# 5.0 ENVIRONMENTAL BASELINE

## 5.1 OVERVIEW

The environmental baseline is defined as: "the past and present impacts of all Federal, state, or private actions and other human activities in the action area, including the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation and the impacts of state and private actions that are contemporaneous with the consultation in progress" (50 CFR 402.02, "effects of the action," emphasis added). It is an analysis of "the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat and ecosystem, within the action area," including designated critical habitat. It is a "snapshot of a species' health at a specified point in time" although adjusted to reflect the future effects of proposed Federal projects. "It does not include the effects of action under review" (ESA Section 7 Consultation Handbook [March 1998] p. 4-22, emphasis added).

When the consultation is for an ongoing action, the task of assessing the effects of the environmental baseline is complicated by the fact that certain preexisting aspects of the ongoing project are also part of the environmental baseline, while other proposed aspects represent the proposed action that is the subject of the consultation. It is important to recognize a fundamental principle of an ESA § 7(a)(2) consultation. Section 402.03 provides: "Section 7 and the requirements of this part apply to all actions in which there is discretionary involvement or control." Accordingly, the ESA requires a Federal agency to consult on actions that it proposes to authorize, fund, or carry out pursuant to its discretionary authority. See also 50 CFR § 402.02 "*action*" and ESA § 7(a)(2). Thus it follows that the ESA does not require consultation on any elements of the pre-existing project that are beyond the agency's current discretion or control, i.e., anything that is part of the environmental baseline. In addition, the continuing effects of those aspects of the FCRPS and USBR dams that are not subject to Action Agency discretion, such as their existence and certain operations necessary to minimally satisfy Congressionally mandated purposes (i.e., flood control and irrigation) are considered part of the environmental baseline.

The effects of the project that must be considered as part of the environmental baseline are a subset of all environmental baseline effects in the action area. The continuing effects of the project's past construction and operation must be considered with the effects of past or present actions and other human activities affecting the species and their habitat within the action area.

Environmental baseline effects are evaluated in relation to the biological requirements of the listed species. The ESUs differ in how they use habitat in the action area, but all rely on this habitat during one or more stages in the life cycle. Uses include adult holding, spawning, incubation, rearing, and migration. The biological requirements of the species include conditions sufficient to satisfy these uses, thus contributing to the survival and recovery of the ESUs to naturally reproducing and self-sustaining population sizes such that protection under the ESA would become unnecessary. Sections 5.1.1–5.1.13 review the status of habitat and other factors within the action area that affect viability for each ESU. If critical habitat would be affected, NOAA reviews the environmental baseline conditions of constituent elements: substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food (primarily for juveniles), riparian vegetation, space, and safe passage conditions.

### 5.1.1 Action Area

The action area for an ESA consultation is described by the Services' joint implementing regulations (50 CFR §402.02) to mean "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The action area is not delineated by the migratory range of the species affected by the project unless that area is also directly or indirectly affected by the proposed actions. NOAA defines the action area for this consultation as:

- The mainstem Columbia River, including and downstream of Libby and Hungry Horse dams and reservoirs; the Snake River below the head of Lower Granite Reservoir; and the Clearwater River below Dworshak Reservoir and Dam, down to and including the Columbia River estuary and plume (i.e., near-shore ocean).

- The estuary and nearshore environment affected by water management operations, including the area between the upstream limit of tidal influence at Bonneville Dam (approximately River Mile 146), the mouth of the Columbia River, and the ocean plume.

- The 4$^{th}$-field Hydrologic Unit Code (HUC) tributary subbasins where the Action Agencies have proposed non-hydro mitigation measures for effects of their proposed hydro operations (Methow, Wenatchee, and Entiat subbasins) as well as additional subbasins in which mitigation projects were implemented pursuant to the 2000 RPA prior to this revised Opinion.

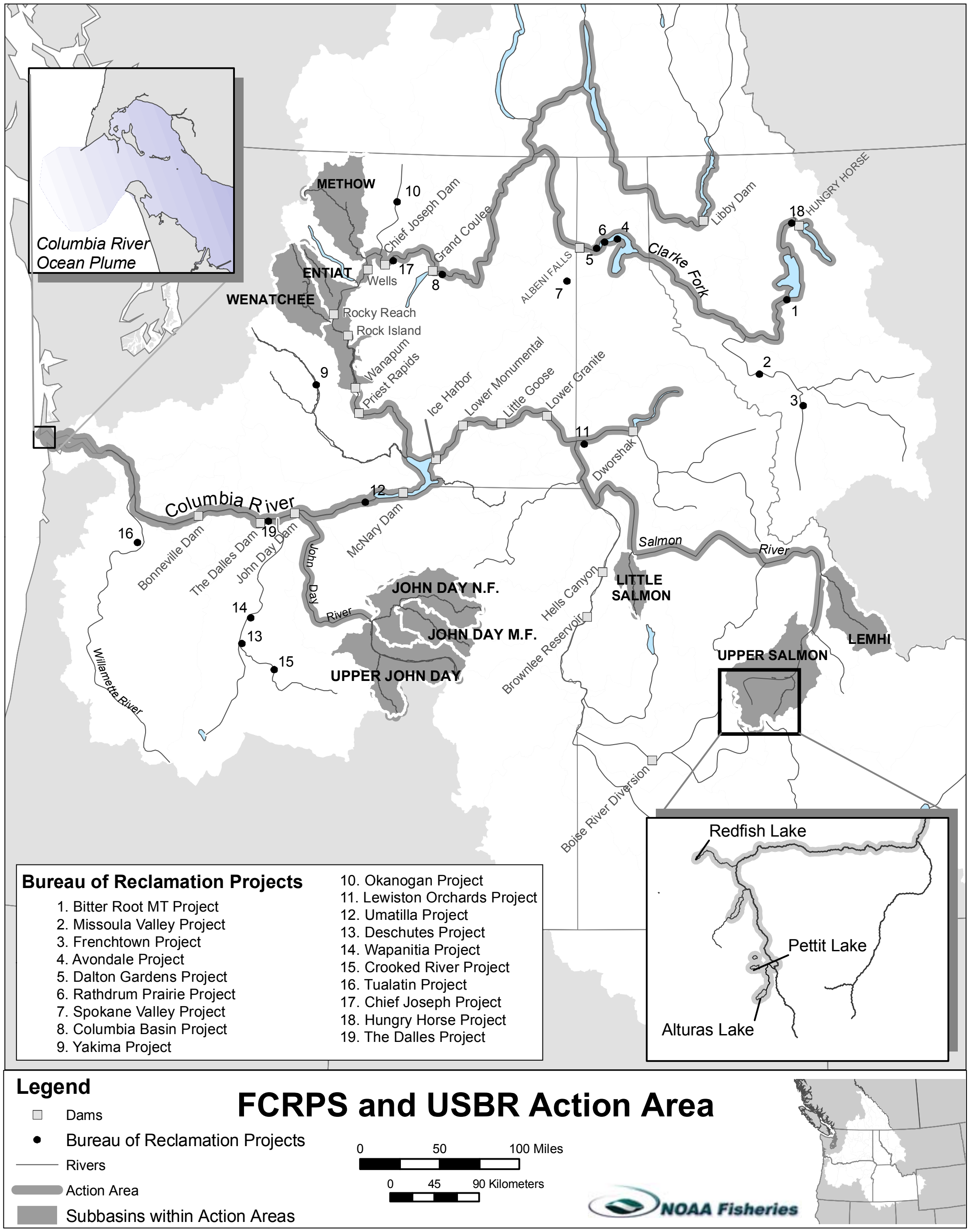
- The area affected by USBR's conservation measures in the Upper Salmon, Little Salmon, Lemhi, Upper John Day (including the South Fork), North Fork John Day, and Middle Fork John Day subbasins.

- Redfish, Alturas, and Pettit lakes and the tributaries that connect them to the Snake River, due to the activities associated with the safety-net hatchery programs for sockeye.

- All additional areas directly or indirectly affected by the 19 USBR projects.

The action area for this consultation is shown in Figure 5.1.

**Figure 5.1** Action Area.



## 5.2 SUMMARY OF THE ENVIRONMENTAL BASELINE

### 5.2.1 Reference Operations at Mainstem FCRPS Projects

In addition to the continuing effects of past FCRPS operations and additional USBR project operations on the listed species, the environmental baseline for this consultation includes the continuing effects of those aspects of the FCRPS and USBR projects that are not subject to Action Agency discretion. Unlike an original dam construction or FERC relicensing situation where an action agency has authority for the option of not building or decommissioning a project, the Action Agencies lack such authority with respect to FCRPS. For an ongoing action such as hydro operations, the future existence of the project is, to a significant extent, outside the Action Agencies' discretion and thus part of the environmental baseline. For purposes of this consultation, NOAA must, where possible, determine what effects of FCRPS operations on the listed species and critical habitat are attributable to the existence rather than the proposed operations of the dams.

With respect to the FCRPS and USBR projects, it is clear that each of the dams already exists, and their existence is beyond the scope of the present discretion of the Corps or USBR to reverse. Conversely, many aspects of the management of river flow at the dams are within the Action Agencies' scope of discretion, and thus the effects of that management are attributable to the proposed action. Beyond these obvious conclusions, however, the limits of discretion are difficult to define.

Similar to their lack of authority to significantly modify structures, the Corps and the USBR do not have the discretion to abandon some operations. Flood control and irrigation are examples, as is some level of power generation to serve demand. As an example, Congress has not prescribed precisely how the Corps must achieve its flood control responsibilities to protect public safety and property, but it is clear that the Corps is obligated by statutory mandate to provide such a benefit. USBR is required by Congress to meet its non-discretionary obligation to deliver water for irrigation. BPA is obligated to provide some level of power generation, although the precise level is not defined. Thus, some aspects of operations like flood control, irrigation, and power generation may be considered part of the environmental baseline. The August 30, 2004 Updated Proposed Action contains both discretionary and some level of undefined non-discretionary actions, as described above.

Although a jeopardy analysis calls for distinguishing the effects of the existence and non-discretionary operations of the FCRPS dams from the effects of the proposed action, it is beyond NOAA and the Action Agencies' technical ability to do so with analytic precision for the FCRPS and USBR projects. This is due in large part to the fact that mainstem Snake and Columbia river dams are structures in a river through which both water and fish must pass each year. It is analytically impossible for NOAA to assess the projects' environmental baseline effects without assuming some sort of operation for the environmental baseline. Ideally, this environmental baseline operation would meet all of the Action Agencies' non-discretionary obligations. A major difficulty with characterizing a non-discretionary operation is that it varies dynamically as a function of the available natural water supply. There may also be numerous operational ways to achieve the non-discretionary objectives.

