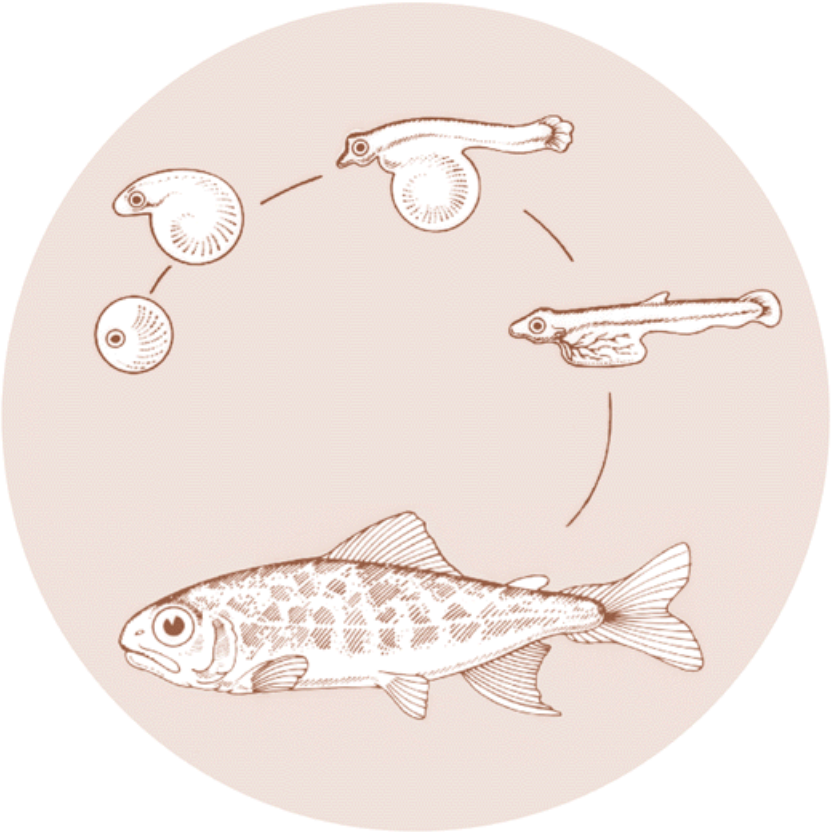
May 1997

# POPULATION GENETIC STRUCTURE AND LIFE HISTORY VARIABILITY IN ONCORHNCHUS NERKA FROM THE SNAKE RIVER BASIN

Final Report



DOE/BP-05326-1

This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views of this report are the author's and do not necessarily represent the views of BPA.

This document should be cited as follows:

*Waples, Robin S., Paul B. Aebersold, Gary A. Winans - National Marine Fisheries Service, 1997, Population Genetic Structure And Life History Variability In Oncorhynchus Nerka From The Snake River Basin, Final Report, Report to Bonneville Power Administration, Contract No. 1993BP05326, Project No. 199306800, 108 electronic pages* (BPA Report DOE/BP-05326-1)

This report and other BPA Fish and Wildlife Publications are available on the Internet at:

**http://www.efw.bpa.gov/cgi-bin/efw/FW/publications.cgi**

For other information on electronic documents or other printed media, contact or write to:

Bonneville Power Administration
Environment, Fish and Wildlife Division
P.O. Box 3621
905 N.E. 11th Avenue
Portland, OR 97208-3621

Please include title, author, and DOE/BP number in the request.

# POPULATION GENETIC STRUCTURE AND LIFE HISTORY VARIABILITY IN *ONCORHYNCHUS NERKA* FROM THE SNAKE RIVER BASIN

## FINAL REPORT

Prepared by:

Robin S. Waples
Paul B. Aebersold
and
Gary A. Winans

Funded by:

Coastal Zone and Estuarine Studies Division
Northwest Fisheries Science Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
Seattle, Washington 98 112-2097

and

U. S. Department of Energy
Bonneville Power Administration
Environment, Fish and Wildlife
P-0. Box 3621
Portland, OR 9720X-362 1

Project Number 93-068
Contract Number DE-AI7993BP05326

May 1997

# CONTENTS


| | Page |
|---|---|
| EXECUTIVE SUMMARY | v |
| INTRODUCTION | 1 |
| METHODS | 3 |
| Study Areas and Experimental Design | 3 |
| RedfishLake | 4 |
| Alturas Lake | 8 |
| Other Snake River lakes | 8 |
| Idahokokanee | 9 |
| Columbia River sockeye salmon | 10 |
| Deschutes River basin 0. *nerka* | 10 |
| Other samples | 10 |
| Sampling Methods | 11 |
| Data Analysis | 12 |
| RESULTS | 15 |
| Preliminary Analyses | 15 |
| Tests of Genotypic and Phenotypic Proportions | 17 |
| Temporal Comparisons | 19 |
| Levels of Genetic Variability | 20 |
| Variation Between Life-history Forms and Collection Types | 22 |
| Geographic Variation | 23 |
| Sawtooth Valley | 32 |
| Idahokokanee | 34 |
| DISCUSSION | 36 |
| Redfish Lake 0. *nerka* | 36 |
| Effects of Stock Transfer | 40 |
| Amount and Pattern of Genetic Variability | 47 |
| Captive Broodstock Program | 50 |
| Comparison with Results of DNA Studies | 51 |
| ACKNOWLEDGMENTS | 52 |
| REFERENCES | 53 |
| APPENDIX TABLES | 57 |

# 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 (0.006-0.0411, 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 *0. 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 *0. nerka* that appear to be native were also found in Alturas and Stanley Lakes. Collectively, the native 0. *nerka* from the Sawtooth Valley lakes form a coherent group that is well-separated genetically from all other populations of *0. 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 0reille.J.

In addition to a population of presumably native 0. *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 0. *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 pear, 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 *0. 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 *0. 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

---

[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 0. *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 0. *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 Redfrsh 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 0. *nerka* into Sawtooth Valley populations? What genetic lineages are represented by existing populations of *0. 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 *0. 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 0. *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 0. *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 0. *nerka* than is contained in Winans et al. (1996), and it also includes a more comprehensive evaluation of other populations of 0. *nerka* from the Snake River basin.

## METHODS

### Study Areas and Experimental Design

Although this study focused on populations of 0. *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 0. *nerka* were also made in Redfish Lake. In 1990, 1992, 1993, and 1994, midwater trawls were used to collect samples of mixed-age *0. nerka*. In 1991-93, juvenile *0. 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" *0. nerka* were made in 1992 and 1993,

These latter collections were prompted by two observations. First, preliminary results from this study indicated that outmigrant *0. nerka* were genetically similar to Redfish Lake sockeye salmon but had substantial allele frequency differences

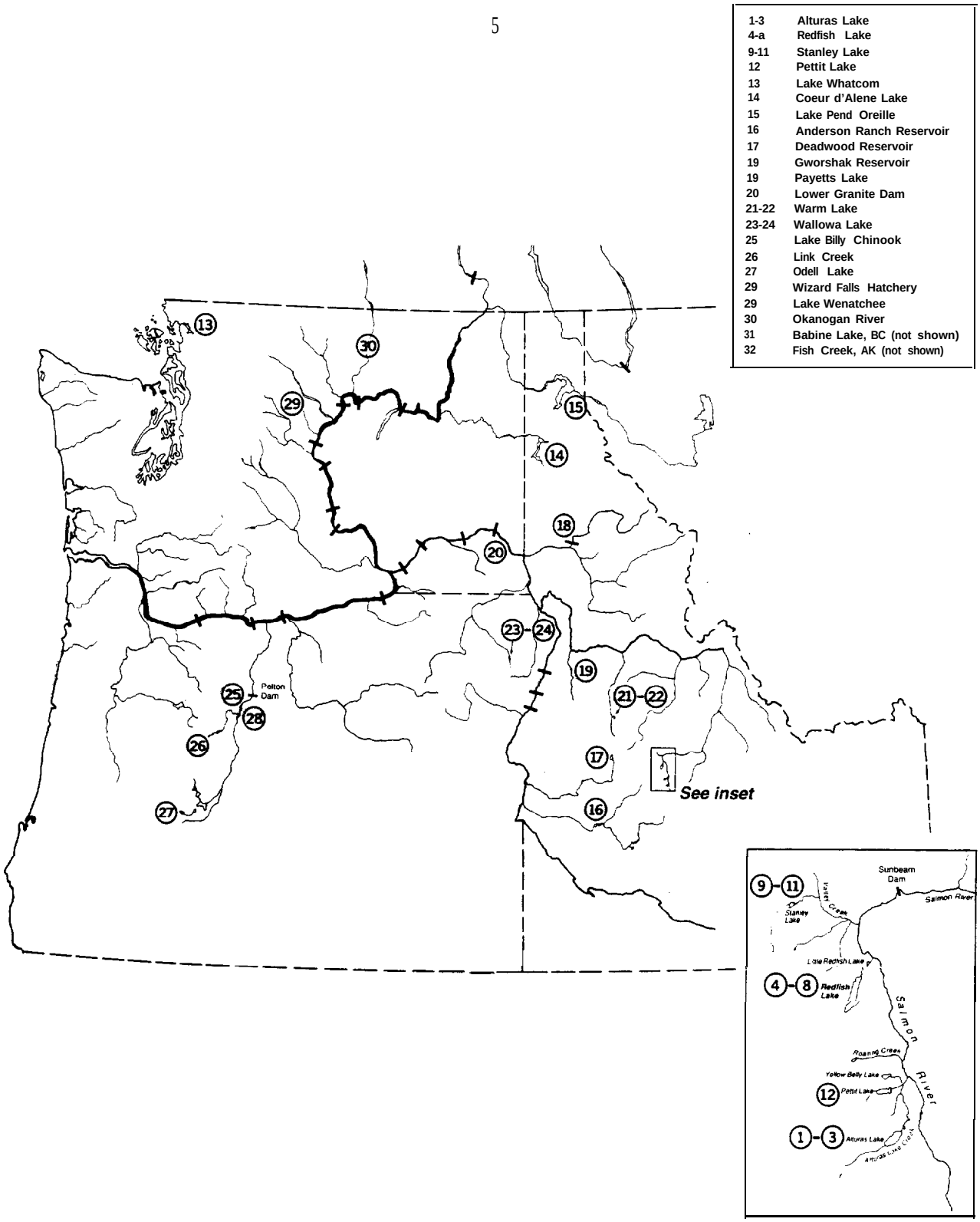



Figure 1. Map of the Pacific Northwest showing collection locations for samples included in this study. Numbers correspond to population ID numbers in Table 1.

