
Deadwood Reservoir	92	120	1.000	.000
Dworshak Reservoir	90	120	1.000	.000
Payette Lake	90	120	1.000	.000
NF Payette River	92	118	1.000	.000
Lower Granite	92	36	1.000	.000
Warm Lake	90	0	.000	.000
Warm Lake	92	112	1.000	.000
Wallowa River	92	118	1.000	.000
Wallowa Lake	93	74	1.000	.000
Lake Billy Chinook	92	96	1.000	.000
Link Creek	92	98	1.000	.000
Odell Lake	92	120	1.000	.000
Wizard Falls Hatchery	93	0	.000	.000
Lake Wenatchee	87	240	1.000	.000
Lake Wenatchee	88	320	1.000	.000
Okanogan River	90	126	1.000	.000
Babine Lake	90	112	1.000	.000
Fish Creek (Alaska)	92	80	1.000	.000

G3PDH-2*

	Year	2N	-100	-175
Alturas L. outmigrant	91	66	1.000	.000
Alturas L. spawners	92	60	1.000	.000
Alturus L. trawl	90	200	1.000	.000
Alturas L. trawl	92	84	1.000	.000
Redfish L. kokanee	90	74	1.000	.000
Redfish L. kokanee	91	138	1.000	.000
Redfish L. kokanee	92	120	1.000	.000
Redfish L. trawl	90	24	1.000	.000
Redfish L. trawl	92	88	1.000	.000
Redfish L. trawl	93	84	1.000	.000
Redfish L. trawl	94	46	1.000	.000
Redfish L. outmigrant	91	142	1.000	.000
Redfish L. outmigrant	92	34	1.000	.000
Redfish L. outmigrant	93	52	1.000	.000
Redfish L. sockeye	91-93	26	1.000	.000
Redfish L. residual	92-93	28	1.000	.000
Stanley L. spawners	92	40	1.000	.000
Stanley L. trawl	92	20	1.000	.000
Stanley L. trawl	93	26	1.000	.000
Stanley L. trawl	94	34	1.000	.000
Stanley L. spawners	94	16	.875	.125
Pettit Lake	92	50	1.000	.000
Pettit Lake	94	76	1.000	.000
Lake Whatcom	90	120	.983	.017
Lake Coeur d'Alene	90	100	1.000	.000
Pend Oreille Lake	90	120	1.000	.000
Anderson Ranch Res.	90	24	1.000	.000
Deadwood Reservoir	90	0	.000	.000
Deadwood Reservoir	92	120	1.000	.000
Dworshak Reservoir	90	112	1.000	.000
Payette Lake	90	120	1.000	.000
NF Payette River	92	120	1.000	.000
Lower Granite	92	36	1.000	.000
Warm Lake	90	116	1.000	.000
Warm Lake	92	120	1.000	.000
Wallowa River	92	120	1.000	.000
Wallowa Lake	93	80	1.000	.000
Lake Billy Chinook	92	96	1.000	.000
Link Creek	92	98	1.000	.000
Odell Lake	92	118	1.000	.000
Wizard Falls Hatchery	93	160	1.000	.000
Lake Wenatchee	87	40	1.000	.000
Lake Wenatchee	88	236	1.000	.000
Okanogan River	90	116	1.000	.000
Babine Lake	90	110	1.000	.000
Fish Creek (Alaska)	92	80	1.000	.000

GPI-B2*

	Year	2N	100	132	143
Alturas L. outmigrant	91	66	1.000	.000	.000
Alturas L. spawners	92	60	1.000	.000	.000
Alturus L. trawl	90	200	1.000	.000	.000
Alturas L. trawl	92	84	1.000	.000	.000
Redfish L. kokanee	90	176	1.000	.000	.000
Redfish L. kokanee	91	138	1.000	.000	.000
Redfish L. kokanee	92	120	1.000	.000	.000
Redfish L. trawl	90	24	1.000	.000	.000
Redfish L. trawl	92	88	1.000	.000	.000
Redfish L. trawl	93	84	1.000	.000	.000
Redfish L. trawl	94	50	1.000	.000	.000
Redfish L. outmigrant	91	274	1.000	.000	.000
Redfish L. outmigrant	92	34	1.000	.000	.000
Redfish L. outmigrant	93	52	1.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000
Stanley L. spawners	92	120	1.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000
Stanley L. trawl	93	26	1.000	.000	.000
Stanley L. trawl	94	34	1.000	.000	.000
Stanley L. spawners	94	16	1.000	.000	.000
Pettit Lake	92	50	1.000	.000	.000
Pettit Lake	94	76	1.000	.000	.000
Lake Whatcom	90	120	1.000	.000	.000
Lake Coeur d'Alene	90	100	1.000	.000	.000
Pend Oreille Lake	90	120	1.000	.000	.000
Anderson Ranch Res.	90	24	1.000	.000	.000
Deadwood Reservoir	90	172	1.000	.000	.000
Deadwood Reservoir	92	120	.992	.008	.000
Dworshak Reservoir	90	120	.992	.000	.008
Payette Lake	90	120	.992	.000	.008
NF Payette River	92	118	1.000	.000	.000
Lower Granite	92	36	1.000	.000	.000
Warm Lake	90	120	1.000	.000	.000
Warm Lake	92	120	1.000	.000	.000
Wallowa River	92	120	1.000	.000	.000
Wallowa Lake	93	78	.987	.013	.000
Lake Billy Chinook	92	96	.979	.021	.000
Link Creek	92	98	1.000	.000	.000
Odell Lake	92	118	1.000	.000	.000
Wizard Falls Hatchery	93	160	1.000	.000	.000
Lake Wenatchee	87	240	.967	.013	.021
Lake Wenatchee	88	320	.991	.003	.006
Okanogan River	90	126	.937	.048	.016
Babine Lake	90	120	1.000	.000	.000
Fish Creek (Alaska)	92	80	1.000	.000	.000

GPI-A*

	Year	2N	100	94	107	86
Alturas L. outmigrant	91	66	.985	.000	.015	.000
Alturas L. spawners	92	60	1.000	.000	.000	.000
Alturus L. trawl	90	200	.985	.000	.015	.000
Alturas L. trawl	92	84	.964	.000	.036	.000
Redfish L. kokanee	90	176	1.000	.000	.000	.000
Redfish L. kokanee	91	138	1.000	.000	.000	.000
Redfish L. kokanee	92	120	1.000	.000	.000	.000
Redfish L. trawl	90	24	1.000	.000	.000	.000
Redfish L. trawl	92	88	1.000	.000	.000	.000
Redfish L. trawl	93	84	1.000	.000	.000	.000
Redfish L. trawl	94	50	1.000	.000	.000	.000
Redfish L. outmigrant	91	274	1.000	.000	.000	.000
Redfish L. outmigrant	92	34	1.000	.000	.000	.000
Redfish L. outmigrant	93	52	1.000	.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000	.000
Stanley L. spawners	92	120	1.000	.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000	.000
Stanley L. trawl	93	26	1.000	.000	.000	.000
Stanley L. trawl	94	34	1.000	.000	.000	.000
Stanley L. spawners	94	16	1.000	.000	.000	.000
Pettit Lake	92	50	1.000	.000	.000	.000
Pettit Lake	94	70	1.000	.000	.000	.000
Lake Whatcom	90	120	1.000	.000	.000	.000
Lake Coeur d'Alene	90	100	1.000	.000	.000	.000
Pend Oreille Lake	90	120	1.000	.000	.000	.000
Anderson Ranch Res.	90	24	1.000	.000	.000	.000
Deadwood Reservoir	90	170	.965	.000	.035	.000
Deadwood Reservoir	92	120	.975	.000	.025	.000
Dworshak Reservoir	90	120	.967	.000	.033	.000
Payette Lake	90	120	.950	.000	.050	.000
NF Payette River	92	118	.975	.000	.025	.000
Lower Granite	92	36	1.000	.000	.000	.000
Warm Lake	90	120	1.000	.000	.000	.000
Warm Lake	92	120	.950	.000	.050	.000
Wallowa River	92	120	.992	.000	.008	.000
Wallowa Lake	93	78	1.000	.000	.000	.000
Lake Billy Chinook	92	96	1.000	.000	.000	.000
Link Creek	92	98	1.000	.000	.000	.000
Odell Lake	92	118	.975	.000	.025	.000
Wizard Falls Hatchery	93	160	1.000	.000	.000	.000
Lake Wenatchee	87	240	1.000	.000	.000	.000
Lake Wenatchee	88	320	1.000	.000	.000	.000
Okanogan River	90	126	.984	.016	.000	.000
Babine Lake	90	120	1.000	.000	.000	.000
Fish Creek (Alaska)	92	80	1.000	.000	.000	.000