Therefore, for purposes of this consultation, NOAA, with the assistance of the Action Agencies, developed a "reference operation" that serves as an operational surrogate for the hydro portion of the environmental baseline. The reference operation theoretically helps determine the least amount of adverse effect to fish that can be achieved given the existing structures. NOAA used this theoretical reference operation to estimate the fish survival associated with the hydro portion of the environmental baseline. This reference or "baseline" level of survival was then compared to the fish survival level associated with the hydro portion of the proposed action to determine the hydro effect. It is important to recognize, however, that the reference operation serves as a point of reference for measuring effects of the proposed hydro operation, i.e., the difference between the two operations represents the effects caused by the Action Agencies' exercise of discretion to achieve all authorized project purposes. As a result of developing and modeling an FCRPS reference operation to maximize fish benefits (one that does not acknowledge other statutory purposes – e.g., navigation, flood control, irrigation and power), the reference operation may overestimate the beneficial effects that the FCRPS can actually achieve. As a result, the reference operation is a theoretical operation that the Action Agencies cannot implement, because it fails to meet all the authorized purposes of the projects. However, its development allowed the consultation to move forward without having to go through the process of trying to precisely determine the extent of the Action Agencies' discretionary and non-discretionary operations.

In developing the reference operation, as further described in Appendix D, NOAA adjusted the operational parameters for the FCRPS to maximize fish survival based on the best science available. For example, since spilling water over the spillways is the option that provides dam passage with the least mortality, the reference operation calls for the use of additional spill for fish passage. Similarly, flows were managed to the levels providing the greatest benefits with the guidance of available science. Downstream transportation of juvenile salmonids presented special considerations. Since the dams are currently configured to collect and bypass listed juvenile fish into barges for transport around FCRPS projects, this reference operation also included a transportation operation that utilizes existing fish passage facilities to the extent that, in NOAA's judgment, transportation improves survival. Transportation should also be included where it provides the same survival.

For this Opinion, NOAA developed a quantitative analysis showing fish survival under a hypothetical reference operation of the FCRPS, as described in Appendix D. NOAA used the results of this reference operation analysis to compare with its quantitative analysis of fish survival under the effects of the proposed near-term (2004) and long-term (2014) hydro operations, also presented in Appendix D and Section 6.0. It is important to recognize, however, that the reference analysis is an analytic tool used to demonstrate quantitative differences in survival rates (also referred to as survival gaps) that, although expressed numerically, are, at best, an approximation of actual survival differences. NOAA necessarily must qualify the output of its quantitative analysis by recognizing that there are also unquantifiable factors that cannot be represented in the numbers. For example, as mentioned above, the Corps has discretion to modify existing FCRPS structures, which indicates that, to some limited extent, modification of the structures is not entirely in the environmental baseline. NOAA considers these limits to its analysis when reaching conclusions in Section 8.0.

#### 5.2.1.1 Reference Operation Synopsis

As described above, the reference operation defines an operation of the FCRPS that tries to maximize the survival of all listed species. Key operational elements of the reference operation are:

- FCRPS storage projects are operated as run-of-river dams.
- Federal storage projects are managed to achieve refill by June 30.
- Spill occurs at mainstem dams on a 24-hour basis to the total dissolved gas cap from April to mid-September.
- Federal storage projects are drafted as needed to meet salmon flow targets.
- RSWs are operated on a 24-hour basis at Lower Granite (in spring only) and Ice Harbor dams.
- The corner collector at Bonneville Dam Second Powerhouse is operated on a 24-hour basis.
- USFWS 2000 Biological Opinion operations continue at Libby and Hungry Horse Dams.
- Current predator controls continue.

NOAA's analytical approach methods and results for evaluating juvenile and adult survival under the reference operation are described in Appendix D. Resulting habitat conditions and juvenile and adult mortality are discussed in the following sections.

### 5.2.2 Effects of the Existence of the FCRPS and Non-discretionary Operations

This section describes the Federal Columbia River Power System (FCRPS) and other hydroelectric development in the Columbia River basin and analyzes their effects on the survival of anadromous fish.

The FCRPS is a system of water resource projects built within the Columbia River basin. These Federal projects were developed over a 37-year period, starting with Bonneville Dam in 1938 and Grand Coulee Dam in 1941 and ending with construction of Libby Dam in 1973 and Lower Granite Dam in 1975. A series of large storage dams in the headwaters of the basin (both in the U.S. and Canada) hold back heavy spring and summer snowmelt runoffs to prevent flooding. In the winter, when stream flows would ordinarily be low, water is gradually released from the storage reservoirs. The water flows through downstream run-of-the-river dams in the Snake and Columbia rivers and provides such other river uses as fish migration, navigation, irrigation, recreation, water supplies to industrial and municipal users, and power generation. FCRPS annual operations are planned, coordinated, and implemented through a number of treaties, Federal laws, and operating agreements to achieve the multiple purposes for which the projects were built.

Several non-Federal projects licensed by the Federal Energy Regulatory Commission (FERC) also affect threatened and endangered fish on the mainstem Columbia and Snake rivers. Many listed species are also affected by FERC projects on smaller tributaries or other water development projects.

Concern over the decline of salmon and steelhead species and the effects of the FCRPS surfaced in the 1960s and 1970s, and voluntary efforts to improve fish survival were initiated. The Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Act) provided the first structured institutional means to restore and protect fish populations in the basin. The Act established a regional body (the Northwest Power and Conservation Council) responsible for developing a regional fish and wildlife program that included changes in how the FCRPS was operated. The most notable was the establishment of an annual water budget, which enabled salmon managers to call for the release of limited amounts of water from storage projects in the upper Columbia and Snake rivers to aid the spring downstream migration of juvenile salmon. The program also contained non-hydrosystem strategies for improving fish and wildlife.

Development of the Pacific Northwest regional hydroelectric power system, dating to the early twentieth century, has had profound effects on the ecosystems of the Columbia River basin (ISG 1996). These effects have been especially adverse to the survival of anadromous salmonids. The direct effects of the construction of the FCRPS on salmon and steelhead in the Columbia basin can be divided into four categories: blockage of habitat; alteration of habitat; barrier to, or modification of, juvenile migration; and barrier to, or modification of, adult migration. Where no fish passage facilities have been provided, hydroelectric dams completely block anadromous fish runs on the river. In addition, dams inundate historical spawning and rearing habitat. For salmon and steelhead, much of this effect occurred with Federal construction of Grand Coulee (1941) and Chief Joseph (1961) dams on the Columbia River and the privately-developed Hells Canyon Hydroelectric Complex (1959) on the Snake River. More than 55% of the Columbia River basin accessible to salmon and steelhead before about 1939 has been blocked by large dams (NWPPC 1986).

The eight FCRPS dams in the migration corridor of the mainstem Snake and Columbia rivers have altered both juvenile and adult fish migrations. Dams present barriers to the upstream and downstream migrations of anadromous fish, and a substantial rate of juvenile injury and mortality occurs during downstream passage. Physical injury and direct mortality result from passage through turbines, juvenile fish bypasses, and, to a lesser degree, spill. Indirect effects of passage through all routes may include disorientation, stress, delay in passage, exposure to high concentrations of dissolved gases, exposure to warm water, and cumulative effects of all of the above. Although the direct mortality of adults is low during passage at individual dams, each dam presents the potential for delays at fishway facilities, energy expenditure in passage through multiple fishways, involuntary fallback, downstream passage difficulties for iteroparous fish (e.g., steelhead), and, during periods of involuntary spill, increased exposure to high concentrations of dissolved gases.

The impoundments created by the FCRPS dams greatly increased the cross-sectional area in much of the Columbia and lower Snake rivers, reducing water velocity and water particle travel times in the impounded river reaches. Regulating water in upriver storage reservoirs modifies the natural hydrograph and affects the listed species throughout the action area, from the up-river storage reservoirs to the Columbia River plume. Water regulation and upstream water development reduces flow (volume per unit time) to less than what would naturally occur during runoff of snowmelt in spring and early summer.

Water regulation and impoundment also change water quality factors such as temperature and turbidity, as well as the production of salmonid prey, since reservoirs also provide habitat for salmonid predators. Channel complexity is reduced, affecting fluid dynamics (e.g., ISG 1996) and substrate types. Load-following operations at hydrosystem projects (hourly and daily changes in project discharge to meet prevailing electrical loads and reduced weekend flows) can affect access to suitable spawning habitat and can trap and strand both adults and juveniles.

In 1990, protection for five species of salmon that live in the Columbia and Snake rivers was petitioned under the Federal Endangered Species Act (ESA). NOAA and the FCRPS Action Agencies have consulted on how to enhance the migration of listed endangered salmon and steelhead through the FCRPS. Biological opinions outlining a number of proposed operations and structural configuration changes to FCRPS dams were issued in 1993, 1994, 1995, 1998, 1999, and 2000. As a result of these operations and configuration improvements, juvenile and adult survival through the FCRPS migration corridor has improved significantly since the early 1990s. For Snake River spring/summer chinook juveniles migrating in-river, Williams *et al.* (2004) estimated survival through the eight mainstem Federal dams is now between 28% and 58%, compared with an estimated survival rate during the 1970s of 3% to 30% (Williams *et al.* 2001). For Snake River steelhead juveniles migrating in-river, Williams *et al.* (2004) estimated survival through the eight mainstem Federal dams to currently range between 4% and 50%, compared with an estimated survival rate during the 1970s of 1% to 27% (Williams *et al.* 2001). The transportation of smolts from the Snake River and McNary Dam on the Columbia River has also improved passage survival rates. Ongoing research and development of new fish passage facilities such as removable spillway weirs is expected to further enhance passage survival rates.

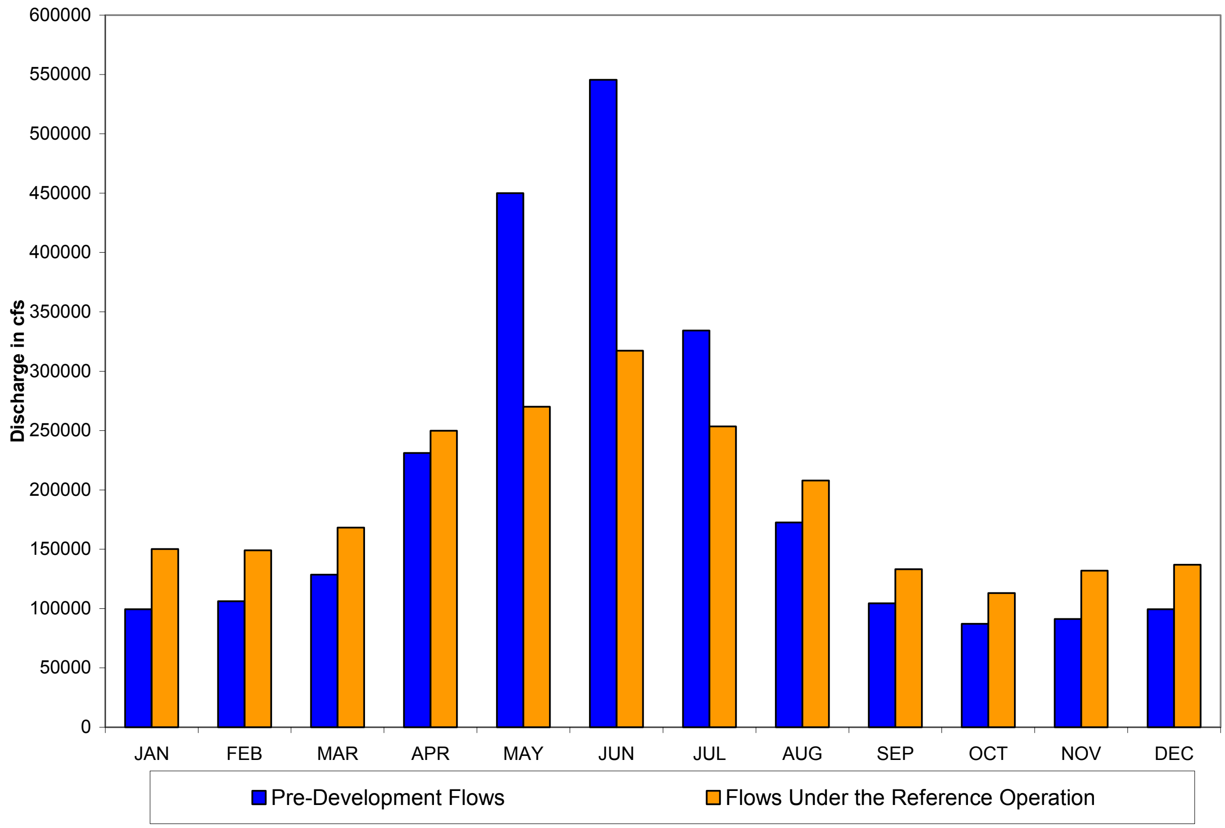
#### 5.2.2.1 Hydrologic Effects

Large multipurpose storage projects developed in both Canada and the United States have altered the seasonal runoff pattern and volume of flow throughout the mainstem corridor and into the estuary. Recent model studies by Bottom *et al.* (2000) indicate that the volume and timing of water and sediment delivery have changed in the Columbia River basin since the late 1880s due to hydrosystem operation, even after the effects of climate change and irrigation withdrawals are taken into account. Compared with the 1880s, current operations do the following:

- Deliver more water to the estuary during winter (October through April) and less water during spring and summer.
- Reduce the peak spring freshet by more than 40% and reduce total freshet-season flow volume by about 30%.
- Lengthen the period of the freshet and move the peak flow earlier (by pre-releasing stored water for flood control, which interacts with recent climate change).
- Greatly increase fall-winter minimum flows.

These hydrologic effects are illustrated by Figure 5.2, which depicts simulated hydrologic conditions between 1929 and 1978 under both the reference operation and conditions that would have existed in the absence of water and hydropower developments.

**Figure 5.2**. Simulated Columbia River flows at Bonneville Dam under the 1990 level of development and flows that would have occurred under the reference operation from October 1929 through September 1978. Source: Pre-Development Flows – USBR (1999) Cumulative Hydrologic Effects of Water Use: An Estimate of the Hydrologic Impacts of Water Resource Development in the Columbia River Basin. Final Report. Reference Operation Flows – Roger Schiewe, Bonneville Power Administration, HYDSIM model run FRIII_03sh05D9, 8-10-04.




### 5.2.2.2 Effects on Habitat in Columbia River Mainstem, Estuary, and Plume

The lower Columbia River and estuary habitats have been affected over the past 60 years by the series of mainstem hydrosystem reservoirs and by the operation of upstream multipurpose storage projects. The impoundments have also inundated extensive salmon spawning and rearing habitat. Historically, fall chinook salmon spawned in mainstem reaches from near The Dalles, Oregon upstream to the Pend Oreille and Kootenai rivers in Idaho and to the Snake River downstream of Shoshone Falls. Presently, mainstem production areas for fall chinook are confined to the Hanford Reach of the Columbia River, the Hells Canyon Reach of the Snake River, the mid-Columbia River, and in the tailrace areas below the lower Snake River projects and below Bonneville Dam. The Hanford Reach is the only known mainstem spawning area for steelhead. Spawning habitat used historically by LCR chinook, CR chum salmon, and by LCR steelhead was probably inundated by the Bonneville pool, as well.

The mainstem habitats of the lower Columbia and Willamette rivers have been reduced primarily to a single channel. Floodplains have been reduced, off-channel habitat features have been eliminated or disconnected from the main channel, and the amount of large woody debris in the mainstem has been greatly reduced. Finally, most of the remaining habitats are affected by flow fluctuations associated with reservoir water management for power peaking, flood control, irrigation, and other operations.

In addition, model studies indicate that the hydrosystem and climate change together have decreased suspended particulate matter to the lower river and estuary by about 40% (as measured at Vancouver, Washington) and have reduced fine sediment transport by 50% or more (Bottom *et al.* 2000). Overbank flow events, important to habitat diversity, have become rar, in part because flow management and irrigation withdrawals prevent high flows and in part because diking and revetments have increased the "bankfull" flow level (from about 18,000 to 24,000 $m^3/s$). The dynamics of estuarine habitat have changed in other ways relative to flow. The availability of shallow (between 10 cm and 2 m depth), low-velocity (less than 30 cm/s) habitat now appears to decrease at a steeper rate with increasing flow than during the 1880s, and the absorption capacity of the estuary appears to have declined.

The significance of these changes for salmonids is unclear. Estuarine habitat is likely to provide services (food and refuge from predators) to subyearling migrants that reside in estuaries for up to two months or more (Casillas 1999). Historical data from Rich (1920) indicate that small juvenile salmon (< 50 mm), which entered the Columbia River estuary during May, grew 50 to 100 mm during June, July, and August. Data from a more contemporary period (Dawley *et al.* 1986; CREDDP 1980) show neither small juveniles entering the estuary in May nor growth over the summer season.

The Columbia River plume also appears to be an important habitat for juvenile salmonids, particularly during the first month or two of ocean residence. The plume may simply represent an extension of the estuarine habitat. More likely, it represents a unique habitat created by interaction of the Columbia River freshwater flow with the California Current and local oceanographic conditions. Ongoing studies show that nutrient concentrations in the plume are similar to nutrient concentrations associated with upwelled waters. Upwelling is a well recognized, oceanographic process that produces highly productive areas for fish. Primary productivity, and more important, the abundance of zooplankton prey, is higher in the plume compared with adjacent non-plume waters. Further, salmon appear to prefer low surface salinity, as the abundance and distribution of juvenile salmon are higher and more concentrated in the Columbia River plume than in adjacent, more saline waters. These findings support the notion that the plume is an important habitat for juvenile salmonids. What is not known is how Columbia River flows affect the structure of the plume during outmigration periods and whether critical threshold flows are needed. Ongoing research will document important relationships between juvenile salmon growth and survival during this stage of their life history.

### 5.2.2.3 Effects on Juvenile Salmonid Passage Survival

The presence of dams in the migratory corridor results in some migrational delay (Raymond 1969, 1979), thereby influencing juvenile migration speed and timing. Dams also impede the safe passage of juveniles. Some juvenile mortality is associated with all routes of passage at dams, but turbines cause the highest direct mortality (Whitney *et al.* 1997), and use of spillways results in the lowest direct mortality (NMFS 2000e). Some passage routes have additional effects, such as the increase in TDG (total dissolved gas) caused by spill.

For SR and UCR chinook salmon and steelhead, an analysis of effects on survival is the primary method used in this Opinion for evaluating the effects of the proposed hydro operation on the biological requirements of listed species in the action area. An important objective of project operations is to increase survival by routing a high proportion of juveniles past the projects in a manner that avoids passing them through turbines. The proportion of smolts that pass a project through either bypass systems or spillways, also described as project fish passage efficiency (FPE), varies by species composition and may vary within a season and between years for a single species with changes in smolt condition, environmental conditions, and project operations.

### 5.2.2.4 Effects on Adult Salmonid Passage Survival

Adult salmon and steelhead must pass up to eight mainstem dams and reservoirs to reach their natal spawning streams and river reaches. Each FCRPS project within currently occupied habitats imposes stresses on migrating adults. Those project-induced effects most likely to adversely affect adult survival are: delay and delay-induced predation, water quality changes (e.g., total dissolved gas concentrations and water temperatures), and fallback and volitional downstream passage (e.g., kelts).

To pass each dam, adult fish must successfully locate and ascend the project fish ladder(s). The ability to successfully pass each dam has been found to be affected by project configuration and various operating characteristics, principally attraction flow rates, project spill patterns, and powerhouse discharge patterns. However, Bjornn *et al.* (1999) estimated that the median time to transit the lower Snake River in 1993 was the same or less with dams than it would be without dams, suggesting that adult passage timing is relatively unaffected by the FCRPS. This is due to the faster transit times through project reservoirs than would occur in a naturally flowing river.

Available data suggest that projects with well designed and carefully operated fishways result in very low mortality rates for migrating adults. High per-project and system survivals indicate adult salmonid biological requirements are generally being met under current conditions. It is expected that biological requirements for migrating adult salmon and steelhead are met under the reference operation. NOAA does not expect a substantial difference in adult salmon and steelhead survival rates between the proposed hydro operation and the reference operation.

### 5.2.3 Fish Passage Facilities and Structural Configurations at the Corps' Mainstem Lower Columbia and Lower Snake River Dams

#### 5.2.3.1 Juvenile Fish Passage Facilities

Specific facilities and operations are provided at all eight of the Corps' lower Columbia and lower Snake hydroelectric projects to provide juvenile salmon and steelhead with alternative passage routes through the dams to avoid turbine passage. These passage routes include powerhouse bypass systems, sluiceways, and spillways. Powerhouse bypass systems are composed of intake screens that guide fish away from the turbines intakes, collection channels to carry fish through the dam, and outfalls to deposit fish below the dam. Sluiceways carry surface water, debris, and fish in channels through the powerhouse, and spillways pass water and fish directly through the dam and are separate from the powerhouse. Some spillways are modified to pass water and fish over the top of the spillway, thereby providing a passage route near the surface rather than through the usual deep spillway gates. Powerhouse bypass systems are operated continuously during the fish passage period from April through November and are maintained according to criteria in the Corps' annual Fish Passage Plans. Spillways and sluiceways are operated for fish passage from April through August, except in the summer months at the fish transport dams.

***5.2.3.1.1 Powerhouse Bypass Systems***. Powerhouse bypass systems use two submersible fish screen designs to guide fish away from turbine intakes and into juvenile bypass systems: a standard-length submersible traveling screen (STS) and an extended-length submersible bar screen (ESBS). STSs are currently installed at Lower Monumental, Ice Harbor, John Day, and Bonneville dams. ESBSs are currently installed at Lower Granite, Little Goose, and McNary dams. The Dalles Dam powerhouse does not have a mechanical screen bypass system. The intake screens guide migrating juveniles from turbine intakes into gatewells. Fish guidance efficiency (FGE) is a measure of how efficiently intake screens guide juveniles out of turbine intakes. Higher FGE equates with higher diversion of the migrants away from turbine passage and into the bypass system. Once guided into gatewells by intake screens, fish exit through orifices to a collection channel extending the length of the powerhouse. After primary dewatering, the channel conveys fish and the remaining orifice water flow either directly to the river below the dam at the tailrace outfall or to a fish sampling and holding facility, where fish health can be examined and fish tags detected. Lower Granite, Little Goose, Lower Monumental, and McNary smolt sampling facilities include loading flumes so that collected juveniles can be transported downstream in truck or barges.