Table 1. Collection data for 53 samples of 0. *nerka* considered in this report. In some analyses, temporal samples (indented) from the same location were combined. An asterisk ("1 indicates the total number of individuals in a combined sample. A = adult spawner; J = juvenile; M = mixed or unknown.

| Area/Sample | N | Tme | Age | Collection date | Population number" |
|---|---|---|---|---|---|
| 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 | IO | Unknown | M | 8/27/92 | |
| September 1992 | 37 | Unknown | M | 9/24/92 | - |
| September 1993 | A- | Unknown | M | 9/16/93 | |
| September 1994 | Z', | Unknown | M | 9/06/94 | |
| REDFISH L. OUTMIGPANTS | 181* | | | | 6 |
| 1991 | 138 | TJnknown | 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 | l/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 |

to population numbers in Figure 1.

compared to Fishhook Creek kokanee. This result suggested that most (perhap's 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 0. *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 0. *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 0. *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 0. *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 0. *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 0. *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 0. *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 0. *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 0. *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 0. *nerka* from a mixture of age classes. Resident adult 0. *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 0. *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 0. *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-AI* * 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 0. *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-Al** 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 | .Oll | .012 |
| Redfish L. sockeye | 1991-93 | 12.7 | 4.7 | .Olo | .Olo |
| Redfish L. residuals | 1992-93 | 13.8 | 6.3 | .013 | .Oll |
| 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 |
| Ode11 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-* *, ALAT*, *MPF, PGM-la,* 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-Al** 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-Al*, 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-Al"* and *PGM-l***

Considerable genetic diversity among populations was found, as evident from an examination of Table 3. Fst values at nine loci*(ADA-1 *, mAAT- *, 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-/*, 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 *0. 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 |

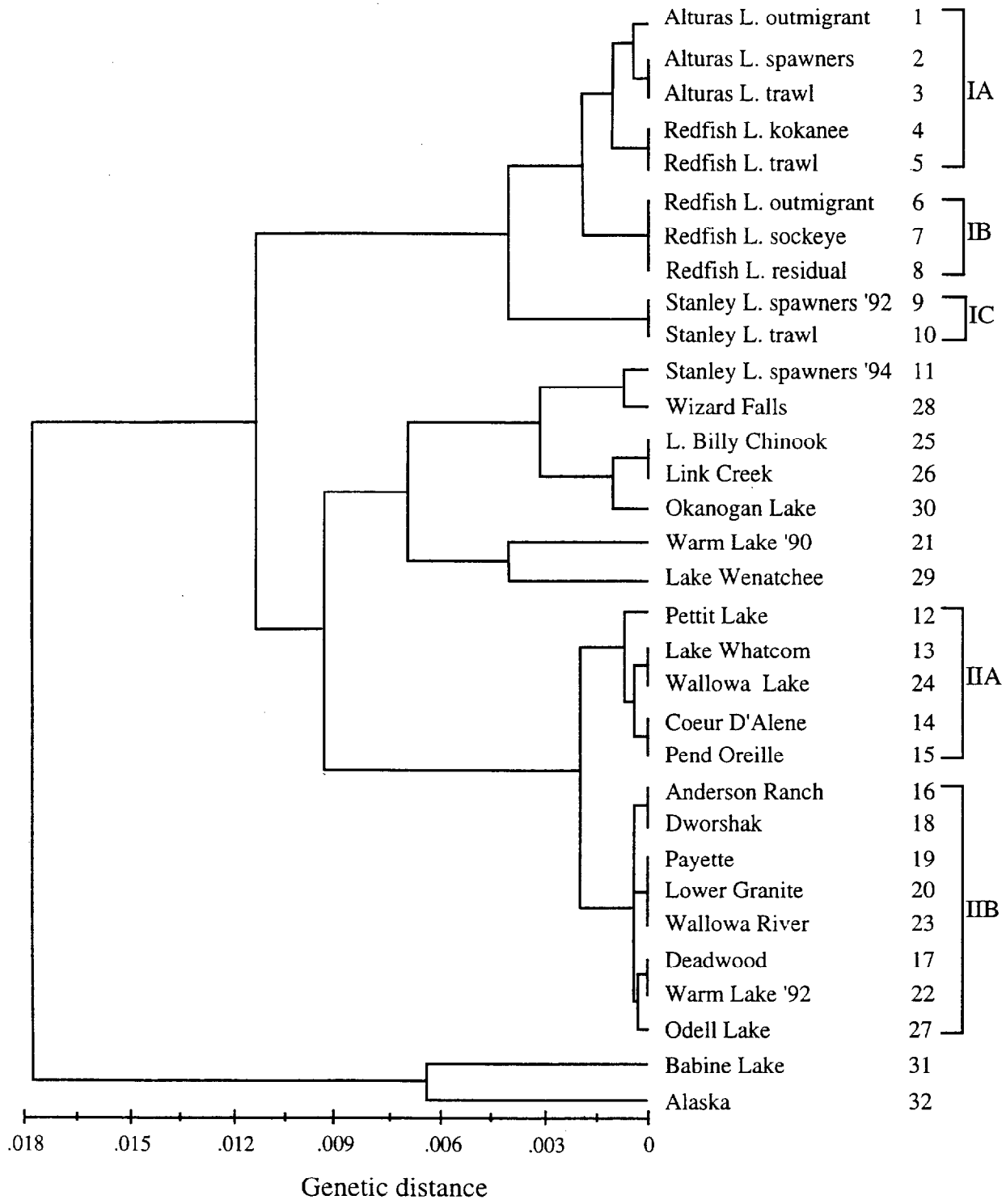



Figure 2. Dendrogram of genetic relationships among 32 populations of *O. nerka* from the Pacific Northwest, based on variation at 64 gene loci. Clustering used the UPGMA method based on a matrix of Nei's (1978) unbiased estimates of genetic distance between each pair of samples. Numbers correspond to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

Group I includes all of the 0. *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 (10.

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 Ode11 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 0. *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 0. *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 0. *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

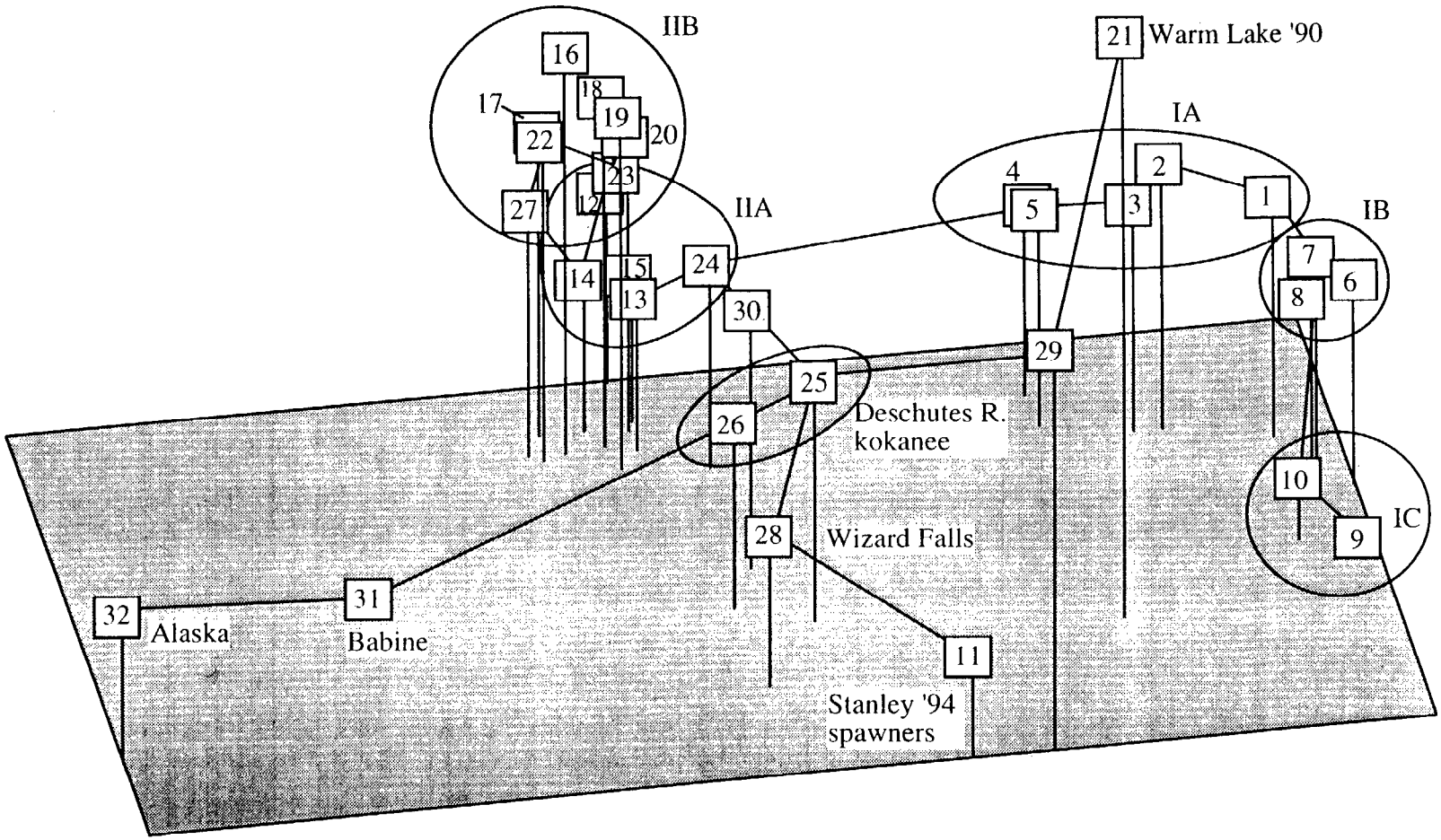



Figure 3. Multidimensional scaling (MDS) plot of genetic relationships among 32 populations of 0. *nerka* from the Pacific Northwest, with a minimum-spanning tree superimposed. This figure is another way of representing the same genetic distance data depicted in Figure 2. Major genetic groups I and II from Figure 2 are identified here.

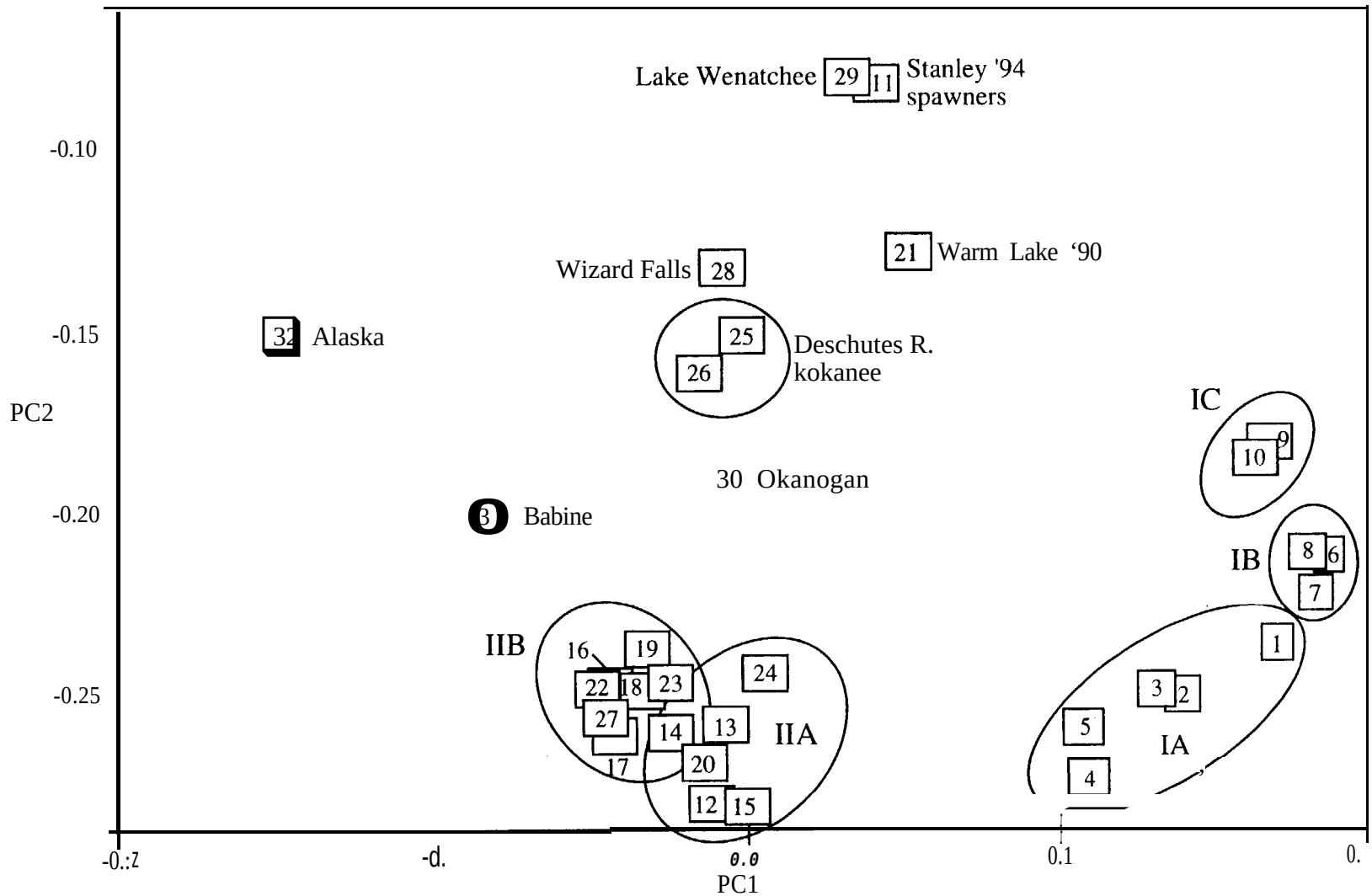



Figure 4. Principal components analysis (PCA) of genetic relationships among 32 populations of 0. *nerka* from the Pacific Northwest. The PCA analysis used the same samples and the same raw data as were used in Figures 2 and 3.

