ATTACHMENT 1

LISTED SPECIES, CRITICAL HABITAT, BIOLOGICAL REQUIREMENTS, AND STATUS UNDER ENVIRONMENTAL BASELINE IN 1995

MAY 1995

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Three Snake River salmon populations are listed under the Endangered Species Act (ESA). Snake River sockeye salmon (*Oncorhynchus nerka*) were listed as endangered (November 20, 1991, 56 FR 58619). Snake River spring/summer chinook salmon (*O. tshawytscha*) and Snake River fall chinook salmon (*O. tshawytscha*) were originally listed as threatened (April 22, 1992, 57 FR 14653). Due to low returns in 1994 and the expectation of lower returns in 1995, NMFS reclassified the Snake River spring/summer and fall chinook salmon as endangered under an interim emergency rule (August 18, 1994, 59 FR 42529) which expired on April 17, 1995. NMFS has published a proposed rule (December 28, 1994, 59 FR 66784) to permanently reclassify the Snake River spring/summer and fall chinook salmon as endangered. However, they will remain classified as threatened until a final rule is published (April 17, 1995, 60 FR 19342).

A. Critical Habitat

Critical habitat was designated for Snake River sockeye salmon, Snake River spring/summer chinook salmon, and Snake River fall chinook salmon on December 28, 1993 (58 FR 68543), it became effective on January 27, 1994. The designation of critical habitat provides notice to Federal agencies and the public that these areas and features are vital to the conservation of listed Snake River salmon.

Essential Snake River salmon habitat consists of four components: (1) Spawning and juvenile rearing areas, (2) juvenile migration corridors, (3) areas for growth and development to adulthood and (4) adult migration corridors.

The essential features of the spawning and juvenile rearing areas for Snake River sockeye salmon consist of adequate: (1) Spawning gravel, (2) water quality, (3) water quantity, (4) water temperature, (5) food, (6) riparian vegetation, and (7) access.

The essential features of the spawning and juvenile rearing areas for Snake River spring/summer chinook salmon and Snake River fall chinook salmon consist of adequate: (1) Spawning gravel, (2) water quality, (3) water quantity, (4) water temperature, (5) cover/shelter, (6) food, (7) riparian vegetation, and (8) space.

Essential features of the juvenile migration corridors for Snake River sockeye salmon, Snake River spring/summer chinook salmon, and Snake River fall chinook salmon consist of adequate: (1) Substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions.

The areas in the Pacific Ocean that listed salmon use for growth and development are not well understood, therefore no essential areas and features have been identified.

The essential features of the Columbia River adult migration corridor for Snake River sockeye salmon, Snake River spring/summer chinook salmon, and Snake River fall chinook salmon include adequate: (1) Substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) riparian vegetation, (8) space, and (9) safe passage conditions.

B. Species' Life Cycle and Historical Population Trends

1. Snake River Sockeye Salmon

Snake River sockeye salmon adults enter the Columbia River primarily during June and July. Arrival at Redfish Lake, which now supports the only remaining run of Snake River sockeye salmon, peaks in August and spawning occurs primarily in October (Bjornn et al. 1968). Eggs hatch in the spring between 80 and 140 days after spawning. Fry remain in the gravel for three to five weeks, emerge in April through May and move immediately into the lake; there, juveniles feed on plankton for one to three years before they migrate to the ocean (Bell 1986). Migrants leave Redfish Lake from late April through May (Bjornn et al. 1968), and smolts migrate almost 900 miles to the Pacific Ocean. For detailed information on the Snake River sockeye salmon, see Waples et al. (1991) and November 20, 1991, 56 FR 58619.

Passage at Lower Granite Dam (the first dam on the Snake River downstream from the Salmon River) ranges from late April to July, and peak passage occurs from May to late June (Fish Passage Center 1992). Once in the ocean, the smolts remain inshore or within the Columbia River influence during the early summer months. Later, they migrate through the northeast Pacific Ocean (Hart 1973, Hart and Dell 1986). Snake River sockeye salmon usually spend two to three years in the Pacific Ocean and return in their fourth or fifth year of life.

Historically, the largest numbers of Snake River sockeye salmon returned to headwaters of the Payette River, where 75,000 were taken one year by a single fishing operation in Big Payette Lake (Bevan et al. 1994). During the early 1880s, returns of Snake River sockeye salmon to the headwaters of the Grande Ronde River in Oregon (Wallowa Lake) were estimated between 24,000 and 30,000 at a minimum (Cramer 1990, cited in Bevan et al. 1994). During the 1950s and 1960s, adult returns to Redfish Lake numbered more than 4,000 fish (Bevan et al. 1994).