***5.2.3.1.2 Spillways and Removable Spillway Weirs***. The spillway of any of the Corps' eight mainstem dams consists of a forebay, multiple spill gates, an ogee, a stilling basin, and a tailrace. Most spillway gates are built from a radial design with a 60-foot radius and 50-foot width. However, the spillways at Bonneville and McNary dams have vertically operated lift gates of similar width. The number of gates per spillway varies from 8 to 10 at lower Snake River dams to 18 to 23 at lower Columbia River dams. The ogee maintains the shape of the spillway flow between the gates and the stilling basin. All of the spillways are equipped with flow deflectors that help reduce the amount of dissolved gas produced at a given level of flow; these are located on the ogee sections at elevations specific to each project. Spillways are the preferable passage route through dams, because fish survival is usually higher through spillways than through the other available passage routes (NOAA 2004c). With the exception in the summer at Lower Granite, Little Goose, Lower Monumental, and McNary, the four transport projects, the spillways are operated to pass juvenile fish at all eight dams throughout the fish passage season. Juvenile passage studies at each dam have contributed to the development of specific spill gate openings, operational patterns, and daily timing to optimize the number of fish passed through the spillway and their survival. To take advantage of the tendency of juvenile fish to migrate in the upper one-third of the water column, the Corps developed the removable spillway weir (RSW) at Lower Granite Dam that passes fish and water at the river surface rather than a depth of 40 or 50 feet through the usual spill gate opening, which is below the radial gate.

Recent studies at Lower Granite have shown that the RSW surface spill is particularly effective in attracting and quickly passing juvenile migrants through the dam. Other spill gates across the spillway are opened in conjunction with the RSW bay opening to ensure good tailrace conditions for speedy fish exit from the tailrace. An RSW for Ice Harbor is under construction and should be installed prior to the 2005 spring migration.

***5.2.3.1.3 Sluiceways***. In the original configuration of several dams, sluiceways were built adjacent to the powerhouse to pass forebay debris to the tailrace. Early passage studies found that these sluiceways passed juvenile migrants through the dam quite effectively. Like RSWs, sluiceways pass surface water, taking advantage of the juvenile fish tendency to migrate in the upper portion of the water column. The Dalles dam, while lacking a powerhouse bypass system, does have a sluiceway on the upstream face of the powerhouse that extends along the length of the powerhouse. Several surface weir gates pass water and fish, which would otherwise have likely passed into turbine intakes, from the forebay into the sluiceway channel and through the dam to the sluiceway outfall. The newer powerhouse at Bonneville Dam was originally configured with a sluiceway adjacent to the powerhouse. Studies indicated that the sluiceway surface flow was effective in attracting and passing juvenile migrants from the forebay. This sluiceway was recently re-configured to maximize fish passage survival and effectiveness.

### 5.2.3.2 Adult Fish Passage Facilities

Adult salmon and steelhead pass upstream through the eight Corps' dams by means of fishways that were installed as part of the original project construction. The fishways typically consist of an entrance gallery and ladder, a diffuser system that provides additional water at the ladder entrances (to attract fish from the tailrace), and a flow-control section at the ladder exit that maintains ladder flow over various forebay elevations. Observation areas are established in each ladder to monitor upstream progress (i.e., fish-counting stations). Criteria for the operation of the ladders and entrances are specified in the Corps' annual Fish Passage Plans, and facilities are inspected regularly throughout the fish passage season to ensure correct operations. The ladders at Bonneville and Lower Granite dams have traps used for broodstock collection, research, and monitoring. Bonneville, McNary, Ice Harbor, and Lower Granite ladders have PIT tag detection capability. Migrational delays are most likely to occur at fish ladder entrances, in the collection galleries (at junctions between galleries and ladders), and when the traps are operated. Injury related to adult fish passage facilities is usually minimal. However, system failures (e.g., displacement of diffuser gratings in the entrance pools) can result in significant injury and mortality. Adults also pass downstream through the dams. After spawning adult steelhead (kelts) may migrate to salt water for a subsequent repeat spawning. Adult salmon may overshoot their natal stream and fall back through one or several dams. Downstream passing adults can pass through any of the routes provided for juvenile passage (bypass systems, spillways, RSWs, or sluiceways), or they can pass through turbines.

### 5.2.4 Juvenile Fish Transportation Program

The reference operation incorporates juvenile transportation as a management measure to the extent supported by research data. Data from transport studies conducted from 1995 through 2001 using PIT- tag technology have provided a much higher level of understanding about the effects of transportation. Also, efforts have been made over the years to improve fish passage conditions for in-river migrants by managing both spill and flow in the mainstem migration corridor. Adequate migration conditions for fish that remain in-river are essential for them to serve as a suitable control group. The results of these transportation studies are presented in the *Effects of the Federal Columbia River Power System on Salmon Populations* memo (Williams *et al.* 2004). The reference operation incorporates these results by reducing reliance on transportation during the month of April.

- When seasonal average flows at Lower Granite Dam are projected to be less than 70 kcfs, no spill would be provided at collector projects, and all fish collected would be transported. This flow equates to the lowest 20% of annual runoff conditions for the Lower Snake River. This operation maximizes transportation during low-flow years. This flow threshold criterion is based on the lower range of the confidence interval at which optimal survival for spring chinook is calculated to occur (Williams *et al.* 2004). It is assumed that, below this seasonal flow, maximum survival would be achieved by maximizing transportation.

- When seasonal average flows at Lower Granite Dam are projected to range between 70 to 85 kcfs, spill would be provided at all Lower Snake River projects until May 1 or until steelhead collections predominate for three consecutive days. After that date, spill would be terminated, and all non-study fish collected would be transported. The rationale for this operation is that transportation has shown a consistent benefit to spring chinook early in the season only during the lowest flow years, so they should remain in-river to the extent possible. Conversely, these flows will be near the low end of the estimated 95% CI survival threshold for steelhead. This operation would provide in-river passage for spring chinook during April but would switch to a maximum transportation strategy for steelhead when they make up the majority of fish being collected.

- When seasonal average flows at Lower Granite Dam are projected be in excess of 85 kcfs, various levels of 24-hour spill would be provided at all Snake River collector projects throughout the spring season. This operation is a “spread-the-risk” strategy. On a seasonal basis, some of the fish are transported, while some remain in-river.

- There would continue to be no juvenile fish transportation from McNary Dam during the spring in the reference operation.

For the summer transport operations in the reference operation, which primarily affect SR fall chinook salmon, the reference operation consists of the same transport operation as that called for in the 2000 Biological Opinion (Appendix D); i.e., no spill at collector projects and all collected fish would be transported from Lower Granite, Little Goose, Lower Monumental, and McNary dams. This transportation strategy is based on Williams *et al.* (2004), which states that "no empirical evidence exists to suggest that transportation either harms or helps fall chinook salmon." Thus, it is uncertain whether transport provides a benefit or a detriment for SR fall chinook. The lack of scientific information to inform the appropriate transportation strategy results in a determination based on a combination of policy and scientific considerations (D. Robert Lohn, August 25, 2004, personal communication).

A significant consideration in favor of this summer transport strategy is that, for the past several years since the 2000 BiOp, the region has experienced above-average adult returns of SR fall chinook under a strategy that maximizes transportation of juvenile SR fall chinook during the summer months. Without better information, a change to a strategy of leaving more fish in the river could either further improve or instead reduce the level of adult returns. The risk of a reduction in adult returns associated with leaving more fish in the river is less acceptable than the risk of failing to achieve even higher adult returns than the record numbers observed during the past four years.

Therefore, for the reference operation, NOAA Fisheries' transport strategy will be to use the same approach identified in the 2000 BiOp, i.e., to maximize juvenile fish collection and transportation due to concerns about low in-river survival rates. However, given the absence of empirical information on the benefits of transportation for this stock, the Action Agencies' proposal to initiate an in-river survival and summer transport evaluation in the Snake River by 2007/2008 is an important component of this strategy.

### 5.2.5 Predation

Dams and reservoirs are generally believed to have increased the incidence of predation over historical levels (Poe *et al.* 1994). Impoundments in the Columbia River basin increase the availability of microhabitats in the range preferred by northern pikeminnow and other predators (Faler *et al*. 1988; Beamesderfer 1992; Mesa and Olson 1993; Poe *et al.* 1994). They also can increase local water temperatures, which increases digestion and consumption rates by northern pikeminnow (Falter 1969; Steigenberger and Larkin 1974; Beyer *et al.* 1988; Vigg and Burley 1991; Vigg *et al.* 1991); decrease turbidity, which may increase capture efficiency of predators (Gray and Rondorf 1986); favor introduced competitors, which could cause some predators to shift to a diet composed largely of juvenile salmonids (Poe *et al.* 1994); and increase stress and subclinical disease of juvenile salmonids, which could increase susceptibility to predation (Rieman *et al.* 1991; Gadomski *et al.* 1994; Mesa 1994). In addition, dam-related passage problems and reduced river discharge can affect the availability, distribution, timing, and aggregation of migrating salmonids, thereby increasing exposure time to predation (Raymond 1968, 1969, 1979, 1988; Park 1969; Van Hyning 1973; Bentley and Raymond 1976). In particular, they can increase exposure time later in the season, when predator consumption rates are high (Beamesderfer *et al.* 1990; Rieman *et al.* 1991).

### 5.2.5.1 Piscivorous Predation

The Columbia River basin has a diverse assemblage of native and introduced fish species, some of which prey on salmon and steelhead. The primary resident fish predators of salmonids in the reaches of the Columbia and Snake rivers inhabited by anadromous salmon are northern pikeminnow, smallmouth bass, and walleye (NMFS 2000b). Other predatory resident fish include channel catfish, Pacific lamprey, yellow perch, largemouth bass, and bull trout.

Although northern pikeminnow (*Ptychocheilus oregonensis)* are a native species that has always preyed upon juvenile salmonids, development of the Columbia River hydropower system has likely increased the level of predation, as noted above. Northern pikeminnow predation throughout the Columbia and Snake rivers was indexed in 1990-1993 based on electrofishing catch rates of predators and the occurrence of salmonids in predator stomachs relative to estimates in John Day Reservoir (Ward *et al.* 1995). Northern pikeminnow abundance was estimated to total 1.8 million, and daily consumption rates averaged 0.06 salmonids per predator (Beamesderfer *et al.* 1996).

Beamesderfer *et al.* (1996) estimated that over 16 million total salmonids were consumed annually in the mainstem Columbia and Snake rivers prior to initiation of the Northern Pikeminnow Management Program (NPMP). However, total system-wide impacts are not evenly distributed throughout the Columbia and Snake rivers but are concentrated in the lower Columbia River from The Dalles Reservoir downstream, where approximately 13 million of the 16.4 million total salmonids are estimated to have been consumed by northern pikeminnow. This estimated predation loss is 8% of the approximately 200 million hatchery and wild juvenile salmonid migrants in the system. The next highest zone of northern pikeminnow predation is believed to be in the John Day Reservoir, where 1.2 million juvenile salmon were estimated to have been consumed by northern pikeminnow (Beamesderfer *et al.* 1996).