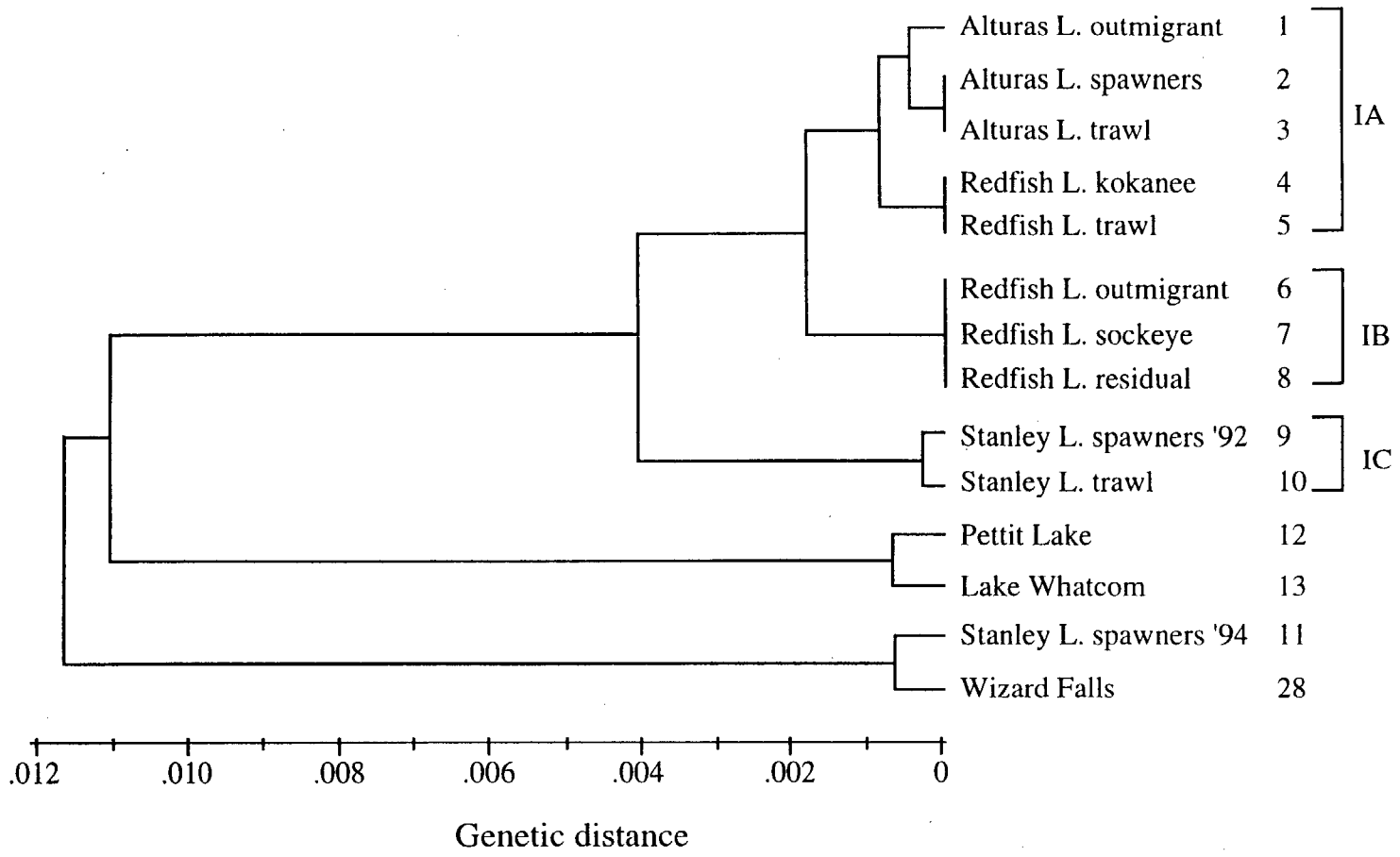



Figure 5. As in Figure 2, but using only 12 populations from the Sawtooth Valley in Idaho and two exogenous populations.

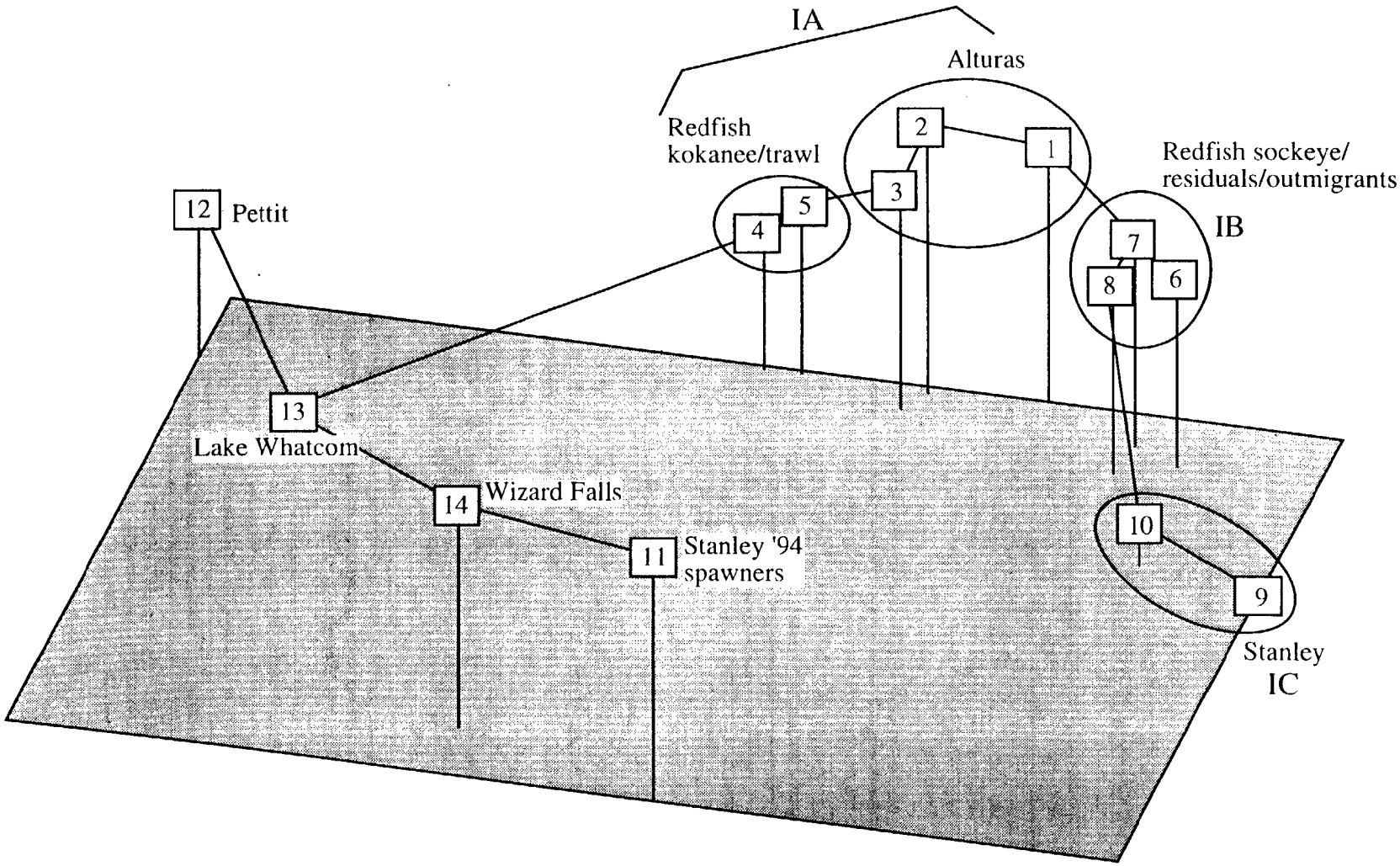



Figure 6. As in Figure 3, but using only 14 populations from the Sawtooth Valley in Idaho and two exogenous populations.

Redfish Lake kokanee and Alturas Lake 0. *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 0. *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 0. *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 0. *nerka* were not large. Relatively modest allele frequency differences between the groups at *ADH*,* mAAT-I*, *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 0. *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/Red&h Lake kokanee and the Redfish Lake sockeyeloutmigrantslresiduals, 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 (O-0.008) of the “94” allele at *ADA-l* *, 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 0. *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 0. *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, Wallows/Deadwood, and Warm/Payette were statistically significant. The sample from Ode11 Lake was more loosely affiliated with this group; it

---

[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 *mlDHP-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 0. *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 0. *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 0. *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

---

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

observations of anadromous 0. *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 0. *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]).

---

[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 m 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 *ALIT**, 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 0. *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 0. *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 0. *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 | Llfestage | Type | Source |
|---|---|---|---|---|---|
| | Alturas Lake | | | | |
| 1921 | Unknown | 40,300 | yearling | sockeye' | 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' | 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' | 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' | 10,440 | fingerling | sockeye | k |
| 19712 | 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' | 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?' | 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 *0. 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 0. *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 0. *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 (Weile?).

---

5B. 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?. This may be a remnant, native population of 0. *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 DeadwoodlDworshaWAnderson 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 0. *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 Ode11 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

---

[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 0.0411, 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 (O.Oll-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 0. *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 0. *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 0. *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 *0. 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.

## ACKNOWLEDGMENTS

This study would not have been possible without the cooperation and assistance of many people involved in field collections, including Ernie Brannon and Anne Setter (University of Idaho), Bruce Rieman, Keith Johnson, and Paul Kline (Idaho Department of Fish and Game), Scott Spaulding, Dave Teuscher, and Doug Taki (Shoshone-Bannock Tribes), Kathryn Kostow and Bill Knox (Oregon Department of Fish and Wildlife), and Chuck Guthrie (NMFS Auke Bay Laboratory, Alaska). The discovery of the "residual" sockeye salmon in Redfish Lake was due in no small part to the efforts of Bruce Rieman (currently with the U.S. Forest Service). Bud Welch, Cindy Shiflett, Stephanie Woods, Eric Iwamoto, and Delia Patterson assisted with the electrophoretic analyses. Don Anderson, Sharon Clark, Rick Gustafson, Kathryn Kostow, and Matt Powell provided information on histories of stock transfers.

## REFERENCES

Aebersold, P. B., G. A. Winans, D. J. Teel, G. B. Milner, and F. M. Utter. 1987. Manual for starch gel electrophoresis: a method for the detection of genetic variation. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 61, 19 p.

Allendorf, F. W., and G. H. Thorgaard. 1984. Tetraploidy and the evolution of salmonid fishes. *In:* B. Turner (editor). Evolutionary genetics of fishes, p. l-53. Plenum Press, New York.

Bjornn, T. C., D. R. Craddock, and D. R. Corley. 1968. Migration and survival of Redfish Lake, Idaho, sockeye salmon, *Oncorhynchus nerka.* Trans. Am. Fish. Soc. 97:360-373.