Since at least 1985, when the Idaho Department of Fish and Game began operating a temporary weir below the lake, Snake River sockeye salmon returns to Redfish Lake have been extremely small (Table 1). Snake River sockeye salmon have a very limited distribution relative to critical spawning and rearing habitat. Redfish Lake represents only one of the five Stanley Basin lakes historically occupied by Snake River sockeye salmon and which are designated as critical habitat for the species.

Table 1. Returns of Snake River sockeye salmon to Redfish Lake, as determined by trapping at Redfish Lake creek weir and spawning ground surveys.

Year	Adults Observed
1985	12
1986	29
1987	16
1988	4
1989	1
1990	0
1991	4
1992	1
1993	8
1994	1

2. Snake River Spring/Summer Chinook Salmon

The present range of spawning and rearing habitat for naturally-spawned Snake River spring/summer chinook salmon is primarily limited to the Salmon, Grande Ronde, Imnaha, and Tucannon Subbasins. Most Snake River spring/summer chinook salmon enter individual subbasins from May through September. Juvenile Snake River spring/summer chinook salmon emerge from spawning gravels from February through June (Perry and Bjornn 1991). Typically, after rearing in their nursery streams for about one year, smolts begin migrating seaward in April and May (Bugert et al. 1990; Cannamela 1992). After reaching the mouth of the Columbia River, spring/summer chinook salmon probably inhabit nearshore areas before beginning their northeast Pacific Ocean migration, which lasts two to three years. For detailed information on the life history and stock status of Snake River spring/summer chinook salmon, see Matthews and Waples (1991), NMFS (1991a), and 56 FR 29542 (June 27, 1991).

Bevan et al. (1994) estimated the number of wild adult Snake River spring/summer chinook salmon in the late 1800s to be more than 1.5 million fish annually. By the 1950s, the population had declined to an estimated 125,000 adults. Escapement estimates indicate that the population continued to decline through the 1970s. Redd count data also show that the populations continued to decline through about 1980. See Table 2 for the estimated annual number of wild adult Snake River spring/summer chinook salmon returning over Lower Granite Dam in recent years.

Table 2. Estimates of "wild-natural" Snake River spring/summer chinook salmon counted at Lower Granite Dam in recent years. Estimates through 1993 from Tables 26 and 33 of WDFW and ODFW (1994). Preliminary estimates for 1994 from TAC (1994) and for 1995 from TAC (1995).

Year	Spring Chinook	Summer Chinook	Total
1985	6,048	3,196	9,244
1986	7,925	3,934	11,859
1987	8,928	2,414	11,342
1988	10,915	2,263	13,178
1989	3,900	2,350	6,250
1990	4,152	3,378	7,530
1991	2,706	2,814	5,520
1992	8,196	1,148	9,344
1993	6,224	3,959	10,183
1994	1,517	305	1,822
1995	250	346	596
Threshold Escapement Level			Approximately 11,000-22,000
Recovery Escapement Level			31,440

The Snake River spring/summer chinook salmon Evolutionarily Significant Unit (ESU—the distinct population segment listed for ESA protection) consists of 39 local spawning populations (subpopulations) spread over a large geographic area (Lichatowich et al. 1993; see Table 3). The number of fish returning to a given subpopulation is therefore much less than the total run size.

Based on recent trends of redd counts in major tributaries of the Snake River, many subpopulations could be at critically low levels. Subpopulations in the Grande Ronde River, Middle Fork Salmon River, and Upper Salmon River basins are at particularly high risk. Both demographic and genetic risks are causes for concern in such subpopulations and, in some cases, habitat may be so sparsely populated that adults have difficulty finding mates.

Table 3. Snake River spring/summer chinook salmon classification by subbasin (metapopulations) and subpopulation. Based on Lichatowich et al. 1993, Bevan et al. 1994, and BRWG 1994. SP = spring chinook population; SU = summer chinook population.

River System/Subbasin	Breeding Unit/Subpopulation
Tucannon River	• watershed population (SP)
Grande Ronde River	• Minam River (SP) • Lostine and Upper Wallowa Rivers and tributaries (SP) • Wenaha River (SP) • Catherine Creek (SP) • Upper Grande Ronde (SP)
Imnaha River	• mainstem (SP/SU) • Big Sheep and Lick Creeks
Snake River mainstem	• Asotin Creek (SP) • mainstem, Sheep, Granite Creeks `(SP)
Lower Salmon River	• mainstem tributaries, mouth to and including Horse Creek (SP)
Little Salmon River	• watershed except Rapid River (SP) • Rapid River (SU)
South Fork Salmon River	• mainstem, Blackmare to Stolle Creeks (SU) • mainstem, mouth to Poverty Flats (SU) • Secesh River (SU) • Johnson Creek (SU) • East Fork South Fork (SU)
Middle Fork Salmon River	• mainstem, mouth to Indian Creek (SU) • mainstem, Indian to Bear Valley Creek (SP) • Marsh Creek and tributaries (SP) • Bear Valley and Elk Creeks (SP) • Sulphur Creek • Upper Loon Creek and tributaries (SP) • Lower Loon Creek (below TM 23) (SU) • Camas Creek (SP) • Lower Big Creek (below TM 23) (SU) • Upper Big Creek and tributaries (SP)
Lemhi River	• watershed population (SP)
Pahsimeroi River	• watershed population (SU)