### 5.2.5.2 Northern Pikeminnow Management Program (NPMP)

Predator control fisheries have been implemented in the Columbia basin since 1990 to harvest northern pikeminnow with an exploitation rate goal of between 10 and 20% annually. This goal is important, because a 10 to 20% exploitation rate is necessary to obtain about a 50% reduction in smolts consumed by pikeminnow (Rieman and Beamesderfer 1990). The NPMP is a multi-year, ongoing effort funded by BPA to reduce piscivorous predation on juvenile salmon, primarily through public, angler-driven, system-wide removals of predator-sized northern pikeminnow. From 1991 to 1996, three fisheries (sport-reward, dam angling, and gill net) harvested approximately 1.1 million northern pikeminnow greater than or equal to 250 mm fork length. Total exploitation averaged 12.0% (range, 8.1 to 15.5%) for 1991 to 1996 (Section 6.2.7.1 of 2000 BiOp).

Since program inception in 1990, the NPMP monetary incentive to harvest northern pikeminnow has motivated sports fishermen to remove over two million northern pikeminnow throughout the system. This has reduced predation mortality by an estimated 25% since fishery implementation (Friesen and Ward 1999), which is estimated to equate to approximately 4 million fewer juvenile salmonids consumed by pikeminnow each year. Currently, the annual harvest rate ranges between approximately 8 and 16% of the northern pikeminnow qualifying in size but has averaged approximately 12% in the last number of years. In 2001 and again in 2004, BPA increased the reward, which led to significant increases in both catch and exploitation. Preliminary estimates are in the range of 14 to 18% (Tom Friesen, ODFW, personal communication).

Introduced smallmouth bass and walleye are also significant predators of juvenile salmonids. Found in lakes, rivers, and streams, smallmouth bass (*Micropterus dolomieu*) have relatively large mouths that enable them to consume juvenile fish, including salmonids. According to Bennett and Naughton (1999), smallmouth bass and salmonids utilize many of the same habitat types. Smallmouth bass are the dominant predators in reservoirs of the lower Snake River and are co-dominant with northern pikeminnow and percids in certain reaches of the Snake River (NMFS 2000b). The highest densities of smallmouth bass in the Columbia and Snake rivers occur in the Lower Granite forebay, tailrace, and reservoir, followed by the John Day Reservoir (NMFS 2000b). Throughout the John Day Reservoir study area, smallmouth bass consumed far fewer juvenile salmonids than did northern pikeminnow (Zimmerman 1999).

Zimmerman (1999) also found that smallmouth bass consumed smaller chinook salmon in the spring than did northern pikeminnow, and they consumed far more subyearling chinook salmon in the summer than yearling chinook in the spring. Predator-prey size relationships may reflect the degree and timing of habitat overlap, as suggested by Tabor *et al.* (1993), who attributed high levels of smallmouth bass predation on subyearling chinook salmon to overlap of rearing habitat for subyearling chinook with the preferred habitats of smallmouth bass in summer.

As the largest member of the perch family, walleye (*Stizostedion vitreum*) can grow up to 20 pounds, are extremely piscivorous, and are most abundant in dam tailraces, where the potential for impacts on juvenile salmonids is high (NMFS 2000b). McMahon and Bennett (1996) estimated that walleye predation might account for two million salmon smolts annually, or about one-third of total predation loss.

#### 5.2.5.3 Avian Predation

Avian predation is one of the factors currently limiting salmonid recovery in the Columbia River basin. In the Columbia River Basin, piscivorous birds congregate near hydroelectric dams and in the estuary near man-made islands and structures and eat large numbers of migrating juvenile salmonids (Ruggerone 1986; Roby *et al.* 1998). Diet analyses indicate that juvenile salmonids are a major food source for avian predators in the Columbia River and its estuary and that basin-wide losses to avian predators are high enough that they constitute a substantial portion of each run of salmon (Roby *et al.* 1998).

Caspian terns, double-crested cormorants, glaucous-winged/western gull hybrids, California gulls, and ring-billed gulls are the principal avian predators in the basin (NMFS 2000b). Populations of these birds have increased throughout the basin as a result of nesting and feeding habitats created by human activities, such as dredge spoil deposition in or near the estuary (which has led to nesting islands) and reservoir impoundments and tailrace bypass outfalls associated with hydro projects (Roby *et al.* 1998). The breeding season for these birds coincides with the juvenile salmon outmigration, which provides a ready prey source in the vicinity of large avian nesting colonies (Roby *et al.* 1998).

For many of the listed salmon species migrating through the Columbia River estuary, avian predation is considered one of the primary limiting factors affecting juvenile survival (Fresh *et al.* 2004). Since 1997, researchers have been studying the effect of piscivorous waterbirds on juvenile salmonid survival in the Lower Columbia River. In 1998, Collis *et al.* (2003) estimated that Caspian terns nesting on Rice Island consumed about 12.4 million juvenile salmonids, or approximately 13% of the estimated 97 million out-migrating smolts that reached the estuary during the 1998 migration year. This research prompted managers to relocate the tern colony to East Sand Island, located approximately 15 miles downstream and near the ocean, which resulted in a successful reduction in predation of juvenile salmonids by approximately five to six million fish annually. However, annual predation rates of terns nesting on East Sand Island are still substantial; on average, terns consumed 5.9 million smolts annually from 2000 to 2003 (Collis *et al*. 2003).

The double-crested cormorant colony on East Sand Island in the Columbia River estuary is the largest along the Pacific coast (Collis *et al.* 2002). In 2003, approximately 10,646 breeding pairs were nesting on East Sand Island. Given the birds' feeding habits, it is difficult to determine the number of juvenile salmonids they consume. However, based on preliminary bioenergetics modeling, it appears that cormorants nesting on East Sand Island consumed about the same numbers of juvenile salmonids as Caspian terns in 2003.

#### 5.2.5.4 Pinniped Predation

Marine mammal predation has increased in recent years in the tailrace below Bonneville Dam, probably in response to increased populations of returning adult spring chinook. Aggregations of over 100 individual pinnipeds, primarily California sea lions with a few Stellar sea lions and Pacific harbor seals, have been observed feeding immediately below the dam, often near the powerhouse fishway entrances. Visual observations have indicated that these pinnipeds consumed 0.3, 1.1, and 2% of the spring chinook salmon run in 2002, 2003, and 2004, respectively (Stansell 2004).

### 5.2.6 Estuary and Plume Conditions and Limiting Factors

The Columbia River Channel Improvements project identified a number of ecosystem restoration features proposed under Section 7(a)(1) of the ESA. The projects are designed to benefit ocean-type juvenile salmon and the overall ecosystem for the Columbia River estuary. The ecosystem restoration projects include tide gate retrofits, water quality improvements, side channel habitat restoration, and invasive species control. The ecosystem restoration features were not proposed as mitigation for impacts of the Channel Improvements project, but effects on listed species were evaluated as part of the proposed action in NMFS' May 20, 2002 biological opinion. Depending on final designs for the restoration features, additional consultation may be required.

Regarding the Channel Improvements project itself, computer modeling and analysis indicated that dredging of the navigation channel will not, in the short term, adversely affect ESA-listed fish habitat. There remains some uncertainty as to whether some adverse impacts may be discovered after the navigation channel is deepened. A long-term, comprehensive monitoring program will track any unforeseen changes in ESA-listed fish habitat.

### 5.2.7 Tributary Habitat Conditions

Tributary habitat, including factors limiting viability, are described for specific ESUs in Section 5.3. In revising the 2000 FCRPS BiOp, NOAA also considered the expected beneficial and adverse effects of Federal actions that have undergone Section 7 consultation since December 2000. Both types of information were considered in assessing the type and extent of factors limiting listed salmonids in the action area and in estimating the potential to improve habitat conditions through restoration actions (Appendix E).

To perform the latter evaluation, NOAA relied on its Public Consultation Tracking System (PCTS) database. Federal actions authorized and implemented through programmatic consultations do not appear in the PCTS database, however, and are thus being evaluated through a separate review of annual reports submitted by the responsible Federal agencies. *The latter evaluation was not completed in time to be included in this draft biological opinion.*

### 5.2.8 Artificial Propagation Programs

For more than 100 years, hatcheries in the Pacific Northwest have been used primarily to produce fish for harvest and replace natural production lost to dam construction and other development. They have been used only minimally to protect and rebuild naturally produced salmonid populations (e.g., Redfish Lake sockeye). As a result, a large proportion of salmonids returning to the region are first-generation hatchery-origin fish. In 1987, for example, 95% of the coho salmon, 70% of the spring chinook salmon, 80% of the summer chinook salmon, 50% of the fall chinook salmon, and 70% of the steelhead returning to the Columbia River Basin originated in hatcheries (CBFWA 1990). Because hatcheries have traditionally focused on providing fish for harvest, it is only recently that the substantial adverse effects of hatcheries on natural populations have been demonstrated. For example, hatchery practices, among other factors, have contributed to the 90% reduction in natural coho salmon runs in the lower Columbia River over the past 30 years (Flagg *et al.* 1995).

NOAA has identified four primary ways hatcheries harm natural-origin salmon and steelhead: 1) ecological effects, 2) genetic effects, 3) over-harvest effects, and 4) masking effects (Appendix F). Ecologically, hatchery-origin fish can prey on, displace, and compete with natural fish. These effects are most likely to occur when hatchery-reared juveniles are released in poor condition and remain in the streams for extended rearing periods rather than migrating to marine waters. Hatchery-origin fish also may transmit hatchery-borne diseases, and hatcheries themselves may release disease-carrying effluent into streams. Hatchery-origin fish can affect the genetic variability of native fish by interbreeding with them. Outbreeding depression can also result from the introduction of stocks from other areas. Genetic interactions like these can result in fish being less adapted to the local habitats where the original native stock evolved and may therefore be less productive there.

In many areas, hatchery-origin fish provide increased fishing opportunities. However, when natural fish mix with hatchery-origin fish in these areas, naturally produced fish can be over-harvested. Moreover, when migrating adult hatchery and natural fish mix on the spawning grounds, the health of the natural runs and the habitat's ability to support them can be overestimated, because the hatchery fish mask the actual natural run status from surveyors' observations.

The role hatcheries play in the Columbia basin is being redefined by NOAA's proposed hatchery listing policy, developing environmental impact statements, and recovery planning efforts. These efforts will focus on maintaining and improving ESU viability. Research designed to clarify interactions between natural and hatchery fish and quantify the effects of artificial propagation on natural fish will play a pivotal role in informing these efforts. The final facet of these initiatives is to use hatcheries to create fishing opportunities that are benign to listed populations (e.g., terminal area fisheries).

### 5.2.9 Harvest

Treaty Indian fishing rights are included in the environmental baseline for this consultation. The four Columbia River "Stevens" Treaty Tribes (the Nez Perce, Umatilla, and Warm Springs Tribes, and the Yakama Indian Nation) entered into treaties with the United States in 1855. In exchange for the Indians relinquishing their interest in certain lands, the treaties reserved to the Tribes "exclusive" on-reservation rights and the right to take "fish at all usual and accustomed places in common with citizens of the United States" outside the reservations on the Columbia River and major tributaries. Indian treaty rights such as hunting and fishing rights and water rights are reserved rights that generally date from time immemorial. See, Felix S. Cohen, *Handbook of Federal Indian Law*, 441-448 (1982); *United States v. Winans*, 198 U.S. 371, 381 (1905), 25 S.Ct. 662, 49 L.Ed. 1089 ("In other words, the treaty was not a grant of rights to the Indians, but a grant of right from them -- a reservation of those not granted. . . . There was an exclusive right of fishing reserved within certain boundaries. There was a right outside of those boundaries reserved 'in common with the citizens of the territories.'"); *United States v. Adair*, 723 F.2d 1394, 1412-1414 (9th Cir. 1983), *cert. denied sub nom Oregon v. United States*, 467 U.S. 1252 (1984) ("Accordingly, we agree with the district court that within the 1864 Treaty is a recognition of the Tribe's aboriginal water rights and a confirmation to the Tribe of a continued water right to support its hunting and fishing lifestyle on the [former] Klamath Reservation. Such water rights necessarily carry a priority date of time immemorial.").