Bowler, B. 1990. Additional information on the status of Snake River sockeye salmon. Report submitted to ESA Administrative Record for sockeye salmon, December 1990, 23 p, (Available from Idaho Department of Fish and Game, 600 S. Walnut St., Boise, ID 83707.)

Brannon, E., A. Setter, T. Welsh, R. Danner, K. Collins, and M. Casten. 1994. Genetic analysis of *Oncorhynchus nerka* Life history and genetic analysis of Redfish Lake *Oqorhynchus nerka* Completion Report of Research, 48 p. (Available from Bonneville Power Administration, P.O. Box 3621, Portland, OR 97208.)

Cavalli-Sforza, L. L., and A. W. F. Edwards. 1967. Phylogenetic analysis: models and estimation procedures. Evolution 21:550-570.

Chapman, D. W., W. S. Platts, D. Park, and M. Hill. 1990. Status of Snake River sockeye salmon. Final report, 90 p. (Available from Pacific Northwest Utilities Conference Committee, 101 SW Main Street, Suite 810, Portland, OR 97204.)

Corley, D.-C. 1966. Redfish, Stanley, Yellow Belly, Pettit, Perkins and Little Redfish Lake fisheries investigations, May 15 to September 30, 1966. Idaho Department of Fish and Game report. (Available from Idaho Department of Fish and Game, 600 S. Walnut St., Boise, ID 83707.)

Cramer, S. P. 1990. The feasibility for reintroducing sockeye and coho salmon in the Grand Ronde River and coho and chum salmon in the Walla Walla River. Progress Report under contract to the Nez Perce Tribal Executive Committee and Nez Perce Fisheries Resource Management, 131 p. (Available from S. P. Cramer & Associates, Inc., 300 SE. Arrow Creek Lane, Gresham, OR 97080.)

Crow, J. F., and M. Kimura. 1970. An introduction to population genetics theory. Harper and Row, New York. 591 p.

Flagg, T. A. 1993. Redfish Lake sockeye salmon captive broodstock rearing and research. Annual report of research, 16 p. (Available from Bonneville Power Administration, P.O. Box 3621, Portland, OR 97208.)

Foote, C. J., C. C. Wood, and R. E. Withler. 1989. Biochemical genetic comparison of sockeye salmon and kokanee, the anadromous and nonanadromous forms of *Oncorhynchus nerka*. Can. J. Fish. Aquat. Sci. 46:149-158.

Hall-Griswold, J. A. 1990. Sockeye of Stanley Basin--Summary. Report submitted to the ESA Administrative Record for sockeye salmon, July 1990, 29 p. (Available from Idaho Department of Fish and Game, 600 S. Walnut St., Boise, ID 83707.)

Howell, P., K. Jones, D. Scarnecchia, L. Lavoy, W. Kendra, and D. Ortmann. 1985. Stock assessment of Columbia River anadromous salmonids. Vol. I: Chinook, coho, chum, and sockeye salmon stock summaries. Final Report, Project No. 83-335, 558 p. (Available from Bonneville Power Administration, P.O. Box 3621, Portland, OR 97208.)

Idaho Department of Fish and Game (IDFG). 1997. Computer database of historic stocking records, 1968-present. (Available from Idaho Department of Fish and Game, 600 S. Walnut St., Boise, ID 83707.)

Johnson, K. A. 1993. Research and recovery of Snake River sockeye salmon. Annual report of research, 38 p. (Available from Bonneville Power Administration, P.O. Box 3621, Portland, OR 97208.)

Jones, R. 1991. The effect of Sunbeam Dam on sockeye salmon in the Salmon River, Idaho. Memo to ESA Administrative Record for sockeye salmon, March 1991, 6 p. (Available from Environmental and Technical Services Division, NMFS, 525 N.E. Oregon St., Portland, OR 97232.)

Kalish, J. M. 1990. Use of otolith microchemistry to distinguish the progeny of sympatric anadromous and non-anadromous salmonids. Fish. Bull., U.S., *88:657-666.*

Kline, P. 1994. Research and recovery of Snake River sockeye salmon. Annual report of research, 52 p. (Available from Bonneville Power Administration, P.O. Box 3621, Portland, OR 97208.)

Kostow, K. 1996. ODFW 0. *nerka* hatchery records in Wallowa and Metolius subbasins. Memorandum to R. Gustafson (NMFS), 19 March 1996, 18p. (Available from Northwest Fisheries Science Center, 2725 Montlake Boulevard E., Seattle, WA 98112.)

Monan, G. 1991. Genetic analysis of *0. nerka.* Memo to Merritt Tuttle for inclusion in ESA Administrative Record for sockeye salmon, February 1991, 8 p. (Available from Environmental and Technical Services Division, NMFS, 525 N.E. Oregon St., Portland, OR 97232.)

Mullan, J. W. 1986. Determinants of sockeye salmon abundance in the Columbia River, 1880's1982: A review and synthesis. U.S. Fish Wildl. Serv. Biol. Rep. 86(12), 135 p.

Natural Resources Consultants, Inc. (NRC). 1995. Artificial propagation of anadromous Pacific salmonids: west coast sockeye salmon. Electronic database submitted to Coastal Zone and Estuarine Studies Division, Northwest Fisheries Science Center, Natl. Mar. Fish. Serv. Contract No. 50ABNF400128. 1.8MB. (Available online through anonymous FTP at ftp.streamnet.org/pub/streamnetinmfs_data.)

Nei, M. 1978. Estimation of average heterozygosity and genetic distance from a small number of individuals. Genetics 89:583-590.

Ricker, W. E. 1940. On the origin of kokanee, a fresh-water type of sockeye salmon. Trans. R. Soc. Can. 34:121-135.

Rieman, B. E., D. L. Myers, and R. L. Nielsen. 1994. Use of otolith microchemistry to discriminate *Oncorhynchus nerka* of resident and anadromous origin. Can. J. Fish. Aquat. Sci. 51:68-77.

Rohlf, F. J. 1993. NTSYS-pc: Numerical Taxonomy and Multivariate Analysis System, version 1.80. Exeter Software, Setauket, New York.

Shaklee, J. B., F. W. Allendorf, D. C. Morizot, and G. S. Whitt. 1990. Gene nomenclature for protein-coding loci in fish. Trans. Am. Fish. Soc. 119:2-15.

Swofford, D. L., and R. B. Selander. 1981. BIOSYS-1: a FORTRAN program for the comprehensive analysis of electrophoretic data in population genetics and systematics. J. Hered. 72:281-283.

Thorgaard, G. H., P. Spruell, S. A. Cummings, A. S. Peek, and E. L. Brannon. 1995. Mixed DNA fingerprint analysis differentiates sockeye salmon populations. Am. Fish. Soc. Symp. 17:295-303.

U.S. Army Corps of Engineers (USACE). 1993. 1992 Reservoir drawdown test: Lower Granite and Little Goose Dams. Final Report, 141 p. (Available from U.S. Army Corps of Engineers, Walla Walla District, 201 N. 3rd St., Walla Walla, WA 99362.)

U.S. Department of Agriculture, Forest Service (USDA). 1994. Ode11 Pilot Watershed Analysis, 176 p. (Available from Deschutes National Forest, Crescent Ranger District, 1645 Highway 20, Bend, OR 97701.)

Utter, F. M., P. B. Aebersold, J. Helle, and G. A. Winans. 1984. Genetic characteristics of populations on the southeastern range of sockeye salmon. *In* J. M. Walton and D. B. Houston (editors). Proceedings of the Olympic Wild Fish Conference, Peninsula College, 23-25 March 1983, Port Angeles, Washington, p 17-32.

Utter, F., P. Aebersold, and G. Winans. 1987. Interpreting genetic variation detected by electrophoresis. *In* N. Ryman and F. Utter (editors). Population Genetics and Fishery Management, p. 21-45. University of Washington Press, Seattle.

Waples, R. S. 1988. Estimation of allele frequencies at isoloci. Genetics 118:371-384.

Waples, R. S. 1992. Summary of possible ways to characterize juvenile *Oncorhynchus nerka* outmigrants from Redfish Lake, Idaho. Unpublished report, April 1992. 11 p. (Available from Northwest Fisheries Science Center, 2725 Montlake Boulevard E., Seattle, WA 98112.)

Waples, R. S. 1995. Genetic effects of stock transfers of fish. *In* D. Philipp et al. (editors). Protection of aquatic biodiversity. Proceedings of the World Fisheries Congress, Theme 3, p 51-69. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Waples, R. S., 0. W. Johnson, and R. P. Jones, Jr. 1991a. Status review for Snake River sockeye salmon. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-195, 23 p.

Waples, R. S., D. J. Teel, and P. B. Aebersold. 1991b. A genetic monitoring and evaluation program for supplemented populations of salmon and steelhead in the Snake River Basin. Annual report of research, 50 p. (Available from Bonneville Power Administration, P.O. Box 3621, Portland, OR 97208.)

Welsh, T. L. 1991. Stanley Basin sockeye salmon lakes, upper Salmon River drainage, Idaho: fish stocking history; fish eradication projects; present status of the kokanee salmon stocks. Unpublished report. (Available from Aquaculture Institute, University of Idaho, Moscow, ID. 83843.)

Winans, G. A., P. B. Aebersold, and R. S. Waples. 1996. Allozyme variability of *Oncorhynchus nerka* in the Pacific Northwest, with special consideration to populations of Redfish Lake, Idaho. Trans. Am. Fish. Soc. 125:645-663.

Wood, C. C. 1995. Life history variation and population structure of sockeye salmon. Am. Fish. Soc. Symposium 17:195-216.

Wright, S. 1978. Evolution and the Genetics of Populations, vol. 4. Variability Within and Among Natural Populations. Univ. of Chicago Press, Chicago. 580 p.

# 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 .l | *sAAT-2** | GOT-2 | MH | TBCLE | 32 | 6 |
| | | *sAAT-3** | GOT-3 | E | TBE | 32 | 0 |
| | | | AAT-3 | | | | |
| | | *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-l* * | | 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 |
| | | *mAH4'* | | 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-A 1.* | CK-1 | M | TBCLE | 32 | 1 |
| | | *CK-A2** | CK-2 | M | TBCLE | 32 | 1 |
| | | *CK-B** | CK-5 | E | TBCLE | 32 | 5 |
| | | *CK-CI** | 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 |
| p-N-Acetylgalactosaminidase | 3.2.1.53 | *βGALA** | | L | ACE7 | 32 | 1 |
| Glyceraldehyde-3-phosphate dehydrogenase | 1.2.1.12 | *GAPDH-1.* | GAP-I | 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-I .* | 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 |
| 8-N-Acetylhexosaminidase | 3.2.1.52 | *ß HEX'* | βGLUA,bGA | L | TC4 | 32 | 1 |
| L-Iditol 2-dehydrogenase | 1.1.1.14 | *IDDH-I'* | 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-A 1 .* | LDH-1 | M | TBCLE | 32 | 2 |
| | | *LDH-A2'* | LDH-2 | M | TBCLE | 32 | 0 |
| | | *LDH-BI .* | 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 |
| a-Mannosidase | 3.2.1.24 | *aMAN'* | | L | TC4 | 31 | 0 |
| Malate dehydrogenase | 1.1.1.37 | *sMDH-AI** | 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-B-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<br>GL-1 | ME | TBE | 32 | 1 |
| Tripeptide aminopeptidase | 3.4.11.4 | *PEPB-1** | PEP-3<br>PEP-LGG<br>TAPEP-1 | ME | TBCLE<br><br>TC4 | 32 | 0 |
| Peptidase-C | 3.4.-.- | *PEPC'* | DPEP-2<br>GL-2 | E | TBE | 32 | 6 |
| X-Pro dipeptidase | 3.4.1 3.9 | *PEPD-1'* | PDPEP-1<br>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-I* | | 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-I | L | TBE | 32 | 2 |
| Triose-phosphate isomerase | 5.3.1 .I | TPI-1 . | TPf-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 aiieies 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. 00.0 | .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 |
| Rettit 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 |
| Rend 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 | l:ooo | .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 |
| Ode11 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-l*