River System/Subbasin	Breeding Unit/Subpopulation
Upper Salmon River	• North Fork Salmon River (SP) • East Fork, mouth to Herd Creek (SU) • Herd Creek and Upper East Fork (SP) • Yankee Fork and tributaries (SP) • Valley Creek above Stanley Creek (SP) • Lower Valley Creek (SU) • mainstem Salmon below Redfish Lake Creek (SU) • mainstem Salmon above Redfish Lake Creek (SU)
Clearwater River	• not listed under ESA

3. Snake River Fall Chinook Salmon

Adult Snake River fall chinook salmon enter the Columbia River in July and migrate into the Snake River from August through October. Natural fall chinook salmon spawning is primarily limited to the Snake River below Hells Canyon Dam and the lower reaches of the Clearwater, Grand Ronde, Imnaha, Salmon, and Tucannon Rivers. Fall chinook salmon generally spawn from October through November and fry emerge from March through April. Downstream migration generally begins within several weeks of emergence (Becker 1970, Allen and Meekin 1973), and juveniles rear in backwaters and shallow water areas through mid-summer prior to smolting and migration to the ocean. There, they spend one to four years before beginning their spawning migration. For detailed information on the Snake River fall chinook salmon, see NMFS (1991b) and June 27, 1991, 56 FR 29542.

There are no reliable historic estimates of abundance available for Snake River fall chinook salmon (Bevan et al. 1994). The estimated returns of Snake River fall chinook salmon declined from 72,000 annually between 1938 and 1949, to 29,000 from 1950 through 1959 (Bjornn and Horner 1980, cited in Bevan et al. 1994). The estimated returns of naturally-produced adults from 1985 through 1993 range from 78 to 742 fish (Table 4).

Table 4. Estimates of naturally-produced adults to Lower Granite Dam (not adjusted to include naturally-produced adults trapped at Ice Harbor Dam). Estimates for 1985-1993 are from Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife (1994). The estimate for 1994 is from LaVoy (1995). Preliminary estimate for 1995 is from TAC (1995).

Return Year	Natural Adults
1985	435
1986	449
1987	252
1988	368
1989	295
1990	78
1991	318
1992	549
1993	742
1994	406
1995	208

Specific projections for returns of fall chinook over the next three to five years (1996-1998) cannot be made, but it is possible to comment generally on the prospects for greater returns. The 1991 brood is weak, based on the record low return of jacks in 1993. There was certainly sufficient escapement in 1992 and 1993 to provide for increased returns after 1995, but higher returns will depend largely on improving passage and ocean survival conditions.

C. Biological Requirements for Listed Snake River Salmon

The first step in the method NMFS uses for applying the ESA standards of § 7(a)(2) to listed salmon (NMFS 1995a), consists of defining the species' biological requirements that are most relevant to each consultation. What follows here is a summary of NMFS' conclusions, based upon the considerations described in NMFS (1995a). Generally, NMFS finds that these biological requirements are best expressed as trends in population size and variability. Environmental requirements are also useful for assessing the effects of some actions.

To a large extent, these biological requirements are based upon the work of a Biological Requirements Work Group (BRWG)(1994) composed of scientists and fishery managers from the Federal agencies, states, and tribes that met as a component of the post judgment discussions of the IDFG v. NMFS lawsuit. The NMFS also was guided by scientific opinion provided by the intervenors to this litigation. The BRWG report is discussed in detail in NMFS (1995b); however, in summary, the approach presented in the BRWG report and, to a large extent that followed by NMFS, is a method of determining the listed species' likelihoods of survival and recovery.

The BRWG considered the "likelihood of survival" to be the probability that a set of actions encompassing all phases of a species' life cycle would result in population levels above threshold escapement levels over a short-term period (24 years) and a long-term period (100 years). The BRWG (1994) proposed that this likelihood should be estimated for Snake River spring/summer and fall chinook salmon using regional life-cycle models. They suggested that for Snake River sockeye salmon, the estimate should be approached in a less complex manner because of their low population level, the lack of passage studies directed at this species, and uncertainties regarding releases from the captive broodstock program.