Treaty Indian fishing rights in the Columbia basin are under the continuing jurisdiction of the U.S. District Court for the District of Oregon in the case of *United States v. Oregon*, No. 68-513 (D. Oregon, continuing jurisdiction case filed in 1968). The parties to *U.S. v. Oregon* are the United States acting through the Department of the Interior (U.S. Fish and Wildlife Service and Bureau of Indian Affairs) and Department of Commerce (NOAA), the Warm Springs, Umatilla, Nez Perce, Yakama, and Shoshone-Bannock Tribes, and the states of Oregon, Washington, and Idaho.

In *U.S. v. Oregon*, the court affirmed that the treaties reserved for the Tribes 50% of the harvestable surplus of fish destined to pass through their usual and accustomed fishing areas. In at least a half-dozen published opinions and several unpublished opinions in *U.S. v. Oregon*, as well as dozens of rulings in the parallel case in *U.S. v. Washington* (interpreting the same treaty language for Tribes in the Puget Sound area), the courts have established a large body of case law setting forth the fundamental principles of treaty rights and the permissible limits of conservation regulation of treaty fisheries.

While the general principles for quantifying treaty Indian fishing rights are well established, their application to individual runs during the annual spring and fall fishing seasons is problematical. Annual calculations of allowable harvest rates depend (among other things) on estimated run sizes for the particular year, on the mix of stocks that is present, on application of the ESA to mixed-stock fisheries, on application of the tenets of the “conservation necessity principle” to regulation of treaty Indian fisheries, and on the effect of both the ESA and the conservation necessity principle on treaty and non-treaty allocations. While the precise quantification of treaty Indian fishing rights during a particular fishing season often cannot be established by a rigid formula, the treaty fishing right itself continues to exist and must be accounted for in the environmental baseline.

The quantification of the right in a particular year is subject to negotiations in *U.S. v. Oregon*, in which the parties seek to quantify the Tribal right and associated non-Tribal fishing, subject to ESA-imposed constraints for listed species. A critical harvest management issue under *U.S. v. Oregon* involves what are called "mixed-stock fisheries." Depressed or listed populations are often in the river at the same time as healthy and harvestable stocks of various hatchery and wild components of the runs and are caught incidentally in fisheries that target the healthy stocks. Therefore, harvest must be very carefully managed to provide maximum opportunity to harvest healthy runs while minimizing impact on listed species.

Starting in 1977, Tribal and state fisheries subject to *U.S. v. Oregon* have been regulated pursuant to a series of court orders reflecting court-approved settlement agreements among the parties. The last long-term agreement, known as the Columbia River Fishery Management Plan (“CRFMP”), was adopted and approved by the Court in 1988 and expired in 1999. At the Court’s direction and under its supervision, the parties are currently in the process of negotiating a new long-term agreement.

During the past 10 years, harvest has been managed pursuant to the CRFMP and successor agreements that contain restraints on the fisheries necessitated by the ESA listings of some of the ESUs. As a result, NOAA has conducted ESA Section 7 consultations and issued no-jeopardy opinions covering these agreements and their impact on ESA-listed species.

As of August 2004, there are two interim Court-approved settlement agreements in place in *U.S. v. Oregon*. One is a Spring Agreement entered into in 2001, which will continue to set harvest rates through spring of 2005; the other is the 2004 Fall Agreement, which will remain in effect through December 2004. Agreed-to and estimated harvest rates for various stocks under the current agreements are set forth in Tables 5.1 and 5.2. Both of the currently effective agreements have been subject to ESA Section 7 consultations by NOAA. The parties are actively negotiating a new long-term agreement, which will also be subject to a Section 7 consultation.

**Table 5.1.** Expected harvest rates for listed salmonids in winter, spring, and summer season fisheries in the mainstem Columbia River and in tributary recreational fisheries under the 2001 - 2005 Spring Agreement in *U.S. v Oregon*. NA - similar estimates not available for other areas. (Table modified from NMFS 2004)

| | Non-Indian Fisheries | | Treaty Indian Fisheries |
|---|---|---|---|
| ESU | Mainstem | Tributary[c] Fisheries | Mainstem |
| Snake River fall chinook | 0 | 0 | 0 |
| Snake River spring/summer chinook | <0.5-2.0%[a] | NA | 5.0-15.0%[a] |
| Upper Columbia River spring chinook | <0.5-2.0%[a] | NA | 5.0-15.0%[a] |
| Lower Columbia River chinook | 2.7%[b] | NA | 0 |
| Upper Willamette River chinook | <15%[d] | -[d] | 0 |
| Snake River steelhead | | | |
| A-run | 0.2% | 2.5%[e] | 2.7%[f] |
| B-run | 0 | 2.5%[e] | 0[f] |
| Upper Columbia River steelhead | | | |
| Naturally-produced | 0.6% | NA | 3.8% |
| Hatchery-produced | 4.5% | NA | 2.7% |
| Mid-Columbia River steelhead | <2.0%[g] | NA | 3.6% |
| Lower Columbia River steelhead | <2.0%[g] | NA | 1.6% |
| Upper Willamette River steelhead | <2.0%[g] | <1.2% | 0 |
| Lower Columbia River coho | 0 | 0 | 0 |
| Columbia River chum | 0 | 0[h] | 0 |
| Snake River sockeye | <1.0% | 0 | <7.0% |

[a] Allowable harvest rate varies depending on run size.
[b] Spring component of the Lower Columbia River ESU only.
[c] Impacts in tributary fisheries will be population specific depending on where the fisheries occur.
[d] Harvest rate limited to 15% or less in all non-Indian mainstem and tributary fisheries.
[e] Maximum harvest rate applied to wild fish passing through terminal fishery areas where hatchery fish are being targeted; hooking mortality of 5% applied to an assumed 50% encounter rate. Harvest rates to stocks not passing through targeted terminal fishing areas will be less.
[f] B-run steelhead of the current return year are primarily caught in fall season fisheries. However, a portion of the summer steelhead run holds over in the Lower Columbia River above Bonneville dam until the following winter and spring; these fish, thought to be mostly A-run, are caught in fisheries in those seasons.
[g] Harvest rate limits for winter-run populations.
[h] Chum may be taken occasionally in tributary fisheries below Bonneville Dam. Retention is prohibited.

**Table 5.2.** Expected harvest rates for listed salmonids in fall season fisheries in the mainstem Columbia River under the 2004 Fall Agreement in *U.S. v Oregon*. (Table modified from NMFS 2004)

| ESU | Non-Indian Fisheries | Treaty Indian Fisheries |
|---|---|---|
| Snake River fall chinook | 8.25% | 23.04% |
| Snake River spr/sum chinook | 0 | 0 |
| Upper Columbia River spring chinook | 0 | 0 |
| Lower Columbia River chinook | | |
| Spring component | 0% | 0% |
| Tule component | 12.4% | 0% |
| Bright component | 11.8% | 0% |
| Upper Willamette River chinook | 0 | 0 |
| Snake River steelhead | | |
| A-run | ≤2% (1.1%)[a] | 3.4% |
| B-run | ≤2% (1.7%)[a] | 15% (13.6%)[a] |
| Upper Columbia River steelhead | | |
| Natural-origin | ≤2% (1.1%)[a] | 3.4% |
| Hatchery-origin | 10.9% | 5.7% |
| Mid-Columbia River steelhead | ≤2% (1.1%)[a] | 3.4% |
| Lower Columbia River steelhead | ≤2% (0.3%)[a] | 0.1% |
| Upper Willamette River steelhead | 0 | 0 |
| Lower Columbia River coho | 6.4% | 0 |
| Columbia River chum | 5% (1.6%)[a] | 0% |
| Snake River sockeye | [b] | [b] |

[a] Maximum proposed harvest rates with the expected harvest rates associated with the proposed fisheries shown in parenthesis.

[b] 8% cap (combined Tribal and non-Tribal harvest)

## 5.3 Factors Affecting the Species' Environment in the Action Area

### 5.3.1 Snake River Spring/summer Chinook Salmon

#### 5.3.1.1 Mainstem Hydrosystem Corridor

***5.3.1.1.1 Juvenile Migrants***. Juvenile SR spring/summer chinook salmon are yearling migrants, with downstream movement during April through June. Although yearling chinook salmon move relatively quickly through the hydrosystem, they have biological requirements for cover and shelter to provide refuge from predators. NOAA has demonstrated a strong and consistent relationship between travel time and flow for spring migrants below McNary Dam, where northern pikeminnow predation rates are particularly high (NMFS 2000d). By decreasing the residence time of yearling smolts in the lower river, higher spring flows may reduce exposure time to predators.

NOAA is uncertain to what extent yearling migrants have a biological requirement for food in the juvenile migration corridor. If they need food, they may experience competition from out-of-ESU hatchery smolts moving through the system during the same period. In addition, hatchery fish may act as a vector for disease transmission in the hydro project bypass and juvenile transport systems.

Biological monitoring shows that the incidence of gas bubble trauma (GBT) in both migrating smolts and adults remains below 1% when total dissolved-gas concentrations in the upper water column do not exceed the Oregon and Washington water quality standard (110%) and gas waiver levels of 120% in tailraces and 115% in forebays. When those levels are exceeded, there is a corresponding increase in the incidence of signs of GBT. More recent studies, however, indicate that juveniles and adults avoid exposure by traveling at dissolved gas "compensation" depths (Section 6.2.6.1 in the 2000 BiOp). High water temperatures (i.e., generally considered to be greater than 68°F) are observed system-wide during late summer and early fall, due in part to thermal storage in project reservoirs (Section 6.2.6.2 in the 2000 BiOp). However, because juvenile and adult SR spring/summer chinook salmon migrate through FCRPS reservoirs before July, this ESU is not subject to these thermal effects.

Because yearling chinook salmon migrate mid-channel through FCRPS reservoirs (Battelle and USGS 2000), they do not have biological requirements for riparian vegetation in the juvenile migration corridor. Further, there is no evidence that the change from a free-flowing river to a reservoir environment has resulted in loss of the amount (i.e., quantity) of physical habitat required by yearling migrants in the migration corridor (Battelle and USGS 2000). NOAA is uncertain to what extent yearling migrants have a biological requirement for food in the juvenile migration corridor, or, if food is required, whether the abundance or composition of the prey assemblage is enhanced or adversely affected by the existence of the reservoirs or their operations.