| | | 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 | .lll |
| 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 | 1459 |
| Ode11 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 | :ooo |

mAAT-2*

| | Year | 2N | -100 | -10 |
|---|---|---|---|---|
| Alturas L. outmigrant | 91 | 30 | 1.000 | .ooo |
| Alturas L. spawners | 92 | 60 | 1.000 | .ooo |
| Alturus L. trawl | 90 | 178 | 1.000 | .ooo |
| Alturas L. trawl | 92 | 84 | 1.000 | .ooo |
| Redfish L. kokanee | 90 | 172 | 1.000 | .ooo |
| Redfish L. kokanee | 91 | 138 | 1.000 | .ooo |
| Redfish L. kokanee | 92 | 120 | 1.000 | .ooo |
| Redfish L. trawl | 90 | 22 | 1.000 | .ooo |
| Redfish L. trawl | 92 | 94 | 1.000 | .ooo |
| Redfish L. trawl | 93 | 36 | 1.000 | .ooo |
| Redfish L. trawl | 94 | 52 | 1.000 | .ooo |
| Redfish L. outmigrant | 91 | 266 | 1.000 | .ooo |
| Redfish L. outmigrant | 92 | 34 | 1.000 | .ooo |
| Redfish L. outmigrant | 93 | 52 | 1.000 | .ooo |
| Redfish L. sockeye | 91-93 | 26 | 1.000 | .ooo |
| Redfish L. residual | 92-93 | 28 | 1.000 | .ooo |
| Stanley L. spawners | | 118 | 1.000 | .ooo |
| Stanley L. trawl | ;z | 20 | 1.000 | .ooo |
| Stanley L. trawl | 93 | 12 | 1.000 | .ooo |
| Stanley L. trawl | 94 | 34 | 1.000 | .ooo |
| Stanley L. spawners | 94 | 10 | 1.000 | .ooo |
| Pettit Lake | 92 | 50 | 1.000 | .ooo |
| Pettit Lake | 94 | 74 | 1.000 | .ooo |
| Lake Whatcom | 90 | 116 | 1.000 | .ooo |
| Lake Coeur d'Alene | 90 | 100 | 1.000 | .ooo |
| Pend Oreille Lake | 90 | 120 | 1.000 | .ooo |
| Anderson Ranch Res. | 90 | 22 | 1.000 | .ooo |
| 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 | .ooo |
| Warm Lake | 90 | 110 | 1.000 | .ooo |
| Warm Lake | 92 | 120 | 1.000 | .ooo |
| Wallowa River | 92 | 118 | 1.000 | .ooo |
| Wallowa Lake | 93 | 78 | 1.000 | .ooo |
| Lake Billy Chinook | 92 | 96 | 1.000 | .ooo |
| Link Creek | 92 | 98 | 1.000 | .ooo |
| Ode11 Lake | 92 | 120 | 1.000 | .ooo |
| Wizard Falls Hatchery | 93 | 160 | 994 | .006 |
| Lake Wenatchee | 87 | 114 | l:ooo | .ooo |
| Lake Wenatchee | 88 | 120 | 1.000 | 000 |
| Okanogan River | 90 | 116 | 1.000 | :ooo |
| Babine Lake | 90 | 120 | 1.000 | .ooo |
| Fish Creek (Alaska) | 92 | 80 | 1.000 | .ooo |

ADA-l*

| | | Year | 2N | 100 | 94 | 90 |
|---|---|---|---|---|---|---|
| Alturas L. | outmigrant | 91 | 28 | .893 | .107 | .ooo |
| Alturas L. | spawners | 92 | 60 | 983 | .017 | .ooo |
| Alturus L. | trawl | 90 | 200 | :930 | .070 | .ooo |
| Alturas L. | trawl | 92 | 84 | .929 | .071 | .ooo |
| Redfish L. | kokanee | 90 | 168 | .940 | .060 | .ooo |
| Redfish L. | kokanee | 91 | 138 | .942 | .058 | .ooo |
| Redfish L. | kokanee | 92 | 120 | 933 | .067 | .ooo |
| Redfish L. | trawl | 90 | 24 | l:ooo | .ooo | .ooo |
| Redfish L. | trawl | 92 | 94 | .894 | .096 | .Oll |
| Redfish L. | trawl | 93 | 78 | 962 | .038 | .ooo |
| Redfish L. | trawl | 94 | 52 | l:ooo | .ooo | .ooo |
| Redfish L. | outmigrant | 91 | 274 | .993 | .007 | .ooo |
| Redfish L. | outmigrant | 92 | 34 | 971 | .029 | .ooo |
| Redfish L. | outmigrant | 93 | 52 | 1:ooo | .ooo | .ooo |
| Redfish L. | sockeye | 91-93 | 26 | 1.000 | .ooo | .ooo |
| Redfish L. | residual | 92-93 | 28 | 1.000 | .ooo | .ooo |
| Stanley L. | spawners | 92 | 118 | 1.000 | .ooo | .ooo |
| Stanley L. | trawl | 92 | 20 | 1.000 | .ooo | .ooo |
| Stanley L. | trawl | 93 | 24 | .917 | .083 | .ooo |
| Stanley L. | trawl | 94 | 34 | .971 | .029 | .ooo |
| Stanley L. | spawners | 94 | 16 | .938 | .063 | .ooo |
| Pettit Lake | | 92 | 50 | 960 | .040 | .ooo |
| Pettit Lake | | 94 | 64 | l:ooo | .ooo | .ooo |
| Lake Whatcom | | 90 | 120 | 1.000 | .ooo | .ooo |
| Lake Coeur d'Alene | | 90 | 100 | 1.000 | .ooo | .ooo |
| Pend Oreille Lake | | 90 | 120 | 1.000 | 000 | .ooo |
| Anderson Ranch Res. | | 90 | 24 | 792 | :208 | .ooo |
| Deadwood Reservoir | | 90 | 176 | :739 | 261 | .ooo |
| Deadwood Reservoir | | 92 | 120 | .858 | :142 | .ooo |
| Dworshak Reservoir | | 90 | 116 | .784 | .216 | .ooo |
| Payette Lake | | 90 | 118 | .746 | 254 | .ooo |
| NF Payette River | | 92 | 118 | .780 | :220 | .ooo |
| Lower Granite | | 92 | 36 | 778 | .222 | .ooo |
| Warm Lake | | 90 | 120 | 1:ooo | .ooo | .ooo |
| Warm Lake | | 92 | 120 | .767 | .233 | .ooo |
| Wallowa River | | 92 | 120 | 800 | .200 | .ooo |
| Wallowa Lake | | 93 | 78 | l:ooo | .ooo | .ooo |
| Lake Billy Chinook | | 92 | 96 | 1.000 | .ooo | .ooo |
| Link Creek | | 92 | 98 | .980 | .020 | .ooo |
| Ode11 Lake | | 92 | 120 | .883 | .117 | .ooo |
| Wizard Falls Hatchery | | 93 | 160 | 981 | .019 | .ooo |
| Lake Wenatchee | | 87 | 240 | 1:ooo | .ooo | .ooo |
| Lake Wenatchee | | 88 | 320 | 1.000 | .ooo | .ooo |
| Okanogan River | | 90 | 126 | 984 | .016 | .ooo |
| Babine Lake | | 90 | 120 | l:ooo | .ooo | .ooo |
| Fish Creek (Alaska) | | 92 | 80 | 1.000 | .ooo | .ooo |

ADA-2*

| | Year | 2N | 100 | 107 | 94 |
|---|---|---|---|---|---|
| Alturas L. outmigrant | 91 | 66 | 1.000 | 000 | .000 |
| Alturas L. spawners | 92 | 60 | 1.000 | :ooo | .000 |
| Alturus L. trawl | 90 | 186 | 1.000 | .ooo | .000 |
| Alturas L. trawl | 92 | 84 | 1.000 | .ooo | .000 |
| Redfish L. kokanee | 90 | 174 | 1.000 | .ooo | .000 |
| Redfish L. kokanee | 91 | 138 | 1.000 | .ooo | .000 |
| Redfish L. kokanee | 92 | 120 | 1.000 | .ooo | .000 |
| Redfish L. trawl | 90 | 22 | 1.000 | .ooo | .000 |
| Redfish L. trawl | 92 | 94 | 1.000 | .ooo | .000 |
| Redfish L. trawl | 93 | 0 | 000 | .ooo | .000 |
| Redfish L. trawl | 94 | 48 | 1:000 | .ooo | .000 |
| Redfish L. outmigrant | 91 | 266 | 1.000 | .ooo | .000 |
| Redfish L. outmigrant | 92 | 22 | 1.000 | .ooo | .000 |
| Redfish L. outmigrant | 93 | 52 | 1.000 | .ooo | .000 |
| Redfish L. sockeye | 91-93 | 24 | 1.000 | .ooo | .000 |
| Redfish L. residual | 92-93 | 28 | 1.000 | .ooo | .000 |
| Stanley L. spawners | 92 | 118 | 1.000 | .ooo | .000 |
| Stanley L. trawl | 92 | 20 | 1.000 | .ooo | .000 |
| Stanley L. trawl | 93 | 26 | 1.000 | 000 | .000 |
| Stanley L. trawl | 94 | 26 | 1.000 | :ooo | .000 |
| Stanley L. spawners | 94 | 16 | 1.000 | .ooo | .000 |
| Pettit Lake | 92 | 50 | 1.000 | .ooo | .000 |
| Pettit Lake | 94 | 0 | 000 | .ooo | .000 |
| Lake Whatcom | 90 | 120 | 1:ooo | 000 | .000 |
| Lake Coeur d'Alene | 90 | 100 | 1.000 | :ooo | .000 |
| Pend Oreille Lake | 90 | 120 | 1.000 | 000 | .000 |
| Anderson Ranch Res. | 90 | 22 | 1.000 | :ooo | .000 |
| Deadwood Reservoir | 90 | 176 | 994 | .006 | .000 |
| Deadwood Reservoir | 92 | 120 | l:ooo | .ooo | .000 |
| Dworshak Reservoir | 90 | 116 | 1.000 | .ooo | .000 |
| Payette Lake | 90 | 120 | 1.000 | .ooo | .000 |
| NF Payette River | 92 | 118 | 1.000 | .ooo | .000 |
| Lower Granite | 92 | 36 | 1.000 | .ooo | .000 |
| Warm Lake | 90 | 120 | 992 | .008 | 000 |
| Warm Lake | 92 | 120 | l:ooo | .ooo | :000 |
| Wallowa River | 92 | 120 | 1.000 | .ooo | .000 |
| Wallowa Lake | 93 | 80 | 1.000 | .ooo | .000 |
| Lake Billy Chinook | 92 | 96 | 1.000 | 000 | .000 |
| Link Creek | 92 | 98 | 1.000 | :ooo | .000 |
| Ode11 Lake | 92 | 120 | 1.000 | .ooo | .000 |
| Wizard Falls Hatchery | 93 | 156 | 1.000 | 000 | 000 |
| Lake Wenatchee | 87 | 234 | 1.000 | :ooo | :000 |
| Lake Wenatchee | 88 | 320 | 1.000 | .ooo | .000 |
| Okanogan River | 90 | 126 | 1.000 | .ooo | .000 |
| Babine Lake | 90 | 120 | 1.000 | .ooo | .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 | ia | 1.000 | :000 |
| Redfish L. outmiarant | 93 | 52 | 1.000 | .000 |
| Redfish L. sockeye | 91-93 | 0 | 000 | .000 |
| Redfish L. residual | 92-93 | 28 | l:ooo | 000 |
| Stanley L. spawners | 92 | 118 | 1.000 | :000 |
| Stanley L. trawl | 92 | 0 | 000 | .000 |
| Stanley L. trawl | 93 | 12 | l:ooo | 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 | a2 | 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 |
| Ode11 Lake | 92 | 120 | 1:ooo | :000 |
| Wizard Falls Hatchery | 93 | 160 | 1.000 | .000 |
| Lake Wenatchee | a7 | 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 | a3 |
|---|---|---|---|---|---|
| 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 | l:ooo | .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 |
| Ode11 Lake | 92 | 120 | 1.000 | .000 | .000 |
| Wizard Falls Hatchery | 93 | 160 | 1.000 | .000 | .000 |
| Lake Wenatchee | a7 | 238 | 1.000 | .000 | .000 |
| Lake Wenatchee | 88 | 312 | .997 | .003 | .000 |
| Okanogan River | 90 | 126 | 992 | .00a | .000 |
| Babine Lake | 90 | 120 | 1: 000 | .000 | 000 |
| Fish Creek (Alaska) | 92 | 80 | 1.000 | .ooo | : 000 |