The BRWG (1994) considered the "likelihood of recovery" to be the probability that a set of actions encompassing all phases of the species' life cycle would result in eight-year (approximately two-generation) geometric mean population levels equal to or greater than recovery population levels. An expected recovery time period is also necessary to make this determination (i.e., to determine the likelihood of reaching an eight-year mean recovery population level within x number of years from the present). The BRWG suggested recovery time periods of 12, 24, and 48 years.

As with the likelihood of survival determination, the BRWG (1994) proposed that the likelihood of recovery should be estimated for Snake River spring/summer and fall chinook salmon using regional life-cycle models. For Snake River sockeye salmon, the estimate would be approached in a less complex manner for the same reasons cited above.

The NMFS finds this, among others, to be a useful approach (see NMFS 1995b), and thus considers determining survival and recovery thresholds to be the first step in applying the BRWG's methodology. The BRWG's methodology is based on the needs and population trends of the species (including population counts), not their ESA status. Therefore NMFS' application of the ESA standards (NMFS 1995a) is the same whether the salmon species are listed as endangered or threatened.

1. Survival Requirements

Each Pacific salmon species is composed of numerous geographically isolated breeding units (stocks). The stock structure of the Pacific salmon is the result of their propensity for returning to their native stream to spawn and their individual adaptations to local environments (Helle 1981).

In small populations, random processes can lead to two major types of risk: demographic and genetic. Demographic risk is the risk of extinction due to environmental fluctuations, random events affecting individuals in the population, and possible reductions in reproduction or survival resulting from low population sizes. Genetic risk is the risk of losing genetic variability or population fitness through inbreeding and genetic drift. Both types of risk increase rapidly as population size decreases.

Severe, short-term genetic problems resulting from inbreeding are unlikely unless population size remains very low for a number of years. However, the erosion of genetic variability due to low population size is cumulative; thus, long-term effects on a population (even if it subsequently recovers numerically) are also a concern.

The BRWG and NMFS considered these factors in defining the potential numerical returning spawner population thresholds to be used in defining biological requirements for particular salmon stocks. The threshold levels recommended by the BRWG, and adopted by NMFS, do not represent levels at which the trend toward extinction is expected to be irreversible. The BRWG's suggested threshold escapement levels (and suggested methods of analysis) indicate that populations will be able to fall below these levels periodically and still recover to higher levels, even when biological processes particular to low population levels are taken into account. This interpretation is consistent with the observation that the proposed threshold levels are substantially higher than any directly identifiable risk levels such as those associated with genetic or demographic bottlenecks.

These threshold levels for survival correspond to the definition of "survival" found in NMFS' and the FWS' "Draft Section 7 Endangered Species Consultation Handbook--Procedures for Conducting Section 7 Consultations and Conferences" (NMFS/USFWS 1994). There, the term requires "sufficiently large populations" to ensure persistence into the future under conditions that will retain the potential for recovery. In an independent peer review of the BRWG report, Barnthouse et al. (1994) concluded that the BRWG's method of developing threshold levels was credible.

(a). Snake River Spring/Summer Chinook Salmon

The primary threshold level recommended by the BRWG was 150 natural spawners annually (for small, concentrated subpopulations of Snake River spring/summer chinook salmon) and 300 natural spawners annually (for larger, dispersed Snake River spring/summer chinook salmon subpopulations and Snake River fall chinook salmon). The NMFS adopts the BRWG-recommended threshold level of 150-300 spawners annually per subpopulation, depending upon size of the subpopulation, for purposes of applying the jeopardy analysis to Snake River spring/summer chinook salmon. Threshold levels associated with the six subpopulations currently available for analysis are presented in Table 5.

Based on the factors described in NMFS (1995b), NMFS concludes that the best available method for characterizing risk to the ESU is to use projections for available subpopulations. Because the few available subpopulations do not, even taken together, represent conditions throughout the entire ESU, it is prudent to require that a high percentage of the available subpopulations have an acceptable probability of being above the threshold level. A "high percentage" is defined as being at least 80% of available "index stocks."

As suggested in BRWG (1994) and Barnthouse et al. (1994), NMFS encourages development of techniques that will incorporate additional subpopulations into future analyses. The NMFS also encourages analysis of ancillary information, such as aggregate assessments based on dam counts, to supplement the subpopulation analyses. If assessments based on dam counts support the conclusions derived from subpopulations analysis, NMFS will have greater confidence in those conclusions. If the two analyses lead to different conclusions, it will be a signal to carefully review the subpopulation assessments; however, as stated above, the final determination will be based upon the latter.