***5.3.1.1.2 Adult Migrants***. Adult Snake River spring/summer chinook salmon pass up to eight mainstem dams. When adjusted for harvest, average adult survival estimated in the 2000 FCRPS BiOp was 82.5%, with a per-project survival rate of 97.6%. More recent (2000-2002) per-project survival rates have been estimated at 98.2% (Appendix D). Adult salmon migrating upstream require a sufficient quantity and quality of water to survive to and access the spawning grounds and then spawn successfully. Specific ranges of flow components, velocity, temperature, and turbidity are needed for successful migration. Extremely high water velocities (>13-16 fps) (Corps 1960) can limit adult passage. The preferred temperature range is 7° to 14.5° C (upper and lower lethal limits of 0° and 25° C) (Bell 1991); and high concentrations of dissolved solids can irritate or suffocate salmon. High total dissolved gas supersaturation (TDG) greater than 125% due to involuntary high spill levels during high flow events can impair and reduce survival of migrating adults (Ferguson *et al.* 2004).

Velocity and turbidity extremes that can impair the survival of adult salmon generally do not occur in the mainstem Columbia and lower Snake rivers in the FCRPS. Water temperatures as high as 23° C have been noted in localized surface water areas in the FCRPS, but summer water temperatures in the surface zone (i.e., the upper 15 feet of the water column) generally do not exceed 22° C (DART U. Wash.). Voluntary spill for juvenile fish passage is managed to less than 120% TDG; at this level, no signs of gas bubble disease have been noted, and the effects are considered benign.

SR spring/summer chinook salmon have biological requirements for spawning habitat within the action area, including the Upper Salmon, Little Salmon, and Lemhi subbasins, where USBR has proposed to implement conservation measures.

Estimates of juvenile system survival provide a summary statistic for habitat conditions in the hydro part of the action area. Appendix D modeling estimates indicate that system survival in the reference operation ranged from about 48 to nearly 54% during 1994-2003 with a mean of nearly 52% (in-river survivals ranged from about 36 to 60% with a mean of over 51% during the same period). These system survival estimates include the effects of differential post-Bonneville survival for transported fish but do not include latent mortality of in-river fish. These estimates indicate that the habitat-related biological requirements of juveniles, as described in Section 1.2, are not being fully met.

These estimates are lower than estimated survival through free-flowing river sections, which are assumed to approximate the survival rate associated with properly functioning habitat conditions. The 2000 FCRPS Biological Opinion (Appendix A and Incidental Take Statement) estimated free-flowing survival to be approximately 85%. These estimates are currently under review and are subject to revision to reflect more recent data.

#### 5.3.1.2 Estuary and Plume Habitat Conditions

The primary factors affecting the status of this stream-type ESU as juveniles move through the lower Columbia River are avian predation and flow (Fresh *et al.* 2004). Tern predation is primarily directed at yearling-size fish, the dominant life-history strategy for this ESU. These larger juveniles occur in deep water and channels within the estuary where they are most vulnerable to tern predation. Predation affects the abundance and productivity of the affected populations. Flow management for power production, flood control, and irrigation water deliveries has significantly changed mainstem flow patterns from the historical condition, resulting in a decrease in the mean annual flow, a decreased volume, earlier timing of the spring freshet, almost complete loss of overbank flows, and a shift in occurrence from spring to winter. As a consequence of these changes in flow regime, average annual sediment transport has also declined, increasing the visibility and thus vulnerability of migrating smolts to predators. Primarily as a result of flow changes, the shape, behavior, size, and composition of the plume is now different from the way it was before construction and operation of the hydro system. The plume appears to be a rich feeding area for yearling salmonids and may distribute juvenile salmon in the coastal environment, away from predation pressure. Based on the fact that the richest foraging habitat associated with the plume appears to be at the interface between saline and brackish water (Fresh *et al.* 2004), any change in size of the plume could reduce the amount of that habitat. At some level this could result in density-dependent interactions. Also, with a smaller plume, salmon could be in a more confined space and therefore more vulnerable to predators. FCRPS and Canadian hydro storage operations have reduced the size of the plume in June during the period when yearling migrants are making the transition to the ocean phase of their life cycle. This factor may affect viability, although there is no empirical information at this time.

#### 5.3.1.3 Tributary Habitat Conditions

The action area for Snake River spring/summer chinook includes three subbasins in which USBR proposed a conservation measure in the proposed action. Those three subbasins are included in the environmental baseline, as follows.

***5.3.1.3.1 Little Salmon River***. The watersheds occupied by this population have been degraded from their historical conditions and are believed to be limiting for spring/summer chinook because of flow, altered channel morphology, temperature, grazing, roads, and forestry practices. The lack of a properly functioning riparian corridor in the Little Salmon River has affected stream temperatures and the structure of the channel due to a lack of LWD recruitment. (NPCC 2004b draft Salmon River Subbasin Plan) Water is diverted for numerous purposes, homes are built near the high-water mark, and most tributaries are inaccessible. State Highway 55 constricts channel migration.

A review of NOAA’s Public Consultation Tracking System (PCTS) identified 24 formal and informal consultations completed since December 2000 for actions in the Little Salmon subbasin (USGS HUC 17060210). These actions addressed herbicide and insecticide applications; culvert, road, and bridge repair and removals; and special use permits for grazing, cemeteries, phone lines, guide services, and bridges, with varying short- and long-term effects on passage, instream flow and riparian condition.

The Corps completed consultation on a number of non-restoration actions focused on roads. These included debris slide remediation, extension and repair of four culverts, and road widening. The Corps also completed consultation on the repair of a velocity barrier at the Rapid River Fish Hatchery.

Other Federal agency consultations included an FHA road repair and bridge repair on different tributaries of the Little Salmon. BLM completed consultation on continuing localized herbicide applications. The FS completed a number of consultations which were generally small actions distributed widely over the Little Salmon. These small actions included maintenance of recreational facilities, hazardous tree removal, localized application of insecticide and special use permits for telephone lines, bridge use, and cemetery maintenance. Larger scale consultations included one emergency fire suppression action and an associated salvage project, special use permits for sheep grazing and fish guides all with minimal effects on listed salmonids. The FS completed consultation on expansion of a ski slope area and proposed and on-going program actions.

Based on this review, there will be slight effects, both adverse and beneficial, to factors limiting listed salmonids at the reach scale in the Lemhi subbasin.

***5.3.1.3.2 Lemhi***. The watersheds occupied by this population have been degraded from their historical conditions and are believed to be limiting for spring/summer chinook because of flow, altered channel morphology, temperature, water quality, grazing, and agricultural practices. The hydrologic regime (peak flows, base flows, flow timing) and connectivity of most Lemhi tributaries have been altered by irrigation withdrawals. Only 7% of all tributaries remain connected to the mainstem. These changes limit the access of resident and anadromous populations to potentially available habitat and delay anadromous smolt and adult migration in the lower reaches of the mainstem Lemhi, which contributes to increased mortality rates (NPCC 2004b draft Salmon River Subbasin Plan).

NOAA’s PCTS identified 13 formal and informal consultations completed since December 2000 for actions in the Lemhi subbasin (USGS HUC 17060204). These actions addressed herbicide applications, water diversion modification, culvert replacement, bridge replacement, and water leases with varying short- and long-term effects on passage, instream flow and riparian condition.

BPA completed consultation on the Mill Creek Pipeline project, which repaired a section of irrigation pipe and stabilized associated sections of stream bank in a tributary to the Lemhi River. In the Lemhi River, BPA proposed to transfer point of use for some Lemhi irrigators from the Lemhi (L6) to the mainstem Salmon (S14). This action, which could increase flows for a portion of the Lemhi to benefit listed salmonids, has experienced delays in implementation. BPA also completed Lemhi River Diversion Replacement L3A. This action will improve passage for all life stages of resident and anadromous fish species in this section of the Lemhi by removing an existing push-up dam and install three “v”-shaped rock weirs. Replacing the push-up berm with a permanent structure will improve conditions for upstream and downstream migrating fish by eliminating annual instream maintenance, improving water quality conditions, creating step pools, increasing flow over the new structures, reducing the amount of water diverted out of the river, and creating a defined channel.

USBR completed a consultation to lease water in the Lemhi to provide increased flows for rearing, passage and improved water quality. The Corp completed consultation on an action to replace a small wooden bridge and rock ford with a railcar bridge.

Other Federal agency consultations included an FHA Basin Creek action to replace an existing bridge. This project is expected to have long-term positive effects on SR spring/summer chinook salmon and SR steelhead through extensive riparian plantings and floodplain restoration. BLM completed consultation on a project in Basin Creek to repair a culvert and improve road surfaces to increase fish passage and reduce adverse impacts to water quality. The FS completed two consultations on actions to apply herbicides to small numbers of acres in the Lemhi. These actions were not expected to reduce survival to listed salmonids. NOAA completed consultation on funding a point of diversion screen in the Lemhi to reduce salmonid mortality.

Based on this review, there will be slight effects, both adverse and beneficial, to factors limiting listed salmonids at the reach scale in the Lemhi subbasin.

***5.3.1.3.3 Upper Salmon River (Salmon River and tributaries upstream of the confluence of the Pahsimeroi River).*** The watersheds occupied by this population have been degraded from their historical conditions and are believed to be limiting for spring/summer chinook because of flow, altered channel morphology, and grazing. The natural hydrologic regime in the Upper Mainstem Salmon (from the East Fork confluence to the headwaters) has been altered by streamflow withdrawals. The effects from these pressures include a reduction in base flow conditions and some modifications in flow timing (NPCC 2004b draft Salmon River Subbasin Plan). Sedimentation from various land use activities has impacted habitat quality and quantity in the mainstem from the East Fork confluence to the headwaters (NPCC 2004b draft Salmon River Subbasin Plan). Roads, timber harvest, grazing, and changes to the hydrologic regime of the small Upper Salmon tributaries have acted alone or cumulatively to contribute excess amounts of fine sediment to channels (NPCC 2004b draft Salmon River Subbasin Plan).

NOAA's PCTS identified 10 formal and informal consultations completed since December 2000 for actions in the Upper Salmon subbasin (USGS HUC 17060201). These actions addressed herbicide applications, water diversion modification, culvert replacement, road realignment, bridge replacement, and proscribed burns with varying short- and long-term effects on passage and instream flow.

BPA[1] completed consultation on the East Fork of the Salmon River (SEF) Diversions – projects SEF 10, 11, and 12. The action consolidated points of diversion, reduced head cutting actions in the river at SEF 10 by eliminating an instream push-up diversion berm, replaced the existing SEF 11 and 12 push-up gravel berms that impeded anadromous fish passage and required regular mechanized instream maintenance and repair with a permanent rock weir that also spanned the East Fork. The project should help improve rearing and fish passage habitat and protect downstream spawning and in-gravel nursery habitat and may increase survival of SR spring/summer chinook salmon and SR steelhead.

The Corp consulted on the Salmon River at Challis Project (USRC), which will restore the riparian function of the floodplain, the geomorphic function of the river channel, and the fluvial salmonid habitat. The project would specifically benefit SR steelhead, and to a lesser extent, SR spring/summer chinook salmon, by improving a variety of habitat components in the 12-mile reach of the Upper Salmon River drainage. The USRC project site covers a small portion of the watershed and NOAA expects only short-term negative effects on salmonid habitat.

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[1] In some of these actions where it has no construction authority, Reclamation provides technical assistance to the lead agency in the form of project design elements.