mAH-1,2*

| | Year | 4N | 100 | 75 | 133 | 65 | 111 | a4 |
|---|---|---|---|---|---|---|---|---|
| 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 | .ooo | .000 | .000 | .000 |
| Redfish L. kokanee | 90 | 348 | .914 | .083 | .003 | .000 | .000 | .000 |
| Redfish L. kokanee | 91 | 264 | .928 | .072 | .ooo | .000 | .000 | .000 |
| Redfish L. kokanee | 92 | 240 | .887 | .112 | .ooo | .000 | .000 | .000 |
| Redfish L. trawl | 90 | 48 | 938 | .063 | .ooo | .000 | .000 | .000 |
| Redfish L. trawl | 92 | 176 | .920 | .080 | .ooo | .000 | .000 | .000 |
| Redfish L. trawl | 93 | 76 | .908 | .092 | .ooo | .000 | .000 | .000 |
| Redfish L. trawl | 94 | 52 | 865 | 135 | .ooo | .000 | .000 | .000 |
| Redfish L. outmigrant | 91 | 512 | .746 | .250 | .004 | .000 | .000 | .000 |
| Redfish L. outmigrant | 92 | 64 | .719 | .281 | .ooo | .000 | .000 | .000 |
| Redfish L. outmiqrant | 93 | 104 | .558 | 442 | .ooo | .000 | .000 | .000 |
| Redfish L. sockeye | 91-93 | 52 | 750 | :231 | 019 | .000 | .000 | .000 |
| Redfish L. residual | 92-93 | 56 | .714 | .286 | :ooo | .000 | .000 | .000 |
| Stanley L. spawners | 92 | 232 | .552 | .448 | .ooo | .000 | .000 | .000 |
| Stanley L. trawl | 92 | 40 | .525 | 475 | .ooo | .000 | .000 | 000 |
| Stanley L. trawl | 93 | 48 | .604 | :396 | .ooo | .000 | .000 | :000 |
| Stanley L. trawl | 94 | 20 | .600 | .400 | .ooo | .000 | .000 | .000 |
| Stanley L. spawners | 94 | 28 | .786 | .214 | .ooo | .000 | .000 | .000 |
| Pettit Lake | 92 | 92 | .913 | 087 | .ooo | .000 | .000 | .000 |
| Pettit Lake | 94 | 144 | .875 | .125 | .ooo | .000 | .000 | .000 |
| Lake Whatcom | 90 | 232 | .823 | .177 | .ooo | .000 | .000 | .000 |
| Lake Coeur d'Alene | 90 | 200 | .825 | 175 | .ooo | -000 | .000 | .000 |
| Pend Oreille Lake | 90 | 240 | .813 | :188 | .ooo | .000 | .000 | .000 |
| Anderson Ranch Res. | 90 | 44 | .955 | .ooo | .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 | .ooo | .000 | :000 | .000 |
| NF Payette River | 92 | 236 | .945 | .047 | .ooa | .000 | .000 | 000 |
| Lower Granite | 92. | 56 | .982 | .018 | .ooo | .000 | 000 | :000 |
| Warm Lake | 90 | 240 | .962 | .038 | .ooo | .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 | .ooo | .006 | .000 | .000 |
| Lake Billy Chinook | 92 | 192 | .885 | .109 | .005 | .ooo | .000 | .000 |
| Link Creek | 92 | 196 | .878 | .122 | .ooo | .ooo | .000 | .000 |
| Ode11 Lake | 92 | 240 | .867 | .121 | .013 | .ooo | .000 | .0a0 |
| Wizard Falls Hatchery | 93 | 320 | .828 | .172 | .ooo | .ooo | .000 | .000 |
| Lake Wenatchee | a7 | 480 | 996 | .004 | .ooo | .ooo | .000 | .000 |
| Lake Wenatchee | 88 | 476 | 1:ooo | .ooo | .ooo | .ooo | .000 | .000 |
| Okanogan River | 90 | 252 | .980 | ,020 | .ooo | .ooo | .000 | .000 |
| Babine Lake | 90 | 232 | .832 | .168 | .ooo | .ooo | .000 | .000 |
| Fish Creek (Alaska) | 92 | 160 | 1.000 | .000 | .000 | .ooo | .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 | a4 | 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. outmiarant | 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 | l:ooo | .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 | l:ooo | .000 | .000 |
| Link Creek | 92 | 98 | 1.000 | .000 | .000 |
| Ode11 Lake | 92 | 120 | 1.000 | .000 | .000 |
| Wizard Falls Hatchery | 93 | 160 | 1.000 | .000 | .000 |
| Lake Wenatchee | a7 | 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 | .ooo | .ooo | .800 |
| Alturas L. spawners | 92 | 60 | .217 | .033 | .ooo | .ooo | .750 |
| Alturus L. trawl | 90 | 196 | .219 | .077 | .ooo | .ooo | .704 |
| Alturas L. trawl | 92 | a4 | .179 | .095 | .ooo | .ooo | .726 |
| Redfish L. kokanee | 90 | 176 | .170 | .176 | .ooo | .ooo | .653 |
| Redfish L. kokanee | 91 | 138 | .174 | .138 | .ooo | .ooo | 688 |
| Redfish L. kokanee | 92 | 120 | .133 | .142 | .ooo | .ooo | :725 |
| Redfish L. trawl | 90 | 24 | 375 | .042 | .ooo | .ooo | 583 |
| Redfish L. trawl | 92 | 90 | :211 | 200 | .ooo | .ooo | :589 |
| Redfish L. trawl | 93 | 84 | .190 | .119 | .ooo | .ooo | 690 |
| Redfish L. trawl | 94 | 50 | 100 | .160 | .ooo | .ooo | :740 |
| Redfish L. outmigrant | 91 | 272 | :217 | . 026 | .ooo | .ooo | 757 |
| Redfish L. outmigrant | 92 | 34 | .235 | .029 | .ooo | .ooo | :735 |
| Redfish L. outmigrant | 93 | 52 | 327 | .OOO | .ooo | .ooo | 673 |
| Redfish L. sockeye | 91-93 | 26 | :231 | . 000 | .ooo | .ooo | :769 |
| Redfish L. residual | 92-93 | 28 | .214 | .036 | .ooo | .ooo | .750 |
| Stanley L. spawners | 92 | 116 | 103 | .440 | .ooo | .ooo | .457 |
| Stanley L. trawl | 92 | 20 | :200 | . 300 | .ooo | .ooo | 500 |
| Stanley L. trawl | 93 | 26 | .154 | 385 | .ooo | .ooo | .462 |
| Stanley L. trawl | 94 | 32 | .094 | .313 | .ooo | .ooo | .594 |
| Stanley L. spawners | 94 | 16 | .438 | 375 | .ooo | .ooo | 188 |
| Pettit Lake | 92 | 50 | 440 | :260 | .ooo | .ooo | :300 |
| Pettit Lake | 94 | 74 | :459 | 122 | .ooo | .ooo | .419 |
| Lake Whatcom | 90 | 118 | .398 | :271 | .ooo | .ooo | 331 |
| Lake Coeur d'Alene | 90 | 100 | 430 | 340 | .ooo | .ooo | :230 |
| Pend Oreille Lake | 90 | 120 | :308 | :325 | ,000 | .ooo | .367 |
| Anderson Ranch Res. | 90 | 24 | .625 | .208 | .ooo | .ooo | .167 |
| Deadwood Reservoir | 90 | 174 | 466 | 379 | ,000 | .ooo | .155 |
| Deadwood Reservoir | 92 | 120 | :450 | :367 | .ooo | .ooo | .183 |
| Dworshak Reservoir | 90 | 118 | .610 | 186 | .ooo | .ooo | .203 |
| Payette Lake | 90 | 120 | .642 | :225 | .ooo | .008 | .125 |
| NF Payette River | 92 | 116 | 526 | .250 | .ooo | .ooo | 224 |
| Lower Granite | 92 | 34 | :471 | . 176 | .ooo | .ooo | :353 |
| Warm Lake | 90 | 120 | .950 | 017 | .ooo | .ooo | .033 |
| Warm Lake | 92 | 120 | .517 | .333 | .ooo | 000 | 150 |
| Wallowa River | 92 | 118 | .542 | 220 | .ooo | :ooo | :237 |
| Wallowa Lake | 93 | 78 | .462 | :256 | .ooo | .ooo | .282 |
| Lake Billy Chinook | 92 | 96 | .594 | 302 | .021 | .ooo | .083 |
| Link Creek | 92 | 98 | 541 | .347 | .ooo | .ooo | .112 |
| Ode11 Lake | 92 | 118 | .475 | 347 | .ooo | .ooo | .178 |
| Wizard Falls Hatchery | 93 | 160 | .550 | .306 | .ooo | .ooo | .144 |
| Lake Wenatchee | a7 | 120 | 683 | .175 | .lOO | .ooo | .042 |
| Lake Wenatchee | 88 | 120 | .875 | . 100 | 008 | .ooo | .017 |
| Okanogan River | 90 | 126 | .421 | .246 | .206 | .ooa | .119 |
| Babine Lake | 90 | 120 | .283 | .650 | .033 | .ooo | ,033 |
| Fish Creek (Alaska) | 92 | 80 | .637 | .350 | .ooo | .ooo | .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 | a4 | 1.000 | .000 |
| Redfish L. kokanee | 90 | 176 | 1.000 | .000 |
| Redfish L. kokanee | 92 | 138 | 1.000 | .000 |
| Redfish L. kokanee | 90 | 120 | 1.000 | .000 |
| Redfish L. trawl | | 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 |
| Ode11 Lake | 92 | 118 | 1.000 | .000 |
| Wizard Falls Hatchery | 93 | 160 | 1.000 | .000 |
| Lake Wenatchee | 87 | 240 | 996 | .004 |
| Lake Wenatchee | 88 | 318 | l:ooo | . 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. outmiarant | 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 | | |
| Lake Billy Chinook | 92 | 96 | l:000 987 | .013 |
| Link Creek | 92 | 98 | 1.000 | .000 |
| Ode11 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 | :ooo |
| Deadwood Reservoir | 90 | 176 | 1.000 | .ooo |
| Deadwood Reservoir | 92 | 120 | 1.000 | .ooo |
| Dworshak Reservoir | 90 | 120 | 1.000 | .ooo |
| Payette Lake | 90 | 120 | 1.000 | .ooo |
| NF Payette River | 92 | 116 | 1.000 | .ooo |
| Lower Granite | 92 | 36 | 1.000 | .ooo |
| Warm Lake | 90 | 120 | 1.000 | .ooo |
| Warm Lake | 92 | 118 | 1.000 | .ooo |
| Wallowa River | 92 | 118 | 1.000 | .ooo |
| Wallowa Lake | 93 | 74 | 1.000 | .ooo |
| Lake Billy Chinook | 92 | 96 | 1.000 | .ooo |
| Link Creek | 92 | 98 | 1.000 | .ooo |
| Ode11 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 | .ooo |
| Babine Lake | 90 | 110 | 1.000 | .ooo |
| Fish Creek (Alaska) | 92 | 80 | 1.000 | .OOO |