βHEX*

	Year	2N	100	0
Alturas L. outmigrant	91	64	1.000	.000
Alturas L. spawners	92	60	1.000	.000
Alturus L. trawl	90	182	1.000	.000
Alturas L. trawl	92	20	1.000	.000
Redfish L. kokanee	90	110	1.000	.000
Redfish L. kokanee	91	138	1.000	.000
Redfish L. kokanee	92	120	1.000	.000
Redfish L. trawl	90	24	1.000	.000
Redfish L. trawl	92	74	1.000	.000
Redfish L. trawl	93	32	.969	.031
Redfish L. trawl	94	40	1.000	.000
Redfish L. outmigrant	91	276	1.000	.000
Redfish L. outmigrant	92	34	1.000	.000
Redfish L. outmigrant	93	48	1.000	.000
Redfish L. sockeye	91-93	26	1.000	.000
Redfish L. residual	92-93	28	1.000	.000
Stanley L. spawners	92	118	1.000	.000
Stanley L. trawl	92	0	.000	.000
Stanley L. trawl	93	12	1.000	.000
Stanley L. trawl	94	34	1.000	.000
Stanley L. spawners	94	12	1.000	.000
Pettit Lake	92	50	1.000	.000
Pettit Lake	94	76	1.000	.000
Lake Whatcom	90	98	1.000	.000
Lake Coeur d'Alene	90	100	1.000	.000
Pend Oreille Lake	90	120	1.000	.000
Anderson Ranch Res.	90	22	1.000	.000
Deadwood Reservoir	90	108	1.000	.000
Deadwood Reservoir	92	120	1.000	.000
Dworshak Reservoir	90	80	1.000	.000
Payette Lake	90	112	1.000	.000
NF Payette River	92	118	1.000	.000
Lower Granite	92	26	1.000	.000
Warm Lake	90	40	1.000	.000
Warm Lake	92	120	1.000	.000
Wallowa River	92	120	1.000	.000
Wallowa Lake	93	78	1.000	.000
Lake Billy Chinook	92	96	1.000	.000
Link Creek	92	98	1.000	.000
Odell Lake	92	120	1.000	.000
Wizard Falls Hatchery	93	160	1.000	.000
Lake Wenatchee	87	238	1.000	.000
Lake Wenatchee	88	314	1.000	.000
Okanogan River	90	122	1.000	.000
Babine Lake	90	112	1.000	.000
Fish Creek (Alaska)	92	76	1.000	.000

mIDHP-1*

	Year	2N	100	222	33	77
Alturas L. outmigrant	91	66	1.000	.000	.000	.000
Alturas L. spawners	92	60	1.000	.000	.000	.000
Alturus L. trawl	90	200	1.000	.000	.000	.000
Alturas L. trawl	92	84	1.000	.000	.000	.000
Redfish L. kokanee	90	176	1.000	.000	.000	.000
Redfish L. kokanee	91	138	1.000	.000	.000	.000
Redfish L. kokanee	92	120	1.000	.000	.000	.000
Redfish L. trawl	90	24	1.000	.000	.000	.000
Redfish L. trawl	92	86	1.000	.000	.000	.000
Redfish L. trawl	93	84	1.000	.000	.000	.000
Redfish L. trawl	94	50	1.000	.000	.000	.000
Redfish L. outmigrant	91	276	1.000	.000	.000	.000
Redfish L. outmigrant	92	34	1.000	.000	.000	.000
Redfish L. outmigrant	93	52	1.000	.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000	.000
Stanley L. spawners	92	118	1.000	.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000	.000
Stanley L. trawl	93	26	1.000	.000	.000	.000
Stanley L. trawl	94	34	1.000	.000	.000	.000
Stanley L. spawners	94	16	1.000	.000	.000	.000
Pettit Lake	92	46	1.000	.000	.000	.000
Pettit Lake	94	76	1.000	.000	.000	.000
Lake Whatcom	90	120	.992	.000	.000	.008
Lake Coeur d'Alene	90	100	1.000	.000	.000	.000
Pend Oreille Lake	90	120	1.000	.000	.000	.000
Anderson Ranch Res.	90	24	1.000	.000	.000	.000
Deadwood Reservoir	90	176	1.000	.000	.000	.000
Deadwood Reservoir	92	120	1.000	.000	.000	.000
Dworshak Reservoir	90	120	1.000	.000	.000	.000
Payette Lake	90	120	1.000	.000	.000	.000
NF Payette River	92	118	1.000	.000	.000	.000
Lower Granite	92	36	1.000	.000	.000	.000
Warm Lake	90	120	1.000	.000	.000	.000
Warm Lake	92	120	1.000	.000	.000	.000
Wallowa River	92	120	1.000	.000	.000	.000
Wallowa Lake	93	78	1.000	.000	.000	.000
Lake Billy Chinook	92	94	1.000	.000	.000	.000
Link Creek	92	98	1.000	.000	.000	.000
Odell Lake	92	120	1.000	.000	.000	.000
Wizard Falls Hatchery	93	160	.981	.000	.000	.019
Lake Wenatchee	87	240	.871	.000	.000	.129
Lake Wenatchee	88	320	.875	.000	.000	.125
Okanogan River	90	126	1.000	.000	.000	.000
Babine Lake	90	120	1.000	.000	.000	.000
Fish Creek (Alaska)	92	80	1.000	.000	.000	.000

mIDHP-2*

	Year	2N	100	64	350	133
Alturas L. outmigrant	91	66	1.000	.000	.000	.000
Alturas L. spawners	92	60	1.000	.000	.000	.000
Alturus L. trawl	90	200	1.000	.000	.000	.000
Alturas L. trawl	92	84	1.000	.000	.000	.000
Redfish L. kokanee	90	176	1.000	.000	.000	.000
Redfish L. kokanee	91	138	1.000	.000	.000	.000
Redfish L. kokanee	92	120	1.000	.000	.000	.000
Redfish L. trawl	90	24	1.000	.000	.000	.000
Redfish L. trawl	92	86	1.000	.000	.000	.000
Redfish L. trawl	93	84	1.000	.000	.000	.000
Redfish L. trawl	94	52	1.000	.000	.000	.000
Redfish L. outmigrant	91	276	1.000	.000	.000	.000
Redfish L. outmigrant	92	34	1.000	.000	.000	.000
Redfish L. outmigrant	93	46	1.000	.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000	.000
Stanley L. spawners	92	118	1.000	.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000	.000
Stanley L. trawl	93	26	.923	.000	.000	.077
Stanley L. trawl	94	34	1.000	.000	.000	.000
Stanley L. spawners	94	16	.688	.000	.000	.313
Pettit Lake	92	46	1.000	.000	.000	.000
Pettit Lake	94	76	1.000	.000	.000	.000
Lake Whatcom	90	120	.992	.000	.000	.008
Lake Coeur d'Alene	90	100	1.000	.000	.000	.000
Pend Oreille Lake	90	120	.983	.000	.000	.017
Anderson Ranch Res.	90	24	1.000	.000	.000	.000
Deadwood Reservoir	90	176	1.000	.000	.000	.000
Deadwood Reservoir	92	120	1.000	.000	.000	.000
Dworshak Reservoir	90	120	1.000	.000	.000	.000
Payette Lake	90	120	1.000	.000	.000	.000
NF Payette River	92	118	1.000	.000	.000	.000
Lower Granite	92	36	1.000	.000	.000	.000
Warm Lake	90	120	1.000	.000	.000	.000
Warm Lake	92	120	1.000	.000	.000	.000
Wallowa River	92	120	1.000	.000	.000	.000
Wallowa Lake	93	78	1.000	.000	.000	.000
Lake Billy Chinook	92	94	.926	.000	.000	.074
Link Creek	92	98	1.000	.000	.000	.000
Odell Lake	92	120	1.000	.000	.000	.000
Wizard Falls Hatchery	93	160	.794	.000	.000	.206
Lake Wenatchee	87	240	1.000	.000	.000	.000
Lake Wenatchee	88	320	1.000	.000	.000	.000
Okanogan River	90	126	1.000	.000	.000	.000
Babine Lake	90	120	1.000	.000	.000	.000
Fish Creek (Alaska)	92	80	1.000	.000	.000	.000