The BRWG did not identify a threshold level for the entire Snake River spring/summer chinook ESU that could be compared with aggregate projections derived from dam counts. It is reasonable to assume that, because the ESU is composed of approximately 39 subpopulations with thresholds ranging from 150-300 spawners annually, the aggregate threshold is between 6,000 and 12,000 spawners annually. This estimate assumes that spawners are distributed among all subpopulations in proportion to each subpopulation's threshold. If this assumption is not valid, the aggregate threshold would be higher than 6,000-12,000 spawners annually.

The BRWG (1994) suggested that Snake River spring/summer chinook salmon returns to six subbasins be used as index stocks for assessing status of the ESU. These subpopulations have generally been below threshold escapement levels since 1989 (Table 5). Cohort replacement rates (which are equivalent to spawner-to-spawner ratios) have been less than 1.0 (i.e., the population has been declining) for most of these stocks during recent years (Table 6).

Though the BRWG did not suggest an aggregate threshold for the entire ESU, one could be estimated in the following manner: Assuming that mortality between Lower Granite Dam and the spawning ground is approximately 40-60% (midpoint 50%) for the spring component and 30-40% (midpoint 35%) for the summer component of the ESU (Chapman et al. 1991), and that there is an average ratio of 65% spring component during the past 10 years (Table 2), the corresponding escapement at Lower Granite Dam would be approximately 11,000-22,000 natural spawners. Adult counts at Lower Granite Dam have generally been well below this level in recent years (Table 2).

Table 5. Estimated spawner counts for six subpopulations of Snake River spring/summer chinook salmon during recent years (reproduced from Table 3.1 of BRWG (1994)). The estimates through 1993 are from Idaho Dept. of Fish and Game and Oregon Dept. of Fish and Wildlife, expanded from redd counts in index areas. Bold values represent estimates that meet or exceed threshold escapement levels recommended by BRWG (1994). Recovery escapement levels are based on 60% of pre-1970 average escapements.

Year	Bear Valley/Elk Creeks	Imnaha River	Marsh Creek	Minam River	Poverty Flats of S. Fork Salmon River	Sulphur Creek
1985	295	**783**	**197**	**479**	**342**	70
1986	235	**1159**	**184**	130	246	**458**
1987	**457**	**535**	**273**	**222**	**508**	77
1988	**1116**	**719**	**395**	**224**	**763**	**289**
1989	91	**439**	80	136	258	14
1990	189	272	104	95	**513**	**155**
1991	184	209	73	94	**515**	**183**
1992	178	184	118	8	**519**	35
1993	**710**	**465**	**218**	144	**779**	**176**
1994	N/A	N/A	N/A	N/A		
Threshold escapement level	300	300	150	150	300	150
Recovery escapement level	968	610	441	389	1669	405

Table 6. Estimated cohort replacement rates (equivalent to spawner-to-spawner ratios) for six subpopulations of Snake River spring/summer chinook salmon in recent years. The estimates are from Idaho Dept. of Fish and Game and Oregon Dept. of Fish and Wildlife and are based on expanded redd counts and age structure in index areas (Wilson 1995). Replacement rates greater than 1.0 are necessary for population growth.

Last Esc. Year	Brood Year	Bear Valley/Elk Creeks	Imnaha River	Marsh Creek	Minam River	Poverty Flats of S. Fork Salmon River	Sulphur Creek
1985	1980	5.7	3.1	10.1	4.3	1.7	3.4
1986	1981	1.7	1.4	1.6	6.9	2.3	6.5
1987	1982	4.7	1.7	3.5	1.5	1.6	9.6
1988	1983	6.8	1.9	7.5	3.8	3.2	5.4
1989	1984	1.0	0.5	0.8	1.2	1.1	N/A[1]
1990	1985	0.5	0.4	0.5	0.3	0.9	1.4
1991	1986	1.0	0.5	0.5	0.5	1.9	0.5
1992	1987	0.2	0.3	0.3	0.1	0.8	0.6
1993	1988	0.7	0.9	0.7	0.3	0.8	0.6
1994	1989	N/A	N/A	N/A	N/A	N/A	N/A

[1]No redds observed in index area.