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 | 9 0 | 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 |
| Ode11 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 | l:ooo | .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 | l:ooo | .000 |
| Redfish L. trawl | 93 | 0 | .ooo | .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 | .ooo | .000 |
| Stanley L. trawl | 94 | 0 | .ooo | .000 |
| Stanley L. spawners | 94 | 0 | 000 | .000 |
| Pettit Lake | 92 | 48 | 1:ooo | .000 |
| Pettit Lake | 94 | 0 | .ooo | .000 |
| Lake Whatcom | 90 | 0 | 000 | .000 |
| Lake Coeur d'Alene | 90 | 96 | l:ooo | .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 | l:ooo | .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 |
| Ode11 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 | .ooo |

FDGH*

| | Year | 2N | 100 | 108 | 128 |
|---|---|---|---|---|---|
| Alturas L. outmigrant | 91 | 52 | 1.000 | .ooo | .ooo |
| Alturas L. spawners | 92 | 54 | 1.000 | .ooo | .ooo |
| Alturus L. trawl | 90 | 164 | 1.000 | .ooo | .ooo |
| Alturas L. trawl | 92 | 20 | 1.000 | .ooo | .ooo |
| Redfish L. kokanee | 90 | 144 | 1.000 | .ooo | .ooo |
| Redfish L. kokanee | 91 | 128 | 1.000 | .ooo | .ooo |
| Redfish L. kokanee | 92 | 120 | 1.000 | .ooo | .ooo |
| Redfish L. trawl | 90 | 24 | 1.000 | .ooo | .ooo |
| Redfish L. trawl | 92 | 74 | 1.000 | .ooo | .ooo |
| Redfish L. trawl | 93 | 40 | 1.000 | .ooo | .ooo |
| Redfish L. trawl | 94 | 48 | 1.000 | .ooo | .ooo |
| Redfish L. outmigrant | 91 | 222 | 1.000 | .ooo | .ooo |
| Redfish L. outmigrant | 92 | 34 | 1.000 | .ooo | .ooo |
| Redfish L. outmigrant | 93 | 52 | 1.000 | .ooo | .ooo |
| Redfish L. sockeye | 91-93 | 26 | 1.000 | .ooo | .ooo |
| Redfish L. residual | 92-93 | 28 | 1.000 | .ooo | .ooo |
| Stanley L. spawners | 92 | 120 | 1.000 | .ooo | .ooo |
| Stanley L. trawl | 92 | 0 | 000 | .ooo | .ooo |
| Stanley L. trawl | 93 | 12 | 1:ooo | .ooo | .ooo |
| Stanley L. trawl | 94 | 34 | 1.000 | .ooo | .ooo |
| Stanley L. spawners | 94 | 14 | 1.000 | .ooo | .ooo |
| Pettit Lake | 92 | 50 | 1.000 | .ooo | .ooo |
| Pettit Lake | 94 | 76 | 1.000 | .ooo | .ooo |
| Lake Whatcom | 90 | 116 | 1.000 | .ooo | .ooo |
| Lake Coeur d'Alene | 90 | 94 | 1.000 | .ooo | .ooo |
| Pend Oreille Lake | 90 | 120 | 1.000 | .ooo | .ooo |
| Anderson Ranch Res. | 90 | 0 | 000 | .ooo | .ooo |
| Deadwood Reservoir | 90 | 156 | l:ooo | .ooo | .ooo |
| Deadwood Reservoir | 92 | 120 | 992 | .OOO | .008 |
| Dworshak Reservoir | 90 | 116 | l:ooo | .ooo | .ooo |
| Payette Lake | 90 | 68 | 1.000 | .ooo | .ooo |
| NF Payette River | 92 | 118 | 1.000 | .ooo | .ooo |
| Lower Granite | 92 | 36 | 1.000 | .ooo | 000 |
| Warm Lake | 90 | 120 | 1.000 | .ooo | :ooo |
| Warm Lake | 92 | 118 | 1.000 | .ooo | .ooo |
| Wallowa River | 92 | 118 | 1.000 | .ooo | .ooo |
| Wallowa Lake | 93 | 78 | 1.000 | .ooo | .ooo |
| Lake Billy Chinook | 92 | 96 | 1.000 | .ooo | .ooo |
| Link Creek | 92 | 98 | 1.000 | .ooo | .ooo |
| Ode11 Lake | 92 | 120 | 992 | .OOO | .008 |
| Wizard Falls Hatchery | 93 | 160 | l:ooo | 000 | .ooo |
| Lake Wenatchee | 87 | 218 | 1.000 | :ooo | . 000 |
| Lake Wenatchee | 88 | 286 | 1.000 | .ooo | .ooo |
| Okanogan River | 90 | 80 | 1.000 | .ooo | .ooo |
| Babine Lake | 90 | 116 | 1.000 | .ooo | .ooo |
| Fish Creek (Alaska)' | 92 | 80 | 1.000 | .ooo | .ooo |

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 | l:ooo | .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 | l:ooo | .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 |
| Ode11 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 | .ooo |
| Alturas L. spawners | 92 | 60 | 1.000 | .ooo |
| Alturus L. trawl | 90 | 196 | 1.000 | .ooo |
| Alturas L. trawl | 92 | 84 | 1.000 | .ooo |
| Redfish L. kokanee | 90 | 174 | 1.000 | .ooo |
| Redfish L. kokanee | 91 | 134 | 1.000 | .ooo |
| Redfish L. kokanee | 92 | 120 | 1.000 | ,000 |
| Redfish L. trawl | 90 | 24 | 1.000 | .ooo |
| Redfish L. trawl | 92 | 94 | 1.000 | .ooo |
| Redfish L. trawl | 93 | 0 | .ooo | .ooo |
| Redfish L. trawl | 94 | 0 | 000 | .ooo |
| Redfish L. outmigrant | 91 | 260 | l:ooo | .ooo |
| Redfish L. outmigrant | 92 | 0 | .ooo | .ooo |
| Redfish L. outmigrant | 93 | 0 | 000 | .ooo |
| Redfish L. sockeye | 91-93 | 26 | 1:ooo | .ooo |
| Redfish L. residual | 92-93 | 28 | 1.000 | .ooo |
| Stanley L. spawners | 92 | 118 | 1.000 | .ooo |
| Stanley L. trawl | 92 | 20 | 1.000 | .ooo |
| Stanley L. trawl | 93 | 0 | .ooo | .ooo |
| Stanley L. trawl | 94 | 0 | .ooo | .ooo |
| Stanley L. spawners | 94 | 0 | 000 | .ooo |
| Pettit Lake | 92 | 50 | l:ooo | .ooo |
| Pettit Lake | 94 | 0 | .ooo | .ooo |
| Lake Whatcom | 90 | 0 | 000 | .ooo |
| Lake Coeur d'Alene | 90 | 98 | 1:ooo | .ooo |
| Pend Oreille Lake | 90 | 120 | 992 | .008 |
| Anderson Ranch Res. | 90 | 20 | 1:ooo | .ooo |
| Deadwood Reservoir | 90 | 176 | 1.000 | .ooo |
| Deadwood Reservoir | 92 | 120 | 1.000 | .ooo |
| Dworshak Reservoir | 90 | 120 | 1.000 | .ooo |
| Payette Lake | 90 | 120 | 1.000 | .ooo |
| NF Payette River | 92 | 118 | 1.000 | .ooo |
| Lower Granite | 92 | 36 | 1.000 | .ooo |
| Warm Lake | 90 | 0 | 000 | .ooo |
| Warm Lake | 92 | 112 | l:ooo | .ooo |
| Wallowa River | 92 | 118 | 1.000 | .ooo |
| Wallowa Lake | 93 | 74 | 1.000 | .ooo |
| Lake Billy Chinook | 92 | 96 | 1.000 | .ooo |
| Link Creek | 92 | 98 | 1.000 | ,000 |
| Ode11 Lake | 92 | 120 | 1.000 | .ooo |
| Wizard Falls Hatchery | 93 | 0 | 000 | ,000 |
| Lake Wenatchee | 87 | 240 | l:ooo | ,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 | l:ooo | .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 | l:ooo | .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 |
| Ode11 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. | outmio-rant | 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 | .ooo | .008 |
| Payette Lake | | 90 | 120 | 992 | .ooo | .008 |
| NF Payette River | | 92 | 118 | 1:ooo | .ooo | .ooo |
| Lower Granite | | 92 | 36 | 1.000 | .ooo | .ooo |
| Warm Lake | | 90 | 120 | 1.000 | .ooo | .ooo |
| Warm Lake | | 92 | 120 | 1.000 | .ooo | .ooo |
| Wallowa River | | 92 | 120 | 1.000 | .ooo | .ooo |
| Wallowa Lake | | 93 | 78 | .987 | .013 | .ooo |
| Lake Billy Chinook. | | 92 | 96 | 979 | .021 | 000 |
| Link Creek | | 92 | 98 | l:ooo | ,000 | :ooo |
| Ode11 Lake | | 92 | 118 | 1.000 | ,000 | .ooo |
| Wizard Falls Hatchery | | 93 | 160 | 1.000 | .ooo | .ooo |
| 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 | .ooo |
| Fish Creek. (Alaska) | | 92 | 80 | 1.000 | .OOO | .OOO |

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 | .ooo | .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 | .ooo | .000 |
| Redfish L. | kokanee | 91 | 138 | 1.000 | .000 | .ooo | .000 |
| Redfish L. | kokanee | 92 | 120 | 1.000 | .000 | .ooo | .000 |
| Redfish L. | trawl | 90 | 24 | 1.000 | .000 | .ooo | .000 |
| Redfish L. | trawl | 92 | 88 | 1.000 | .000 | .ooo | .000 |
| Redfish L. | trawl | 93 | 84 | 1.000 | .000 | .ooo | .000 |
| Redfish L. | trawl | 94 | 50 | 1.000 | .000 | .ooo | .000 |
| Redfish L. | outmigrant | 91 | 274 | 1.000 | .000 | .ooo | .000 |
| Redfish L. | outmigrant | 92 | 34 | 1.000 | .000 | .ooo | .000 |
| Redfish L. | outmiqrant | 93 | 52 | 1.000 | .000 | .ooo | .000 |
| Redfish L. | sockeye | 91-93 | 26 | 1.000 | .000 | .ooo | .000 |
| Redfish L. | residual | 92-93 | 28 | 1.000 | .000 | .ooo | .000 |
| Stanley L. | spawners | 92 | 120 | 1.000 | .000 | .ooo | .000 |
| Stanley L. | trawl | 92 | 20 | 1.000 | .000 | .ooo | .000 |
| Stanley L. | trawl | 93 | 26 | 1.000 | .000 | .ooo | .000 |
| Stanley L. | trawl | 94 | 34 | 1.000 | .000 | .ooo | .000 |
| Stanley L. | spawners | 94 | 16 | 1.000 | .000 | .ooo | .000 |
| Pettit Lake | | 92 | 50 | 1.000 | .000 | .ooo | .000 |
| Pettit Lake | | 94 | 70 | 1.000 | .000 | .ooo | .000 |
| Lake Whatcom | | 90 | 120 | 1.000 | .000 | .ooo | .000 |
| Lake Coeur d'Alene | | 90 | 100 | 1.000 | .000 | .ooo | .000 |
| Pend Oreille Lake | | 90 | 120 | 1.000 | .000 | .ooo | .000 |
| Anderson Ranch Res. | | 90 | 24 | 1.000 | .000 | .ooo | .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 | .ooo | .000 |
| Warm Lake | | 90 | 120 | 1.000 | .000 | .ooo | .000 |
| Warm Lake | | 92 | 120 | .950 | .000 | .050 | .000 |
| Wallowa River | | 92 | 120 | 992 | .000 | .008 | .000 |
| Wallowa Lake | | 93 | 78 | 1: 000 | .000 | .ooo | .000 |
| Lake Billy Chinook | | 92 | 96 | 1.000 | .000 | .ooo | .000 |
| Link Creek | | 92 | 98 | 1.000 | .000 | .ooo | .000 |
| Ode11 Lake | | 92 | 118 | 975 | .000 | .025 | .000 |
| Wizard Falls Hatchery | | 93 | 160 | 1:000 | 000 | .ooo | .000 |
| Lake Wenatchee | | 87 | 240 | 1.000 | :000 | -000 | .000 |
| Lake Wenatchee | | 88 | 320 | 1.000 | .000 | .ooo | .000 |
| Okanogan River | | 90 | 126 | 984 | .016 | .ooo | .000 |
| Babine Lake | | 90 | 120 | l:ooo | .ooo | .ooo | .000 |
| Fish Creek (Alaska) | | 92 | 80 | 1.000 | .ooo | .ooo | .000 |