sIDHP-1*

	Year	2N	100	162	72	138	84
Alturas L. outmigrant	91	64	1.000	.000	.000	.000	.000
Alturas L. spawners	92	60	1.000	.000	.000	.000	.000
Alturus L. trawl	90	200	1.000	.000	.000	.000	.000
Alturas L. trawl	92	84	1.000	.000	.000	.000	.000
Redfish L. kokanee	90	176	1.000	.000	.000	.000	.000
Redfish L. kokanee	91	138	1.000	.000	.000	.000	.000
Redfish L. kokanee	92	120	1.000	.000	.000	.000	.000
Redfish L. trawl	90	24	1.000	.000	.000	.000	.000
Redfish L. trawl	92	94	1.000	.000	.000	.000	.000
Redfish L. trawl	93	86	1.000	.000	.000	.000	.000
Redfish L. trawl	94	52	1.000	.000	.000	.000	.000
Redfish L. outmigrant	91	270	1.000	.000	.000	.000	.000
Redfish L. outmigrant	92	34	1.000	.000	.000	.000	.000
Redfish L. outmigrant	93	50	1.000	.000	.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000	.000	.000
Stanley L. spawners	92	120	1.000	.000	.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000	.000	.000
Stanley L. trawl	93	26	1.000	.000	.000	.000	.000
Stanley L. trawl	94	34	1.000	.000	.000	.000	.000
Stanley L. spawners	94	16	1.000	.000	.000	.000	.000
Pettit Lake	92	50	1.000	.000	.000	.000	.000
Pettit Lake	94	76	1.000	.000	.000	.000	.000
Lake Whatcom	90	120	1.000	.000	.000	.000	.000
Lake Coeur d'Alene	90	100	1.000	.000	.000	.000	.000
Pend Oreille Lake	90	120	.975	.000	.000	.025	.000
Anderson Ranch Res.	90	24	1.000	.000	.000	.000	.000
Deadwood Reservoir	90	170	1.000	.000	.000	.000	.000
Deadwood Reservoir	92	120	1.000	.000	.000	.000	.000
Dworshak Reservoir	90	120	1.000	.000	.000	.000	.000
Payette Lake	90	120	1.000	.000	.000	.000	.000
NF Payette River	92	118	1.000	.000	.000	.000	.000
Lower Granite	92	36	1.000	.000	.000	.000	.000
Warm Lake	90	120	1.000	.000	.000	.000	.000
Warm Lake	92	120	1.000	.000	.000	.000	.000
Wallowa River	92	120	1.000	.000	.000	.000	.000
Wallowa Lake	93	78	1.000	.000	.000	.000	.000
Lake Billy Chinook	92	96	1.000	.000	.000	.000	.000
Link Creek	92	98	1.000	.000	.000	.000	.000
Odell Lake	92	120	1.000	.000	.000	.000	.000
Wizard Falls Hatchery	93	160	1.000	.000	.000	.000	.000
Lake Wenatchee	87	238	1.000	.000	.000	.000	.000
Lake Wenatchee	88	316	1.000	.000	.000	.000	.000
Okanogan River	90	126	1.000	.000	.000	.000	.000
Babine Lake	90	120	1.000	.000	.000	.000	.000
Fish Creek (Alaska)	92	80	1.000	.000	.000	.000	.000

LDH-A1*

	Year	2N	-100	0	86
Alturas L. outmigrant	91	15	1.000	.000	.000
Alturas L. spawners	92	30	1.000	.000	.000
Alturus L. trawl	90	99	1.000	.000	.000
Alturas L. trawl	92	42	1.000	.000	.000
Redfish L. kokanee	90	85	1.000	.000	.000
Redfish L. kokanee	91	79	1.000	.000	.000
Redfish L. kokanee	92	60	1.000	.000	.000
Redfish L. trawl	90	12	1.000	.000	.000
Redfish L. trawl	92	44	1.000	.000	.000
Redfish L. trawl	93	42	1.000	.000	.000
Redfish L. trawl	94	25	1.000	.000	.000
Redfish L. outmigrant	91	136	1.000	.000	.000
Redfish L. outmigrant	92	17	1.000	.000	.000
Redfish L. outmigrant	93	26	1.000	.000	.000
Redfish L. sockeye	91-93	9	1.000	.000	.000
Redfish L. residual	92-93	14	1.000	.000	.000
Stanley L. spawners	92	59	1.000	.000	.000
Stanley L. trawl	92	10	1.000	.000	.000
Stanley L. trawl	93	13	1.000	.000	.000
Stanley L. trawl	94	17	1.000	.000	.000
Stanley L. spawners	94	8	.875	.000	.125
Pettit Lake	92	25	1.000	.000	.000
Pettit Lake	94	38	1.000	.000	.000
Lake Whatcom	90	56	1.000	.000	.000
Lake Coeur d'Alene	90	50	1.000	.000	.000
Pend Oreille Lake	90	60	1.000	.000	.000
Anderson Ranch Res.	90	12	1.000	.000	.000
Deadwood Reservoir	90	70	1.000	.000	.000
Deadwood Reservoir	92	60	1.000	.000	.000
Dworshak Reservoir	90	60	1.000	.000	.000
Payette Lake	90	56	1.000	.000	.000
NF Payette River	92	59	1.000	.000	.000
Lower Granite	92	18	1.000	.000	.000
Warm Lake	90	56	1.000	.000	.000
Warm Lake	92	60	1.000	.000	.000
Wallowa River	92	60	1.000	.000	.000
Wallowa Lake	93	39	1.000	.000	.000
Lake Billy Chinook	92	48	1.000	.000	.000
Link Creek	92	47	1.000	.000	.000
Odell Lake	92	59	1.000	.000	.000
Wizard Falls Hatchery	93	80	.938	.000	.063
Lake Wenatchee	87	113	1.000	.000	.000
Lake Wenatchee	88	154	1.000	.000	.000
Okanogan River	90	59	1.000	.000	.000
Babine Lake	90	58	1.000	.000	.000
Fish Creek (Alaska)	92	40	1.000	.000	.000

LDH-B1*

	Year	2N	100	123	152	52
Alturas L. outmigrant	91	56	1.000	.000	.000	.000
Alturas L. spawners	92	60	1.000	.000	.000	.000
Alturus L. trawl	90	200	1.000	.000	.000	.000
Alturas L. trawl	92	84	1.000	.000	.000	.000
Redfish L. kokanee	90	176	1.000	.000	.000	.000
Redfish L. kokanee	91	138	1.000	.000	.000	.000
Redfish L. kokanee	92	120	1.000	.000	.000	.000
Redfish L. trawl	90	24	1.000	.000	.000	.000
Redfish L. trawl	92	94	1.000	.000	.000	.000
Redfish L. trawl	93	86	1.000	.000	.000	.000
Redfish L. trawl	94	52	1.000	.000	.000	.000
Redfish L. outmigrant	91	260	1.000	.000	.000	.000
Redfish L. outmigrant	92	34	1.000	.000	.000	.000
Redfish L. outmigrant	93	52	1.000	.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000	.000
Stanley L. spawners	92	120	1.000	.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000	.000
Stanley L. trawl	93	26	1.000	.000	.000	.000
Stanley L. trawl	94	34	1.000	.000	.000	.000
Stanley L. spawners	94	16	1.000	.000	.000	.000
Pettit Lake	92	50	1.000	.000	.000	.000
Pettit Lake	94	76	1.000	.000	.000	.000
Lake Whatcom	90	120	.992	.000	.000	.008
Lake Coeur d'Alene	90	100	.970	.030	.000	.000
Pend Oreille Lake	90	120	.992	.008	.000	.000
Anderson Ranch Res.	90	22	1.000	.000	.000	.000
Deadwood Reservoir	90	176	1.000	.000	.000	.000
Deadwood Reservoir	92	120	1.000	.000	.000	.000
Dworshak Reservoir	90	120	1.000	.000	.000	.000
Payette Lake	90	120	1.000	.000	.000	.000
NF Payette River	92	118	1.000	.000	.000	.000
Lower Granite	92	36	1.000	.000	.000	.000
Warm Lake	90	120	1.000	.000	.000	.000
Warm Lake	92	120	1.000	.000	.000	.000
Wallowa River	92	120	1.000	.000	.000	.000
Wallowa Lake	93	78	1.000	.000	.000	.000
Lake Billy Chinook	92	96	1.000	.000	.000	.000
Link Creek	92	98	1.000	.000	.000	.000
Odell Lake	92	120	.992	.008	.000	.000
Wizard Falls Hatchery	93	160	1.000	.000	.000	.000
Lake Wenatchee	87	240	1.000	.000	.000	.000
Lake Wenatchee	88	320	1.000	.000	.000	.000
Okanogan River	90	126	1.000	.000	.000	.000
Babine Lake	90	116	1.000	.000	.000	.000
Fish Creek (Alaska)	92	80	1.000	.000	.000	.000