(b). Snake River Fall Chinook Salmon

The NMFS finds that the threshold escapement level for Snake River fall chinook salmon is 300 adult spawners, as recommended by the BRWG. The logic for this decision is discussed in NMFS (1995b). The BRWG did not suggest a corresponding number of adults at Lower Granite Dam, but a number can be approximated by adjusting natural adult counts at Lower Granite Dam to account for fallback rate (e.g., 31.6% in 1992; Mendel et al. 1993) and prespawning mortality (approximately 15%; Chapman pers. comm. in Fisher et al. 1993). Therefore, an approximation of the threshold escapement level at Lower Granite Dam would be 519 natural adults past Lower Granite Dam ([300 ÷ [(1.0 - 0.32) * (1.0 - 0.15)]). With the exception of the 1992 and 1993 returns, escapements have been below this approximate threshold level, as well as below a cohort replacement rate of one, in recent years (Table 7). The Proposed Recovery Plan defines a recovery escapement level of 2500 spawners and leaves estimation of a corresponding value at Lower Granite Dam to a Scientific Advisory Panel. Using the method described above, the approximate recovery escapement level at Lower Granite Dam would be 4325 natural adults.

Table 7. Estimates of naturally-produced adult fall chinook salmon to Lower Granite Dam (adjusted to include naturally-produced adults trapped at Ice Harbor Dam). Cohort replacement rates calculated by assuming parents composed of total run. Estimates for all years from Dygert (1994a,b). Threshold and recovery escapement levels at Lower Granite Dam are approximations of levels defined at the spawning grounds, as described in the text.

Return Year	Natural Adults	Total Replacement Rate
1985	615	1.22
1986	482	0.90
1987	332	0.52
1988	511	0.82
1989	396	0.56
1990	144	0.14
1991	318	0.40
1992	**549**	0.72
1993	**742**	1.33
Threshold Escapement Level	[519]	
Recovery Escapement Level	[4325]	

(c). Snake River Sockeye Salmon

The BRWG did not recommend a Snake River sockeye salmon threshold escapement level for use in a jeopardy analysis. However, the thresholds identified for spring/summer chinook and fall chinook salmon were not species-specific. Those thresholds should apply to any "large" and "small" Pacific salmon populations. Presumably the threshold for sockeye would fall between 150-300 annual spawners for each relatively isolated population constituting the ESU (i.e., populations established within each lake in the Stanley Basin). As described in BRWG (1994), analyses used to estimate whether or not Snake River sockeye salmon are likely to be above the threshold will be less complex and less precise than analyses based on life-cycle models for other species.

2. Recovery Requirements

The BRWG report also made provisional recommendations for escapement levels representing recovery; however, these are now superseded by delisting criteria in NMFS' Proposed Recovery Plan (NMFS 1995d). The following numerical escapement delisting criteria are specified in the Proposed Recovery Plan as eight-year geometric means: (1) Sockeye: At least 1000 naturally-produced sockeye salmon in one lake and 500 in each of two other lakes in the Stanley Basin; (2) Fall Chinook: at least 2500 naturally-produced fall chinook salmon in the lower Snake River and tributaries, excluding the lower Clearwater River; (3) Spring/Summer Chinook: (a) at least 31,440 naturally-produced spring/summer chinook at Lower Granite dam; and (b) at least 60% of the pre-1971 brood-year average redd counts for 80% of index areas for which at least five years of pre-1971 redd counts are available. The basis for establish these recovery levels is explained in detail in Chapter IV of the NMFS Proposed Snake River Salmon Recovery Plan.

D. Species Status Under Environmental Baseline

In this second step in applying the ESA § 7(a)(2) standards, as discussed in (NMFS 1995a), NMFS analyzes the effects of past and ongoing human and natural factors which have led to the current status of the species and its habitat. The environmental baseline, to which the effects of the proposed action would be added, "includes the past and present impacts of all Federal, State, or private activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process" 50 C.F.R. § 402.02 ("effects of the action").

What follows is an evaluation of the listed species' prospects under the environmental baseline

1. Snake River Sockeye Salmon

Based on smolt-to-adult returns to the mouth of the Columbia River for the 1991 and 1992 outmigrating cohorts (0.51% and 0.26%, respectively), two adults out of the 521 smolts that migrated from Redfish Lake in 1993 will be expected to return in 1995 (LaVoy 1994).

Since 1991, a captive broodstock program has been in effect for Snake River sockeye salmon, and all returning adults have been spawned in captivity. The program was instigated as an emergency measure designed to avert the threat of imminent extinction. The first adults produced by this program (from the 1991 returns) were released into Redfish Lake to spawn in 1993 and their progeny are expected to outmigrate in the spring of 1995. The surviving 1993 brood year adults will return to spawn in one to three years, and their progeny (the first cohort of naturally-produced spawners) will not return to spawn in Redfish Lake until three to five years after that (1999-2003). Therefore, it will be well into the next century before natural production of Snake River sockeye salmon can begin to be evaluated.