BHEX*

| | 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 | l:ooo | .ooo |
| Redfish L. outmigrant | 91 | 276 | 1.000 | .ooo |
| Redfish L. outmigrant | 92 | 34 | 1.000 | .ooo |
| Redfish L. outmiqrant | 93 | 48 | 1.000 | .ooo |
| Redfish L. sockeye | 91-93 | 26 | 1.000 | .ooo |
| Redfish L. residual | 92-93 | 28 | 1.000 | .ooo |
| Stanley L. spawners | 92 | 118 | 1.000 | .ooo |
| Stanley L. trawl | 92 | 0 | 000 | .ooo |
| Stanley L. trawl | 93 | 12 | l:ooo | .ooo |
| Stanley L. trawl | 94 | 34 | 1.000 | .ooo |
| Stanley L. spawners | 94 | 12 | 1.000 | .ooo |
| Pettit Lake | 92 | 50 | 1.000 | .ooo |
| Pettit Lake | 94 | 76 | 1.000 | .ooo |
| Lake Whatcom | 90 | 98 | 1.000 | .ooo |
| Lake Coeur d'Alene | 90 | 100 | 1.000 | .ooo |
| Pend Oreille Lake | 90 | 120 | 1.000 | .ooo |
| Anderson Ranch Res. | 90 | 22 | 1.000 | .ooo |
| Deadwood Reservoir | 90 | 108 | 1.000 | . . 000 |
| Deadwood Reservoir | 92 | 120 | 1.000 | .ooo |
| Dworshak Reservoir | 90 | 80 | 1.000 | .ooo |
| Payette Lake | 90 | 112 | 1.000 | .ooo |
| NF Payette River | 92 | 118 | 1.000 | .ooo |
| Lower Granite | 92 | 26 | 1.000 | .ooo |
| Warm Lake | 90 | 40 | 1.000 | .ooo |
| Warm Lake | 92 | 120 | 1.000 | .ooo |
| Wallowa River | 92 | 120 | 1.000 | .ooo |
| Wallowa Lake | 93 | 78 | 1.000 | .ooo |
| Lake Billy Chinook | 92 | 96 | 1.000 | .ooo |
| Link Creek | 92 | 98 | 1.000 | .ooo |
| Ode11 Lake | 92 | 120 | 1.000 | .ooo |
| Wizard Falls Hatchery | 93 | 160 | 1.000 | .ooo |
| Lake Wenatchee | 87 | 238 | 1.000 | .ooo |
| Lake Wenatchee | 88 | 314 | 1.000 | .ooo |
| Okanogan River | 90 | 122 | 1.000 | .ooo |
| Babine Lake | 90 | 112 | 1.000 | .ooo |
| Fish Creek (Alaska) | 92 | 76 | 1.000 | .ooo |

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 | 9 2 | 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 |
| Ode11 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 | l.ooo | .000 | .000 | 000 |
| Stanley L. spawners | 94 | 16 | 688 | .000 | .000 | .313 |
| Pettit Lake | 92 | 46 | l.ooo | 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 | l.000 | .000 | 000 | .000 |
| Pend Oreille Lake | 90 | 120 | 983 | .000 | :000 | .017 |
| Anderson Ranch Res. | 90 | 24 | l.ooo | .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 |
| Ode11 Lake | 92 | 120 | 1.000 | .000 | :000 | 000 |
| Wizard Falls Hatchery | 93 | 160 | 794 | .000 | .000 | :206 |
| Lake Wenatchee | 87 | 240 | l.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-l*

| | 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 |
| Ode11 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-Al*

| | 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 | 9 3 | 39 | 1.000 | ,000 | .000 |
| Lake Billy Chinook | 92 | 48 | 1.000 | .000 | .000 |
| Link Creek | 92 | 47 | 1.000 | .000 | .000 |
| Ode11 Lake | 92 | 59 | 1.000 | ,000 | .000 |
| Wizard Falls Hatchery | 93 | 80 | 938 | .000 | .063 |
| Lake Wenatchee | 87 | 113 | l: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-Bl*

| | 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 | .ooo |
| Pend Oreille Lake | 90 | 120 | 992 | .008 | .000 | 000 |
| Anderson Ranch Res. | 90 | 22 | l:ooo | .ooo | .000 | :ooo |
| Deadwood Reservoir | 90 | 176 | 1.000 | .ooo | .000 | .ooo |
| Deadwood Reservoir | 92 | 120 | 1.000 | .ooo | .000 | .ooo |
| Dworshak Reservoir | 90 | 120 | 1.000 | .ooo | -000 | .ooo |
| Payette Lake | 90 | L20 | 1.000 | 000 | .000 | .ooo |
| NF Payette River | 92 | 118 | 1.000 | :ooo | .000 | .ooo |
| Lower Granite | 92 | 36 | 1.000 | .ooo | .000 | .ooo |
| Warm Lake | 90 | 120 | 1.000 | .ooo | .000 | 000 |
| Warm Lake | 92 | 120 | 1.000 | .ooo | 000 | :ooo |
| Wallowa River | 92 | 120 | 1.000 | -000 | :000 | .ooo |
| Wallowa Lake | 93 | 78 | 1.000 | .ooo | .000 | .ooo |
| Lake Billy Chinook | 92 | 96 | 1.000 | .ooo | .000 | .ooo |
| Link Creek | 92 | 98 | 1.000 | .ooo | .000 | .ooo |
| Ode11 Lake | 92 | 120 | .992 | .008 | .000 | .ooo |
| Wizard Falls Hatchery | 93 | 160 | 1.000 | .ooo | .000 | .ooo |
| Lake Wenatchee | 87 | 240 | 1.000 | .ooo | .000 | .ooo |
| Lake Wenatchee | 88 | 320 | 1.000 | .ooo | .000 | .ooo |
| Okanogan River | 90 | 126 | 1.000 | .ooo | .000 | .ooo |
| Babine Lake | 90 | 116 | 1.000 | .ooo | .000 | 000 |
| Fish Creek (Alaska) | 92 | 80 | 1.000 | .ooo | .000 | :ooo |

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 |
| Ode11 Lake | 92 | 120 | 975 | .025 | .000 | .000 | .000 |
| Wizard Falls Hatchery | 93 | 160 | l:000 | .000 | .000 | .000 | .000 |
| Lake Wenatchee | 87 | 240 | 1.000 | .000 | .000 | .000 | 000 |
| Lake Wenatchee | ' 8 8 | 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 | l:ooo | .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 |
| Ode11 Lake | | 92 | 120 | .867 | .125 | .008 |
| Wizard Falls Hatchery | | 93 | 160 | 975 | .025 | .000 |
| Lake Wenatchee | | 87 | 240 | l:ooo | .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 |
| Ode11 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 | .ooo |
| Alturas L. spawners | 92 | 60 | 1.000 | .OOO |
| Alturus L. trawl | 90 | 198 | 1.000 | .ooo |
| Alturas L. trawl | 92 | 84 | 1.000 | .ooo |
| Redfish L. kokanee | 90 | 176 | 1.000 | .ooo |
| Redfish L. kokanee | 91 | 138 | 1.000 | .ooo |
| Redfish L. kokanee | 92 | 120 | 1.000 | .ooo |
| Redfish L. trawl | 90 | 24 | 1.000 | .ooo |
| Redfish L. trawl | 92 | 94 | 1.000 | .ooo |
| Redfish L. trawl | 93 | 86 | 1.000 | .ooo |
| Redfish L. trawl | 94 | 52 | 1.000 | .ooo |
| Redfish L. outmigrant | 91 | 276 | 1.000 | .ooo |
| Redfish L. outmigrant | 92 | 34 | 1.000 | .ooo |
| Redfish L. outmigrant | 93 | 52 | 1.000 | .ooo |
| Redfish L. sockeye | 91-93 | 26 | 1.000 | .OOO |
| Redfish L. residual | 92-93 | 28 | 1.000 | .OOO |
| Stanley L. spawners | 92 | 118 | 1.000 | .OOO |
| Stanley L. trawl | 92 | 20 | 1.000 | .ooo |
| Stanley L. trawl | 93 | 26 | 1.000 | .ooo |
| Stanley L. trawl | 94 | 34 | 1.000 | .ooo |
| Stanley L. spawners | 94 | 16 | 1.000 | .ooo |
| Pettit Lake | 92 | 50 | 1.000 | .ooo |
| Pettit Lake | 94 | 76 | 1.000 | .ooo |
| Lake Whatcom | 90 | 120 | 1.000 | .ooo |
| Lake Coeur d'Alene | 90 | 100 | 1.000 | .ooo |
| Pend Oreille Lake | 90 | 120 | 1.000 | .ooo |
| Anderson Ranch Res. | 90 | 24 | 1.000 | .OOO |
| Deadwood Reservoir | 90 | 176 | .983 | .017 |
| Deadwood Reservoir | 92 | 120 | 983 | .017 |
| Dworshak Reservoir | 90 | 118 | l:ooo | . 000 |
| Payette Lake | 90 | 120 | 1.000 | .ooo |
| NF Payette River | 92 | 118 | 1.000 | .000 |
| Lower Granite | 92 | 36 | 1.000 | .OOO |
| Warm Lake | 90 | 120 | 1.000 | .ooo |
| Warm Lake | 92 | 120 | 975 | .025 |
| Wallowa River | 92 | 120 | l:ooo | .000 |
| Wallowa Lake | 93 | 78 | 1.000 | .OOO |
| Lake Billy Chinook | 92 | 96 | 1.000 | .OOO |
| Link Creek | 92 | 98 | 1.000 | .000 |
| Ode11 Lake | 92 | 120 | 1.000 | .ooo |
| Wizard Falls Hatchery | 93 | 160 | 1.000 | .ooo |
| Lake Wenatchee | 87 | 240 | 1.000 | ,000 |
| Lake Wenatchee | 88 | 318 | 1.000 | .ooo |
| Okanogan River | 90 | 126 | 1.000 | .ooo |
| Babine Lake | 90 | 120 | 1.000 | .ooo |
| Fish Creek (Alaska) | 92 | 80 | 1.000 | .OOO |

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 | l:ooo | .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 | l:ooo | .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 | l:ooo | .000 |
| Deadwood Reservoir | 92 | 120 | 1.000 | .000 |
| Dworshak Reservoir | 90 | 120 | 992 | .008 |
| Payette Lake | 90 | 120 | l:ooo | .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 |
| Ode11 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-l*

| | 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 |
| Ode11 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 | l:ooo | .ooo | .000 | :ooo |
| Fish Creek (Alaska) | 92 | 80 | 1.000 | .ooo | .000 | .ooo |

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 |
| Ode11 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 |