LDH-B2*

	Year	2N	100	116	92	122	86
Alturas L. outmigrant	91	66	1.000	.000	.000	.000	.000
Alturas L. spawners	92	60	1.000	.000	.000	.000	.000
Alturus L. trawl	90	190	1.000	.000	.000	.000	.000
Alturas L. trawl	92	84	1.000	.000	.000	.000	.000
Redfish L. kokanee	90	176	1.000	.000	.000	.000	.000
Redfish L. kokanee	91	138	1.000	.000	.000	.000	.000
Redfish L. kokanee	92	120	1.000	.000	.000	.000	.000
Redfish L. trawl	90	24	1.000	.000	.000	.000	.000
Redfish L. trawl	92	88	1.000	.000	.000	.000	.000
Redfish L. trawl	93	86	1.000	.000	.000	.000	.000
Redfish L. trawl	94	52	1.000	.000	.000	.000	.000
Redfish L. outmigrant	91	276	1.000	.000	.000	.000	.000
Redfish L. outmigrant	92	34	1.000	.000	.000	.000	.000
Redfish L. outmigrant	93	52	1.000	.000	.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000	.000	.000
Stanley L. spawners	92	116	1.000	.000	.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000	.000	.000
Stanley L. trawl	93	26	1.000	.000	.000	.000	.000
Stanley L. trawl	94	34	1.000	.000	.000	.000	.000
Stanley L. spawners	94	16	1.000	.000	.000	.000	.000
Pettit Lake	92	50	1.000	.000	.000	.000	.000
Pettit Lake	94	76	1.000	.000	.000	.000	.000
Lake Whatcom	90	120	1.000	.000	.000	.000	.000
Lake Coeur d'Alene	90	100	1.000	.000	.000	.000	.000
Pend Oreille Lake	90	120	1.000	.000	.000	.000	.000
Anderson Ranch Res.	90	24	1.000	.000	.000	.000	.000
Deadwood Reservoir	90	170	1.000	.000	.000	.000	.000
Deadwood Reservoir	92	120	1.000	.000	.000	.000	.000
Dworshak Reservoir	90	120	1.000	.000	.000	.000	.000
Payette Lake	90	120	1.000	.000	.000	.000	.000
NF Payette River	92	118	1.000	.000	.000	.000	.000
Lower Granite	92	36	1.000	.000	.000	.000	.000
Warm Lake	90	120	1.000	.000	.000	.000	.000
Warm Lake	92	120	1.000	.000	.000	.000	.000
Wallowa River	92	120	.983	.017	.000	.000	.000
Wallowa Lake	93	78	.987	.013	.000	.000	.000
Lake Billy Chinook	92	96	1.000	.000	.000	.000	.000
Link Creek	92	98	1.000	.000	.000	.000	.000
Odell Lake	92	120	.975	.025	.000	.000	.000
Wizard Falls Hatchery	93	160	1.000	.000	.000	.000	.000
Lake Wenatchee	87	240	1.000	.000	.000	.000	.000
Lake Wenatchee	88	314	1.000	.000	.000	.000	.000
Okanogan River	90	126	1.000	.000	.000	.000	.000
Babine Lake	90	120	1.000	.000	.000	.000	.000
Fish Creek (Alaska)	92	80	.913	.087	.000	.000	.000

LDH-C*

	Year	2N	100	109	92	70
Alturas L. outmigrant	91	20	1.000	.000	.000	.000
Alturas L. spawners	92	60	.967	.000	.033	.000
Alturus L. trawl	90	200	.950	.010	.040	.000
Alturas L. trawl	92	82	.963	.024	.012	.000
Redfish L. kokanee	90	176	1.000	.000	.000	.000
Redfish L. kokanee	91	132	1.000	.000	.000	.000
Redfish L. kokanee	92	120	1.000	.000	.000	.000
Redfish L. trawl	90	22	1.000	.000	.000	.000
Redfish L. trawl	92	94	1.000	.000	.000	.000
Redfish L. trawl	93	82	1.000	.000	.000	.000
Redfish L. trawl	94	48	1.000	.000	.000	.000
Redfish L. outmigrant	91	260	1.000	.000	.000	.000
Redfish L. outmigrant	92	32	1.000	.000	.000	.000
Redfish L. outmigrant	93	48	1.000	.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000	.000
Stanley L. spawners	92	118	1.000	.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000	.000
Stanley L. trawl	93	24	1.000	.000	.000	.000
Stanley L. trawl	94	32	1.000	.000	.000	.000
Stanley L. spawners	94	14	.929	.071	.000	.000
Pettit Lake	92	50	1.000	.000	.000	.000
Pettit Lake	94	74	1.000	.000	.000	.000
Lake Whatcom	90	120	1.000	.000	.000	.000
Lake Coeur d'Alene	90	96	1.000	.000	.000	.000
Pend Oreille Lake	90	120	1.000	.000	.000	.000
Anderson Ranch Res.	90	22	1.000	.000	.000	.000
Deadwood Reservoir	90	176	1.000	.000	.000	.000
Deadwood Reservoir	92	120	1.000	.000	.000	.000
Dworshak Reservoir	90	120	1.000	.000	.000	.000
Payette Lake	90	120	1.000	.000	.000	.000
NF Payette River	92	118	1.000	.000	.000	.000
Lower Granite	92	36	1.000	.000	.000	.000
Warm Lake	90	120	1.000	.000	.000	.000
Warm Lake	92	118	1.000	.000	.000	.000
Wallowa River	92	118	.983	.008	.008	.000
Wallowa Lake	93	74	.986	.014	.000	.000
Lake Billy Chinook	92	96	.979	.021	.000	.000
Link Creek	92	98	.949	.051	.000	.000
Odell Lake	92	120	1.000	.000	.000	.000
Wizard Falls Hatchery	93	160	.956	.044	.000	.000
Lake Wenatchee	87	240	1.000	.000	.000	.000
Lake Wenatchee	88	320	1.000	.000	.000	.000
Okanogan River	90	126	1.000	.000	.000	.000
Babine Lake	90	114	1.000	.000	.000	.000
Fish Creek (Alaska)	92	80	1.000	.000	.000	.000