Given the extremely low sockeye salmon population size, NMFS finds that there is a very low probability that Snake River sockeye salmon population will attain their survival requirements in their critical habitat under the continuing effects of the environmental baseline. The risk is extremely high that listed sockeye will be below the threshold escapement level of 150 fish (which applies only to naturally-produced spawners) until natural production is sufficiently re-established. The likelihood of recovery (which only applies to spawners at least two generations removed from captive broodstock) is even less certain, since there is no recent empirical evidence available for evaluating the productivity of second-generation wild fish.

In summary, it appears that the Snake River sockeye salmon face extreme risks as a result of the baseline environmental conditions. The risks are so grave that there must be substantial improvement in the environmental conditions of the sockeye's critical habitat. Any further degradation in these conditions could have significant detrimental effects due to the fact that the baseline risks are already so high.

2. Snake River Spring Summer Chinook Salmon

It is unlikely that the biological requirements of listed Snake River spring/summer chinook salmon will be met, given the substantial adverse effects occurring under the environmental baseline. The significance of these effects is magnified by the current small population size, projected poor returns over the next one to two years, the influence of those poor returns on subsequent cohorts in 1998-2001, and the poor environmental conditions affecting the species throughout all its life stages. Substantial improvements in the baseline environmental conditions are necessary to ensure the continued existence of this species.

Adult returns of Snake River spring/summer chinook salmon in 1994 were the lowest on record. However, the return of the spring component is projected to be even lower in 1995. This is based on the fact that there is a strong relationship between how many Snake/Columbia River spring chinook jacks arrive one year, and how many four-year old adult spring chinook return in the following year. The 1994 spring chinook jack count was less than half of the 1993 jack count, which represented the previous record low (Roler 1994). The projection for 1995 summer chinook returns is approximately the same as 1994 returns (TAC 1994), which were the lowest on record.

The spring component of Snake River spring/summer chinook salmon is unlikely to increase significantly in 1996 because the five-year old component of the 1996 return will be coming from the very low 1991 brood (Table 2) and because the juvenile outmigration of the four-year old component occurred under below-average flow conditions in 1994 (see section IV.A.1 of NMFS 1995c). Therefore, there is little reason to anticipate that returns of the spring component of Snake River spring/summer chinook salmon will increase substantially until the 1993 brood year contributes to the returns in 1997 and 1998. The 1993 brood will be of particular importance because it was the last year with a substantial escapement of wild fish. After 1998, returns will again be influenced by the very low 1994 and (expected) low 1995 brood years. Again, because spring chinook are generally the stronger component of the run, this situation is likely to represent the entire Snake River spring/summer chinook ESU.

The combination of the fact that escapements have been well below threshold levels in most years since 1989 for four of the six subpopulations listed in Table 5 (and for the aggregated estimate at Lower Granite Dam (Table 2)) and the expectation of low returns for the next one to two years suggests that the likelihood of survival and recovery in the near future is low. This assessment is in agreement with an analysis of risk associated with the "recent" time period represented by 1977-1988 brood years (1981-1993 return years) included in the BRWG report (1994). Furthermore, analyses using both the stochastic (SLCM) and empirical (ELCM) life-cycle models indicate low probabilities of survival and recovery for most stocks, given recent conditions and current population levels, for both "short-term" (24 year) and "long-term" (48 and 100 year) simulations.

In summary, it is unlikely that in the near future the biological and ecological requirements of listed Snake River spring/summer chinook salmon will be met due to the substantial adverse effects occurring under the environmental baseline. The significance of these effects is magnified by the current small population size, the projected poor returns over the next one to two years, the influence of those poor returns on subsequent cohorts in 1998-2001, and the poor environmental conditions affecting the species in all its life stages. The extent to which it is likely that the species will see an improvement in its ability to survive and recover (provided the species' status was subject only to the effects of the environmental baseline) has not been quantitatively estimated. However, based on the needed survival improvements described above, that ability is also limited. It is clear that substantial improvement in environmental conditions under the environmental baseline are necessary if the continued existence of this species is to be ensured.

3. Snake River Fall Chinook Salmon

The natural Snake River fall chinook escapement was well below the threshold level in 1994 (see Table 7). The age structure of recent returns indicates that the returns will continue to decline in 1995. Fall chinook returns in the Snake River system are typically dominated by four-year old fish. The 1994 run was dominated by five-year olds with relatively weak returns of three- and four-year old fish. The low return of three-year olds resulted from a record low return of two-year old fish in 1993. The low four-year old return in 1994 resulted from the relatively low three-year old return in 1993. The 1995 forecast suggests that the return will be about 60% of that in 1994, or about 601 fish will reach the river mouth (TAC 1995). The expected escapements to the Snake River would be proportionally low as well.