sMDH-A2*

	Year	2N	100	64	46	147	11
Alturas L. outmigrant	91	66	1.000	.000	.000	.000	.000
Alturas L. spawners	92	60	1.000	.000	.000	.000	.000
Alturus L. trawl	90	200	1.000	.000	.000	.000	.000
Alturas L. trawl	92	84	1.000	.000	.000	.000	.000
Redfish L. kokanee	90	176	.994	.000	.000	.006	.000
Redfish L. kokanee	91	138	1.000	.000	.000	.000	.000
Redfish L. kokanee	92	120	1.000	.000	.000	.000	.000
Redfish L. trawl	90	24	1.000	.000	.000	.000	.000
Redfish L. trawl	92	94	1.000	.000	.000	.000	.000
Redfish L. trawl	93	86	1.000	.000	.000	.000	.000
Redfish L. trawl	94	52	1.000	.000	.000	.000	.000
Redfish L. outmigrant	91	276	1.000	.000	.000	.000	.000
Redfish L. outmigrant	92	34	1.000	.000	.000	.000	.000
Redfish L. outmigrant	93	52	1.000	.000	.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000	.000	.000
Stanley L. spawners	92	118	1.000	.000	.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000	.000	.000
Stanley L. trawl	93	26	1.000	.000	.000	.000	.000
Stanley L. trawl	94	34	1.000	.000	.000	.000	.000
Stanley L. spawners	94	16	1.000	.000	.000	.000	.000
Pettit Lake	92	50	1.000	.000	.000	.000	.000
Pettit Lake	94	76	1.000	.000	.000	.000	.000
Lake Whatcom	90	120	1.000	.000	.000	.000	.000
Lake Coeur d'Alene	90	100	1.000	.000	.000	.000	.000
Pend Oreille Lake	90	120	1.000	.000	.000	.000	.000
Anderson Ranch Res.	90	24	1.000	.000	.000	.000	.000
Deadwood Reservoir	90	176	1.000	.000	.000	.000	.000
Deadwood Reservoir	92	120	1.000	.000	.000	.000	.000
Dworshak Reservoir	90	120	1.000	.000	.000	.000	.000
Payette Lake	90	120	1.000	.000	.000	.000	.000
NF Payette River	92	118	1.000	.000	.000	.000	.000
Lower Granite	92	36	1.000	.000	.000	.000	.000
Warm Lake	90	120	1.000	.000	.000	.000	.000
Warm Lake	92	120	1.000	.000	.000	.000	.000
Wallowa River	92	120	1.000	.000	.000	.000	.000
Wallowa Lake	93	78	1.000	.000	.000	.000	.000
Lake Billy Chinook	92	96	1.000	.000	.000	.000	.000
Link Creek	92	98	.969	.000	.000	.000	.031
Odell Lake	92	120	1.000	.000	.000	.000	.000
Wizard Falls Hatchery	93	160	.994	.000	.000	.000	.006
Lake Wenatchee	87	240	1.000	.000	.000	.000	.000
Lake Wenatchee	88	320	1.000	.000	.000	.000	.000
Okanogan River	90	126	1.000	.000	.000	.000	.000
Babine Lake	90	120	1.000	.000	.000	.000	.000
Fish Creek (Alaska)	92	80	.988	.000	.000	.013	.000

sMDH-B2*

	Year	2N	100	65	120	60	130
Alturas L. outmigrant	91	66	1.000	.000	.000	.000	.000
Alturas L. spawners	92	60	.983	.000	.017	.000	.000
Alturus L. trawl	90	200	.995	.000	.005	.000	.000
Alturas L. trawl	92	84	.988	.000	.012	.000	.000
Redfish L. kokanee	90	176	.977	.000	.023	.000	.000
Redfish L. kokanee	91	138	.986	.000	.014	.000	.000
Redfish L. kokanee	92	120	.975	.000	.025	.000	.000
Redfish L. trawl	90	24	1.000	.000	.000	.000	.000
Redfish L. trawl	92	94	.957	.000	.043	.000	.000
Redfish L. trawl	93	86	.977	.000	.023	.000	.000
Redfish L. trawl	94	52	.981	.000	.019	.000	.000
Redfish L. outmigrant	91	276	1.000	.000	.000	.000	.000
Redfish L. outmigrant	92	34	1.000	.000	.000	.000	.000
Redfish L. outmigrant	93	52	1.000	.000	.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000	.000	.000
Stanley L. spawners	92	120	1.000	.000	.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000	.000	.000
Stanley L. trawl	93	26	1.000	.000	.000	.000	.000
Stanley L. trawl	94	34	1.000	.000	.000	.000	.000
Stanley L. spawners	94	16	1.000	.000	.000	.000	.000
Pettit Lake	92	50	1.000	.000	.000	.000	.000
Pettit Lake	94	76	1.000	.000	.000	.000	.000
Lake Whatcom	90	120	.992	.000	.008	.000	.000
Lake Coeur d'Alene	90	100	1.000	.000	.000	.000	.000
Pend Oreille Lake	90	120	1.000	.000	.000	.000	.000
Anderson Ranch Res.	90	24	1.000	.000	.000	.000	.000
Deadwood Reservoir	90	176	1.000	.000	.000	.000	.000
Deadwood Reservoir	92	120	1.000	.000	.000	.000	.000
Dworshak Reservoir	90	120	1.000	.000	.000	.000	.000
Payette Lake	90	120	1.000	.000	.000	.000	.000
NF Payette River	92	118	1.000	.000	.000	.000	.000
Lower Granite	92	36	1.000	.000	.000	.000	.000
Warm Lake	90	120	.992	.000	.008	.000	.000
Warm Lake	92	120	1.000	.000	.000	.000	.000
Wallowa River	92	120	1.000	.000	.000	.000	.000
Wallowa Lake	93	78	1.000	.000	.000	.000	.000
Lake Billy Chinook	92	96	1.000	.000	.000	.000	.000
Link Creek	92	98	1.000	.000	.000	.000	.000
Odell Lake	92	120	1.000	.000	.000	.000	.000
Wizard Falls Hatchery	93	160	1.000	.000	.000	.000	.000
Lake Wenatchee	87	240	.979	.004	.017	.000	.000
Lake Wenatchee	88	320	.997	.000	.003	.000	.000
Okanogan River	90	126	.905	.095	.000	.000	.000
Babine Lake	90	120	.992	.000	.008	.000	.000
Fish Creek (Alaska)	92	80	1.000	.000	.000	.000	.000

MPI*

	Year	2N	100	105	91
Alturas L. outmigrant	91	66	.985	.015	.000
Alturas L. spawners	92	60	.917	.083	.000
Alturus L. trawl	90	200	.970	.030	.000
Alturas L. trawl	92	84	.964	.036	.000
Redfish L. kokanee	90	176	.966	.034	.000
Redfish L. kokanee	91	138	.986	.014	.000
Redfish L. kokanee	92	120	.958	.042	.000
Redfish L. trawl	90	24	1.000	.000	.000
Redfish L. trawl	92	94	.957	.043	.000
Redfish L. trawl	93	84	.952	.048	.000
Redfish L. trawl	94	52	1.000	.000	.000
Redfish L. outmigrant	91	268	1.000	.000	.000
Redfish L. outmigrant	92	34	1.000	.000	.000
Redfish L. outmigrant	93	52	1.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000
Stanley L. spawners	92	118	.983	.017	.000
Stanley L. trawl	92	20	1.000	.000	.000
Stanley L. trawl	93	26	1.000	.000	.000
Stanley L. trawl	94	34	1.000	.000	.000
Stanley L. spawners	94	16	1.000	.000	.000
Pettit Lake	92	50	1.000	.000	.000
Pettit Lake	94	76	1.000	.000	.000
Lake Whatcom	90	118	1.000	.000	.000
Lake Coeur d'Alene	90	100	1.000	.000	.000
Pend Oreille Lake	90	120	1.000	.000	.000
Anderson Ranch Res.	90	24	.667	.333	.000
Deadwood Reservoir	90	176	.835	.159	.006
Deadwood Reservoir	92	120	.925	.075	.000
Dworshak Reservoir	90	120	.858	.142	.000
Payette Lake	90	120	.850	.150	.000
NF Payette River	92	118	.822	.178	.000
Lower Granite	92	36	.917	.083	.000
Warm Lake	90	102	.980	.010	.010
Warm Lake	92	120	.850	.142	.008
Wallowa River	92	120	.908	.083	.008
Wallowa Lake	93	78	1.000	.000	.000
Lake Billy Chinook	92	96	.979	.021	.000
Link Creek	92	98	.969	.031	.000
Odell Lake	92	120	.867	.125	.008
Wizard Falls Hatchery	93	160	.975	.025	.000
Lake Wenatchee	87	240	1.000	.000	.000
Lake Wenatchee	88	320	1.000	.000	.000
Okanogan River	90	126	1.000	.000	.000
Babine Lake	90	120	1.000	.000	.000
Fish Creek (Alaska)	92	78	1.000	.000	.000

PEP-A*

	Year	2N	100	106
Alturas L. outmigrant	91	66	1.000	.000
Alturas L. spawners	92	60	1.000	.000
Alturus L. trawl	90	200	1.000	.000
Alturas L. trawl	92	84	1.000	.000
Redfish L. kokanee	90	174	1.000	.000
Redfish L. kokanee	91	138	1.000	.000
Redfish L. kokanee	92	120	1.000	.000
Redfish L. trawl	90	24	1.000	.000
Redfish L. trawl	92	94	1.000	.000
Redfish L. trawl	93	84	1.000	.000
Redfish L. trawl	94	52	1.000	.000
Redfish L. outmigrant	91	276	1.000	.000
Redfish L. outmigrant	92	34	1.000	.000
Redfish L. outmigrant	93	52	1.000	.000
Redfish L. sockeye	91-93	26	1.000	.000
Redfish L. residual	92-93	28	1.000	.000
Stanley L. spawners	92	118	1.000	.000
Stanley L. trawl	92	20	1.000	.000
Stanley L. trawl	93	26	1.000	.000
Stanley L. trawl	94	34	1.000	.000
Stanley L. spawners	94	16	1.000	.000
Pettit Lake	92	50	1.000	.000
Pettit Lake	94	70	1.000	.000
Lake Whatcom	90	120	1.000	.000
Lake Coeur d'Alene	90	100	1.000	.000
Pend Oreille Lake	90	120	1.000	.000
Anderson Ranch Res.	90	22	1.000	.000
Deadwood Reservoir	90	174	1.000	.000
Deadwood Reservoir	92	120	1.000	.000
Dworshak Reservoir	90	118	1.000	.000
Payette Lake	90	94	1.000	.000
NF Payette River	92	118	1.000	.000
Lower Granite	92	36	1.000	.000
Warm Lake	90	120	1.000	.000
Warm Lake	92	120	1.000	.000
Wallowa River	92	120	1.000	.000
Wallowa Lake	93	78	1.000	.000
Lake Billy Chinook	92	96	1.000	.000
Link Creek	92	98	1.000	.000
Odell Lake	92	120	1.000	.000
Wizard Falls Hatchery	93	160	1.000	.000
Lake Wenatchee	87	226	1.000	.000
Lake Wenatchee	88	314	1.000	.000
Okanogan River	90	126	1.000	.000
Babine Lake	90	98	.990	.010
Fish Creek (Alaska)	92	80	1.000	.000

PEP-C*

	Year	2N	100	105
Alturas L. outmigrant	91	20	1.000	.000
Alturas L. spawners	92	60	1.000	.000
Alturus L. trawl	90	200	1.000	.000
Alturas L. trawl	92	84	1.000	.000
Redfish L. kokanee	90	176	.994	.006
Redfish L. kokanee	91	132	1.000	.000
Redfish L. kokanee	92	114	1.000	.000
Redfish L. trawl	90	24	1.000	.000
Redfish L. trawl	92	94	1.000	.000
Redfish L. trawl	93	76	1.000	.000
Redfish L. trawl	94	28	1.000	.000
Redfish L. outmigrant	91	258	.981	.019
Redfish L. outmigrant	92	32	1.000	.000
Redfish L. outmigrant	93	52	1.000	.000
Redfish L. sockeye	91-93	26	1.000	.000
Redfish L. residual	92-93	28	1.000	.000
Stanley L. spawners	92	118	1.000	.000
Stanley L. trawl	92	20	1.000	.000
Stanley L. trawl	93	20	1.000	.000
Stanley L. trawl	94	32	1.000	.000
Stanley L. spawners	94	14	1.000	.000
Pettit Lake	92	50	1.000	.000
Pettit Lake	94	74	1.000	.000
Lake Whatcom	90	116	1.000	.000
Lake Coeur d'Alene	90	98	1.000	.000
Pend Oreille Lake	90	120	1.000	.000
Anderson Ranch Res.	90	22	1.000	.000
Deadwood Reservoir	90	176	.989	.011
Deadwood Reservoir	92	120	1.000	.000
Dworshak Reservoir	90	118	.992	.008
Payette Lake	90	120	1.000	.000
NF Payette River	92	118	1.000	.000
Lower Granite	92	36	1.000	.000
Warm Lake	90	120	1.000	.000
Warm Lake	92	120	1.000	.000
Wallowa River	92	118	1.000	.000
Wallowa Lake	93	74	1.000	.000
Lake Billy Chinook	92	96	1.000	.000
Link Creek	92	98	1.000	.000
Odell Lake	92	120	.992	.008
Wizard Falls Hatchery	93	158	1.000	.000
Lake Wenatchee	87	182	1.000	.000
Lake Wenatchee	88	116	1.000	.000
Okanogan River	90	116	1.000	.000
Babine Lake	90	116	1.000	.000
Fish Creek (Alaska)	92	80	.900	.100

PEP-LT*

	Year	2N	100	88	114
Alturas L. outmigrant	91	66	1.000	.000	.000
Alturas L. spawners	92	60	1.000	.000	.000
Alturus L. trawl	90	200	1.000	.000	.000
Alturas L. trawl	92	84	1.000	.000	.000
Redfish L. kokanee	90	176	1.000	.000	.000
Redfish L. kokanee	91	138	1.000	.000	.000
Redfish L. kokanee	92	120	1.000	.000	.000
Redfish L. trawl	90	24	1.000	.000	.000
Redfish L. trawl	92	82	1.000	.000	.000
Redfish L. trawl	93	84	1.000	.000	.000
Redfish L. trawl	94	48	1.000	.000	.000
Redfish L. outmigrant	91	276	.942	.058	.000
Redfish L. outmigrant	92	34	.941	.059	.000
Redfish L. outmigrant	93	50	1.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000
Stanley L. spawners	92	118	1.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000
Stanley L. trawl	93	26	1.000	.000	.000
Stanley L. trawl	94	30	1.000	.000	.000
Stanley L. spawners	94	14	1.000	.000	.000
Pettit Lake	92	50	1.000	.000	.000
Pettit Lake	94	0	.000	.000	.000
Lake Whatcom	90	120	1.000	.000	.000
Lake Coeur d'Alene	90	100	1.000	.000	.000
Pend Oreille Lake	90	118	1.000	.000	.000
Anderson Ranch Res.	90	24	1.000	.000	.000
Deadwood Reservoir	90	160	1.000	.000	.000
Deadwood Reservoir	92	120	1.000	.000	.000
Dworshak Reservoir	90	120	1.000	.000	.000
Payette Lake	90	118	1.000	.000	.000
NF Payette River	92	118	1.000	.000	.000
Lower Granite	92	36	1.000	.000	.000
Warm Lake	90	120	1.000	.000	.000
Warm Lake	92	120	1.000	.000	.000
Wallowa River	92	120	.992	.008	.000
Wallowa Lake	93	78	1.000	.000	.000
Lake Billy Chinook	92	96	1.000	.000	.000
Link Creek	92	98	1.000	.000	.000
Odell Lake	92	120	1.000	.000	.000
Wizard Falls Hatchery	93	160	1.000	.000	.000
Lake Wenatchee	87	240	1.000	.000	.000
Lake Wenatchee	88	320	.997	.003	.000
Okanogan River	90	126	1.000	.000	.000
Babine Lake	90	118	.992	.008	.000
Fish Creek (Alaska)	92	80	.813	.188	.000

PGDH*

	Year	2N	100	90
Alturas L. outmigrant	91	66	1.000	.000
Alturas L. spawners	92	60	1.000	.000
Alturus L. trawl	90	198	1.000	.000
Alturas L. trawl	92	84	1.000	.000
Redfish L. kokanee	90	176	1.000	.000
Redfish L. kokanee	91	138	1.000	.000
Redfish L. kokanee	92	120	1.000	.000
Redfish L. trawl	90	24	1.000	.000
Redfish L. trawl	92	94	1.000	.000
Redfish L. trawl	93	86	1.000	.000
Redfish L. trawl	94	52	1.000	.000
Redfish L. outmigrant	91	276	1.000	.000
Redfish L. outmigrant	92	34	1.000	.000
Redfish L. outmigrant	93	52	1.000	.000
Redfish L. sockeye	91-93	26	1.000	.000
Redfish L. residual	92-93	28	1.000	.000
Stanley L. spawners	92	118	1.000	.000
Stanley L. trawl	92	20	1.000	.000
Stanley L. trawl	93	26	1.000	.000
Stanley L. trawl	94	34	1.000	.000
Stanley L. spawners	94	16	1.000	.000
Pettit Lake	92	50	1.000	.000
Pettit Lake	94	76	1.000	.000
Lake Whatcom	90	120	1.000	.000
Lake Coeur d'Alene	90	100	1.000	.000
Pend Oreille Lake	90	120	1.000	.000
Anderson Ranch Res.	90	24	1.000	.000
Deadwood Reservoir	90	176	.983	.017
Deadwood Reservoir	92	120	.983	.017
Dworshak Reservoir	90	118	1.000	.000
Payette Lake	90	120	1.000	.000
NF Payette River	92	118	1.000	.000
Lower Granite	92	36	1.000	.000
Warm Lake	90	120	1.000	.000
Warm Lake	92	120	.975	.025
Wallowa River	92	120	1.000	.000
Wallowa Lake	93	78	1.000	.000
Lake Billy Chinook	92	96	1.000	.000
Link Creek	92	98	1.000	.000
Odell Lake	92	120	1.000	.000
Wizard Falls Hatchery	93	160	1.000	.000
Lake Wenatchee	87	240	1.000	.000
Lake Wenatchee	88	318	1.000	.000
Okanogan River	90	126	1.000	.000
Babine Lake	90	120	1.000	.000
Fish Creek (Alaska)	92	80	1.000	.000