It is not possible to make specific projections for returns of fall chinook over the next three to five years (1996-1998), but it is possible to comment generally on the prospects for greater returns. Based on the record low return of jacks in 1993, the 1991 brood is weak. There was certainly sufficient escapement in 1992 and 1993 to allow for increased returns after 1995, but higher returns will depend largely on improved passage and ocean survival conditions.

The NMFS finds that the likelihood of survival and recovery of listed fall chinook salmon in the immediate future is low because of a combination of factors: (1) Escapements are well below threshold levels in most years since 1985, and (2) even assuming only the continuing direct and indirect effects of any environmental baseline, and without factoring in cumulative effects or the likely effects of the proposed action, escapement will continue to be extremely low, at least through 1995.

No analyses of the probability of survival and recovery of Snake River fall chinook salmon under the environmental baseline have been conducted for the longer term (over a 24-to 100-year period). However, assuming only the continuing direct and indirect effects of the environmental baseline, their prospects for survival are likely to be better in the long-term than they are in the immediate future. This is because the level of future incidental harvest of fall chinook salmon, which is not considered to be part of the environmental baseline, is a larger factor in determining their likelihood of survival and recovery than it is for either the listed spring/summer chinook or sockeye salmon. The total harvest rate of fall chinook salmon during recent years, including Canadian harvest, has ranged from 46% to 74% (Snake River Salmon Recovery Team 1994). Based on returns of 1988-92 cohorts, the average total U.S. harvest rate was approximately 36% (CRITFC 1994).

In summary, it is unlikely that in the immediate future the biological and ecological requirements of listed Snake River fall chinook salmon will be met due to the substantial adverse effects occurring under the environmental baseline. This problem is exacerbated by the current small population size, the projected poor returns in 1995, the influence of those poor returns on subsequent cohorts in from 1998 to 2001, and the lag time in achieving increases in survival through habitat changes that affect the environmental baseline in a beneficial manner. No quantitative assessment of risk associated with the environmental baseline over a 24-year period is available, but because such an analysis would not consider the impact of a U.S. fall chinook harvest, such an analysis may be expected to indicate at least a moderate likelihood of survival and recovery.

E. Effects of Environmental Baseline, and Other Potential Reasonable and Prudent Actions in Other Sectors Relative to Species Requirements

As described in NMFS (1995a), the effect of a set of actions is evaluated relative to a species' biological requirements by using the analytical method suggested by the BRWG (1994) or other environmental conditions. NMFS also expects that evaluation of biological requirements will require consideration of factors beyond regional life-cycle models (e.g., other population projections). Additionally, professional judgement will be necessary to interpret the range of model outputs relative to the limitations of life-cycle models, the range of model outputs resulting from competing hypotheses, and the significance of threshold levels identified by the BRWG (1994).

During consultation on the 1995 (and future) operation of the Federal Columbia river Power System (FCRPS) (NMFS 1995c), NMFS considered life-cycle modeling results for actions related to operating the power system while taking into account assumptions about actions in other life stages that are consistent with requirements in the Proposed Recovery Plan (NMFS 1995d). Details of the results are included in NMFS (1995e). Because assumptions (for all life stages) consistent with the Proposed Recovery Plan (NMFS 1995d) were included in modeling, these analyses are relevant to all actions proposed during 1995.

1. Spring/Summer Chinook Salmon

Results of life-cycle modeling tend to support a conclusion that the FCRPS reasonable and prudent alternative (coupled with improvements affecting other life stages that are consistent with the Proposed Recovery Plan) is likely to result in meeting the species' biological requirements. Both life cycle models indicate that there is a high likelihood (under certain assumptions NMFS considers reasonable) that the survival goals described in NMFS (1995e) will be met if the FCRPS reasonable and prudent alternative is implemented. In addition, both models' analyses of alternative scenarios proposed by other parties (which are contemplated in the long-term options of the reasonable and prudent alternative) indicate that there is a high likelihood that both the survival and recovery goals will be met.

2. Snake River Fall Chinook Salmon

For at least one option associated with the FCRPS reasonable and prudent alternative (and under certain assumptions regarding other life stages that are consistent with the Proposed Recovery Plan), FLUSH/ELCM modeling indicates that fall chinook salmon have a probability of at least

70% of being at or above the threshold level in 24 or 100 years. Under a combination of optimistic but plausible assumptions (based on the Proposed Recovery Plan), there is a 50-70% probability of being above the recovery level in 48 years. CRiSP/SLCM results indicate that, under certain assumptions, an acceptable probability can be achieved for reaching both short-term and long-term threshold and recovery goals.

3. Sockeye Salmon

No life-cycle modeling has been done for sockeye salmon. The NMFS expects that improvements in listed sockeye salmon survival will be of the same magnitude as those for listed spring/summer chinook.

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