PGK-2*

	Year	2N	100	90
Alturas L. outmigrant	91	66	1.000	.000
Alturas L. spawners	92	60	1.000	.000
Alturus L. trawl	90	200	1.000	.000
Alturas L. trawl	92	84	1.000	.000
Redfish L. kokanee	90	176	1.000	.000
Redfish L. kokanee	91	138	1.000	.000
Redfish L. kokanee	92	120	1.000	.000
Redfish L. trawl	90	24	1.000	.000
Redfish L. trawl	92	94	1.000	.000
Redfish L. trawl	93	86	1.000	.000
Redfish L. trawl	94	52	1.000	.000
Redfish L. outmigrant	91	236	1.000	.000
Redfish L. outmigrant	92	34	1.000	.000
Redfish L. outmigrant	93	52	1.000	.000
Redfish L. sockeye	91-93	10	1.000	.000
Redfish L. residual	92-93	8	1.000	.000
Stanley L. spawners	92	40	1.000	.000
Stanley L. trawl	92	20	1.000	.000
Stanley L. trawl	93	26	1.000	.000
Stanley L. trawl	94	34	1.000	.000
Stanley L. spawners	94	16	1.000	.000
Pettit Lake	92	40	1.000	.000
Pettit Lake	94	76	1.000	.000
Lake Whatcom	90	120	1.000	.000
Lake Coeur d'Alene	90	92	1.000	.000
Pend Oreille Lake	90	104	1.000	.000
Anderson Ranch Res.	90	22	1.000	.000
Deadwood Reservoir	90	170	1.000	.000
Deadwood Reservoir	92	120	.992	.008
Dworshak Reservoir	90	120	1.000	.000
Payette Lake	90	100	1.000	.000
NF Payette River	92	118	1.000	.000
Lower Granite	92	36	1.000	.000
Warm Lake	90	112	1.000	.000
Warm Lake	92	118	1.000	.000
Wallowa River	92	118	1.000	.000
Wallowa Lake	93	0	.000	.000
Lake Billy Chinook	92	96	1.000	.000
Link Creek	92	18	1.000	.000
Odell Lake	92	118	1.000	.000
Wizard Falls Hatchery	93	160	.975	.025
Lake Wenatchee	87	240	1.000	.000
Lake Wenatchee	88	320	1.000	.000
Okanogan River	90	120	1.000	.000
Babine Lake	90	100	1.000	.000
Fish Creek (Alaska)	92	80	1.000	.000

PGM-1*

	Year	N	-100	null
Alturas L. outmigrant	91	33	.970	.030
Alturas L. spawners	92	30	1.000	.000
Alturus L. trawl	90	100	.980	.020
Alturas L. trawl	92	42	.976	.024
Redfish L. kokanee	90	88	.989	.011
Redfish L. kokanee	91	79	1.000	.000
Redfish L. kokanee	92	60	1.000	.000
Redfish L. trawl	90	12	1.000	.000
Redfish L. trawl	92	47	1.000	.000
Redfish L. trawl	93	43	.977	.023
Redfish L. trawl	94	26	.885	.115
Redfish L. outmigrant	91	138	.993	.007
Redfish L. outmigrant	92	17	1.000	.000
Redfish L. outmigrant	93	26	1.000	.000
Redfish L. sockeye	91-93	13	1.000	.000
Redfish L. residual	92-93	14	.929	.071
Stanley L. spawners	92	59	1.000	.000
Stanley L. trawl	92	9	1.000	.000
Stanley L. trawl	93	13	.769	.231
Stanley L. trawl	94	17	1.000	.000
Stanley L. spawners	94	8	.375	.625
Pettit Lake	92	25	.960	.040
Pettit Lake	94	38	.974	.026
Lake Whatcom	90	60	.817	.183
Lake Coeur d'Alene	90	50	.920	.080
Pend Oreille Lake	90	60	.933	.067
Anderson Ranch Res.	90	12	.833	.167
Deadwood Reservoir	90	88	.909	.091
Deadwood Reservoir	92	60	.867	.133
Dworshak Reservoir	90	60	.867	.133
Payette Lake	90	60	.833	.167
NF Payette River	92	59	.932	.068
Lower Granite	92	18	.889	.111
Warm Lake	90	60	1.000	.000
Warm Lake	92	60	.817	.183
Wallowa River	92	60	.833	.167
Wallowa Lake	93	39	.897	.103
Lake Billy Chinook	92	48	.708	.292
Link Creek	92	49	.592	.408
Odell Lake	92	60	.817	.183
Wizard Falls Hatchery	93	80	.512	.488
Lake Wenatchee	87	120	.658	.342
Lake Wenatchee	88	160	.644	.356
Okanogan River	90	63	.746	.254
Babine Lake	90	60	.367	.633
Fish Creek (Alaska)	92	40	.025	.975

PGM-2*

	Year	2N	100	136	-93	-125	186
Alturas L. outmigrant	91	30	1.000	.000	.000	.000	.000
Alturas L. spawners	92	60	.950	.050	.000	.000	.000
Alturus L. trawl	90	200	.955	.045	.000	.000	.000
Alturas L. trawl	92	84	.905	.095	.000	.000	.000
Redfish L. kokanee	90	176	.966	.034	.000	.000	.000
Redfish L. kokanee	91	138	.935	.065	.000	.000	.000
Redfish L. kokanee	92	120	.975	.025	.000	.000	.000
Redfish L. trawl	90	24	.958	.042	.000	.000	.000
Redfish L. trawl	92	94	.926	.074	.000	.000	.000
Redfish L. trawl	93	86	.953	.047	.000	.000	.000
Redfish L. trawl	94	52	1.000	.000	.000	.000	.000
Redfish L. outmigrant	91	276	.996	.004	.000	.000	.000
Redfish L. outmigrant	92	34	1.000	.000	.000	.000	.000
Redfish L. outmigrant	93	52	1.000	.000	.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000	.000	.000
Stanley L. spawners	92	118	1.000	.000	.000	.000	.000
Stanley L. trawl	92	20	.950	.050	.000	.000	.000
Stanley L. trawl	93	26	.962	.038	.000	.000	.000
Stanley L. trawl	94	34	1.000	.000	.000	.000	.000
Stanley L. spawners	94	16	.688	.313	.000	.000	.000
Pettit Lake	92	50	.780	.220	.000	.000	.000
Pettit Lake	94	76	.697	.303	.000	.000	.000
Lake Whatcom	90	120	.858	.142	.000	.000	.000
Lake Coeur d'Alene	90	100	.780	.220	.000	.000	.000
Pend Oreille Lake	90	120	.825	.175	.000	.000	.000
Anderson Ranch Res.	90	24	.958	.042	.000	.000	.000
Deadwood Reservoir	90	174	.862	.138	.000	.000	.000
Deadwood Reservoir	92	120	.883	.117	.000	.000	.000
Dworshak Reservoir	90	120	.908	.092	.000	.000	.000
Payette Lake	90	120	.808	.192	.000	.000	.000
NF Payette River	92	118	.805	.195	.000	.000	.000
Lower Granite	92	36	.806	.194	.000	.000	.000
Warm Lake	90	120	1.000	.000	.000	.000	.000
Warm Lake	92	120	.883	.117	.000	.000	.000
Wallowa River	92	120	.867	.133	.000	.000	.000
Wallowa Lake	93	78	.885	.115	.000	.000	.000
Lake Billy Chinook	92	96	.729	.271	.000	.000	.000
Link Creek	92	98	.765	.235	.000	.000	.000
Odell Lake	92	120	.858	.142	.000	.000	.000
Wizard Falls Hatchery	93	160	.606	.394	.000	.000	.000
Lake Wenatchee	87	240	.733	.267	.000	.000	.000
Lake Wenatchee	88	320	.706	.294	.000	.000	.000
Okanogan River	90	126	.746	.254	.000	.000	.000
Babine Lake	90	120	.833	.167	.000	.000	.000
Fish Creek (Alaska)	92	80	.512	.488	.000	.000	.000

PK-2*

	Year	2N	100	105
Alturas L. outmigrant	91	62	1.000	.000
Alturas L. spawners	92	60	1.000	.000
Alturus L. trawl	90	36	1.000	.000
Alturas L. trawl	92	84	1.000	.000
Redfish L. kokanee	90	176	1.000	.000
Redfish L. kokanee	91	138	1.000	.000
Redfish L. kokanee	92	120	1.000	.000
Redfish L. trawl	90	0	.000	.000
Redfish L. trawl	92	94	1.000	.000
Redfish L. trawl	93	86	1.000	.000
Redfish L. trawl	94	52	1.000	.000
Redfish L. outmigrant	91	266	.959	.041
Redfish L. outmigrant	92	34	1.000	.000
Redfish L. outmigrant	93	52	1.000	.000
Redfish L. sockeye	91-93	26	1.000	.000
Redfish L. residual	92-93	28	1.000	.000
Stanley L. spawners	92	118	1.000	.000
Stanley L. trawl	92	20	1.000	.000
Stanley L. trawl	93	26	1.000	.000
Stanley L. trawl	94	34	1.000	.000
Stanley L. spawners	94	16	1.000	.000
Pettit Lake	92	50	1.000	.000
Pettit Lake	94	76	1.000	.000
Lake Whatcom	90	120	1.000	.000
Lake Coeur d'Alene	90	100	1.000	.000
Pend Oreille Lake	90	120	1.000	.000
Anderson Ranch Res.	90	0	.000	.000
Deadwood Reservoir	90	176	1.000	.000
Deadwood Reservoir	92	120	1.000	.000
Dworshak Reservoir	90	120	.992	.008
Payette Lake	90	120	1.000	.000
NF Payette River	92	118	1.000	.000
Lower Granite	92	36	1.000	.000
Warm Lake	90	120	1.000	.000
Warm Lake	92	120	1.000	.000
Wallowa River	92	120	1.000	.000
Wallowa Lake	93	78	1.000	.000
Lake Billy Chinook	92	96	1.000	.000
Link Creek	92	98	1.000	.000
Odell Lake	92	120	1.000	.000
Wizard Falls Hatchery	93	160	1.000	.000
Lake Wenatchee	87	200	1.000	.000
Lake Wenatchee	88	200	1.000	.000
Okanogan River	90	126	1.000	.000
Babine Lake	90	120	1.000	.000
Fish Creek (Alaska)	92	80	1.000	.000

sSOD-1*

	Year	2N	100	145	84	160
Alturas L. outmigrant	91	64	1.000	.000	.000	.000
Alturas L. spawners	92	60	1.000	.000	.000	.000
Alturus L. trawl	90	188	1.000	.000	.000	.000
Alturas L. trawl	92	20	1.000	.000	.000	.000
Redfish L. kokanee	90	170	1.000	.000	.000	.000
Redfish L. kokanee	91	130	1.000	.000	.000	.000
Redfish L. kokanee	92	120	1.000	.000	.000	.000
Redfish L. trawl	90	24	1.000	.000	.000	.000
Redfish L. trawl	92	74	1.000	.000	.000	.000
Redfish L. trawl	93	24	1.000	.000	.000	.000
Redfish L. trawl	94	48	1.000	.000	.000	.000
Redfish L. outmigrant	91	272	1.000	.000	.000	.000
Redfish L. outmigrant	92	34	1.000	.000	.000	.000
Redfish L. outmigrant	93	52	1.000	.000	.000	.000
Redfish L. sockeye	91-93	26	1.000	.000	.000	.000
Redfish L. residual	92-93	28	1.000	.000	.000	.000
Stanley L. spawners	92	118	1.000	.000	.000	.000
Stanley L. trawl	92	20	1.000	.000	.000	.000
Stanley L. trawl	93	12	1.000	.000	.000	.000
Stanley L. trawl	94	34	1.000	.000	.000	.000
Stanley L. spawners	94	10	1.000	.000	.000	.000
Pettit Lake	92	50	1.000	.000	.000	.000
Pettit Lake	94	76	1.000	.000	.000	.000
Lake Whatcom	90	120	1.000	.000	.000	.000
Lake Coeur d'Alene	90	100	1.000	.000	.000	.000
Pend Oreille Lake	90	120	1.000	.000	.000	.000
Anderson Ranch Res.	90	22	1.000	.000	.000	.000
Deadwood Reservoir	90	166	1.000	.000	.000	.000
Deadwood Reservoir	92	120	1.000	.000	.000	.000
Dworshak Reservoir	90	112	1.000	.000	.000	.000
Payette Lake	90	112	1.000	.000	.000	.000
NF Payette River	92	118	1.000	.000	.000	.000
Lower Granite	92	36	1.000	.000	.000	.000
Warm Lake	90	120	1.000	.000	.000	.000
Warm Lake	92	120	1.000	.000	.000	.000
Wallowa River	92	118	1.000	.000	.000	.000
Wallowa Lake	93	80	1.000	.000	.000	.000
Lake Billy Chinook	92	96	1.000	.000	.000	.000
Link Creek	92	98	1.000	.000	.000	.000
Odell Lake	92	120	1.000	.000	.000	.000
Wizard Falls Hatchery	93	160	1.000	.000	.000	.000
Lake Wenatchee	87	240	.983	.004	.000	.013
Lake Wenatchee	88	314	.978	.003	.000	.019
Okanogan River	90	124	.992	.008	.000	.000
Babine Lake	90	120	1.000	.000	.000	.000
Fish Creek (Alaska)	92	80	1.000	.000	.000	.000

TPI-4*

	Year	2N	100	106
Alturas L. outmigrant	91	66	1.000	.000
Alturas L. spawners	92	60	1.000	.000
Alturus L. trawl	90	200	1.000	.000
Alturas L. trawl	92	84	1.000	.000
Redfish L. kokanee	90	174	1.000	.000
Redfish L. kokanee	91	134	1.000	.000
Redfish L. kokanee	92	120	1.000	.000
Redfish L. trawl	90	24	1.000	.000
Redfish L. trawl	92	94	1.000	.000
Redfish L. trawl	93	86	1.000	.000
Redfish L. trawl	94	52	1.000	.000
Redfish L. outmigrant	91	276	1.000	.000
Redfish L. outmigrant	92	34	1.000	.000
Redfish L. outmigrant	93	52	1.000	.000
Redfish L. sockeye	91-93	26	1.000	.000
Redfish L. residual	92-93	28	1.000	.000
Stanley L. spawners	92	120	1.000	.000
Stanley L. trawl	92	20	1.000	.000
Stanley L. trawl	93	26	1.000	.000
Stanley L. trawl	94	34	1.000	.000
Stanley L. spawners	94	16	1.000	.000
Pettit Lake	92	50	1.000	.000
Pettit Lake	94	76	1.000	.000
Lake Whatcom	90	120	1.000	.000
Lake Coeur d'Alene	90	100	1.000	.000
Pend Oreille Lake	90	120	1.000	.000
Anderson Ranch Res.	90	24	1.000	.000
Deadwood Reservoir	90	176	1.000	.000
Deadwood Reservoir	92	120	1.000	.000
Dworshak Reservoir	90	116	1.000	.000
Payette Lake	90	120	1.000	.000
NF Payette River	92	118	1.000	.000
Lower Granite	92	36	1.000	.000
Warm Lake	90	120	1.000	.000
Warm Lake	92	120	1.000	.000
Wallowa River	92	118	1.000	.000
Wallowa Lake	93	74	1.000	.000
Lake Billy Chinook	92	96	1.000	.000
Link Creek	92	98	1.000	.000
Odell Lake	92	120	1.000	.000
Wizard Falls Hatchery	93	160	1.000	.000
Lake Wenatchee	87	240	1.000	.000
Lake Wenatchee	88	320	1.000	.000
Okanogan River	90	126	1.000	.000
Babine Lake	90	116	.991	.009
Fish Creek (Alaska)	92	80	1.000	.000