Implementing the project to meet the goals of restoring river ecosystem function and improving fish habitat, the USRC will have a long-term positive effect.

Both the Corps and USBR consulted on single culvert replacement projects in different tributaries in this subbasin. NOAA (Pacific Coast Salmon Recovery Fund) consulted on replacing an existing push-up gravel dam with a permanent rock weir. The weir will protect juvenile rearing habitat that is provided by a natural overflow channel, and improve holding and passage conditions.

Other consultations included herbicide or pesticide applications or proscribed fires over small areas by BLM and the FS, which had insignificant adverse effects on listed salmonids, and small road realignment and stream restoration projects completed by the FS which resulted in long-term positive effects on habitat conditions.

Based on this review, there will be slight effects, both adverse and beneficial, to factors limiting listed salmonids at the reach scale in the Upper Salmon subbasin.

***5.3.1.3.4 Salmon River, Mainstem (downstream from East Fork)***. The watersheds occupied by this population have been degraded from their historical conditions and are believed to be limiting for spring/summer chinook because of flow, altered channel morphology, grazing, agricultural practices and roads. Habitat in the mainstem between the confluences of the North Fork Salmon and Pahsimeroi Rivers is primarily limited by a modified hydrologic regime, inadequate pool:riffle ratios, and structural migration barriers (NPCC 2004b draft Salmon River Subbasin Plan). The natural hydrologic regime in the Upper Mainstem Salmon (from the East Fork confluence to the headwaters) has been altered by streamflow withdrawals. Sedimentation from various land use activities has impacted habitat quality and quantity in the mainstem from the East Fork confluence to the headwaters (NPCC 2004b draft Salmon River Subbasin Plan). The diversion of water for irrigation and its subsequent return, combined with reductions in riparian shading, represent the primary factors contributing to increased temperatures in the mainstem Salmon from the 12-mile section upstream to Challis (NPCC 2004b draft Salmon River Subbasin Plan). Channel confinement and development of riparian areas, from the 12-mile section upstream to the headwaters, have caused a reduction in the pool:riffle ratio, a reduction in streambank stability, and a reduction in shade, and there is limited salmonid access to side channel habitat (NPCC 2004b draft Salmon River Subbasin Plan).

### 5.3.1.4 Harvest Rates

Mainstem harvest rates for SR spring/summer chinook salmon are covered by the 2001 Interim Agreement on winter/spring/summer fisheries (Table 5.1) and are considered in the associated biological opinion. The opinion will apply indefinitely as long as fisheries are managed in a manner consistent with the assumed total impact limits (Appendix C). Allowable harvest rates in mainstem fisheries (primarily between the river mouth and McNary Dam) vary, depending on run size, between 5.5 and 17%. Actual harvest rates have ranged between 5 and 15% over the last five years (Appendix C). Harvest rates expected to occur in the action area in the next few years are shown in Table 5.1. Fisheries in the Snake River and its tributaries have been closed for more than 20 years (except for fisheries harvesting non-listed fish in the Little Salmon and

Clearwater rivers). Fisheries on surplus, hatchery-origin fish have been covered under ESA Section 10 permits since 2001.

#### 5.3.1.5 Artificial Propagation Programs

Existing artificial propagation programs for SR spring/summer chinook salmon and their effects on VSP parameters are described in Appendix F.

### 5.3.2 Snake River Fall Chinook Salmon

#### 5.3.2.1 Mainstem

Juvenile SR fall chinook salmon are subyearling migrants, moving downstream during June through September and rearing during at least part of this period. High water temperatures are observed system-wide during summer and early fall and the survival of juvenile fall chinook through Lower Granite Reservoir may be reduced by an interaction between the thermal effects of hydro operations and Idaho Power Company's operations at its Hells Canyon Complex.

Subyearling fall chinook salmon in the lower Snake River reservoirs are either pelagic-oriented or found over sandy, mostly unvegetated substrate. It is uncertain whether subyearlings have biological requirements for cover, shelter, and vegetation (beyond the potential effect of mainstem flow as a refuge from predation). Although the prey resources available to subyearling SR fall chinook in mainstem reservoirs are different than those in free-flowing reaches (e.g., terrestrial insects and zooplankton dominate in reservoirs versus aquatic insects in a free-flowing river), NOAA is uncertain whether this change enhances or adversely affects biological requirements for food during the outmigration. Similarly, water level fluctuations associated with reservoir operations could disrupt the life cycles of invertebrate prey in the littoral zone, but the Corps operates the lower Snake River pools within 1 foot of minimum operating pool, minimizing effects on shallow water habitat.

FCRPS and USBR operations interact with effects of operations at the Hells Canyon Complex to increase water temperatures in the lower Snake River from mid-July through mid-September. Adults entering the Snake River during this period can be delayed by elevated water temperatures, potentially reducing fish condition and fecundity during spawning. Fall chinook salmon are known to spawn in the tailraces of Lower Granite, Little Goose, and Ice Harbor dams. Spawning may be inhibited at temperatures above 61°F (16°C). The effects of flow management on the use of mainstem spawning habitat (water quantity and velocity, space, access to habitat, and availability of suitable substrate) are unknown.

Survival of PIT-tagged juvenile fall chinook salmon from release points in the Snake and Clearwater rivers to Lower Granite Dam is strongly correlated with water temperature, as well as flow and turbidity, in Lower Granite Reservoir (Williams *et al.* 2004). To minimize water temperature-related effects on juvenile and adult fall chinook, Dworshak Dam on the North Fork Clearwater, about 2 river miles upstream of the Clearwater River and 60 miles from Lower Granite Reservoir, is routinely operated to release large amounts of cool water during the months of July, August and early September to reduce water temperatures in Lower Granite Reservoir and downstream reaches to try to achieve State of Washington water temperature standard of 20 C. Dworshak Reservoir is a deep impoundment (over 600 feet at full pool) that stratifies in the summer, and Dworshak Dam is equipped with a variable-intake depth-release structure that facilitates selecting a specific discharge water temperature. During July, August and in recent years into September, reservoir managers typically release water between 45° to 50°F (7° to 10°C) at the request of regional salmon managers. This operation reduces ambient water temperature by approximately 4° to 6° F (-2° to -3°C) at Lower Granite Dam when elevated temperatures are a concern in the Snake River (July through mid-September).

Appendix D estimates juvenile in-river survival rates in the reference operation during 1995-2003 (no survival estimates available for 1994 or 2002) for this ESU ranging from nearly 10% to over 24% (mean 16.5%). These estimates do not include the effects of latent mortality for in-river migrants.

These estimates are lower than estimated survival through free-flowing river sections, which are assumed to approximate the survival rate associated with properly functioning habitat conditions. The 2000 FCRPS Biological Opinion (Appendix A and Incidental Take Statement) estimated free-flowing survival to be approximately 23-68%. This indicates that biological requirements of juveniles have not been fully met in recent years and would not be fully met under the reference operation.

Average adult survival estimated in the 2000 FCRPS Biological Opinion was 71%, with a per project survival rate of 95.8%. Adult survival in 2002 was 80% with an eight-dam per project survival rate of 97.3% (Appendix D).

#### 5.3.2.2 Estuary and Plume Habitat Conditions

Many SR fall chinook appear to enter the estuary as chronological subyearlings. Most migrate to sea in their first year of life, but because of their long (in-river) transit time, probably continue to grow and reach the estuary at a larger size than chronological subyearlings from lower Columbia basin ESUs. Upper basin subyearlings appear to use habitat in the upper estuary, continuing to grow as they transition to brackish and then salt water. Tern predation has a low effect on this ESU; apparently terns do not target smaller chinook or chum salmon. Toxics, both water- and sediment-borne, can affect these life history strategies if they occur in occupied shallow-water areas.

#### 5.3.2.3 Tributary Habitat Conditions

The Action Agencies have not proposed any non-hydro mitigation measures in subbasins used by SR fall chinook for spawning. Therefore, these subbasins are not within the action area for this consultation.

#### 5.3.2.4 Harvest Rates

Mainstem harvest rates for SR fall chinook salmon are covered by the 2004 Fall Agreement (Table 5.2) and are considered in the associated biological opinion, which will remain in effect through 2004. The parties are actively negotiating a new long-term agreement, which will also be subject to a Section 7 consultation. Ocean and mainstem Columbia River fisheries can harvest Snake River fall chinook up to the rate of 45-50% (i.e., total exploitation rate). For the last several years, mainstem fisheries have been managed subject to a 31% harvest rate limit. This represents a 30% reduction in the harvest rate observed during the 1988-1993 base period. The actual harvest rate has ranged between 21 and 31% over the last five years (Appendix C). Fisheries for fall chinook in the Snake River and its tributaries have been closed for more than 20 years. Harvest rates expected to occur in the action area in the next few years are shown in Table 5.2.

#### 5.3.2.5 Artificial Propagation Programs

Existing artificial propagation programs for SR fall chinook salmon and their effects on VSP parameters are described in Appendix F.

### 5.3.3 Upper Columbia River Spring Chinook Salmon

#### 5.3.3.1 Mainstem

***5.3.3.1.1 FCRPS Projects***. Juvenile UCR spring chinook salmon are spring migrants with peak movement past Rock Island Dam in the mid-Columbia reach during late April and May. The status of biological requirements for this ESU related to mainstem habitat and in the estuary and plume, and potential interactions with out-of-ESU hatchery fish, are the same as those discussed for SR spring/summer chinook salmon (Section 5.3.1).

For the reference operation, NOAA estimated that juvenile in-river survival through the lower Columbia River reach ranged from 52 to nearly 80% over the 1994-2003 study period, with a mean value nearly of 69% (Appendix D). This estimate does not include an effect of latent mortality for in-river migrants.

These estimates are lower than estimated survival through free-flowing river sections, which are assumed to approximate the survival rate associated with properly functioning habitat conditions. The 2000 FCRPS Biological Opinion (Appendix A and Incidental Take Statement in NMFS the 2000 BiOp) estimated free-flowing survival to be approximately 91%. This indicates that biological requirements of juveniles have not been met in recent years and would not be met under the reference operation. These estimates indicate that the habitat-related biological requirements of juveniles, as described in Section 1.2, are not being fully met.

Average adult survival estimated in the 2000 FCRPS Biological Opinion was 91%, with a per project survival rate of 97.6%. Recent (2000-2002) adult survival is estimated at 90%, with a per project survival rate of 97.2% (Appendix D).

***5.3.3.1.2 Habitat Conservation Plans for FERC-licensed Projects in the Mid-Columbia Reach***. NOAA completed ESA Section 7(a)(2) consultations on its issuance of incidental take permits to Douglas and Chelan County Public Utility Districts in support of the proposed Anadromous Fish Agreements and Habitat Conservation Plans (HCPs) for the Wells, Rocky Reach, and Rock

Island hydroelectric projects in the mid-Columbia reach on August 12, 2003. Under the HCPs, Douglas and Chelan County PUDs have agreed to use a long-term adaptive management process to meet achieve a 91% combined adult and juvenile survival standard for each salmon and steelhead ESU migrating through each project. In addition, compensation for up to 9% unavoidable project mortality is provided through hatchery and tributary programs, with compensation for up to 7% mortality provided through hatchery programs and compensation for up to 2% provided through tributary habitat improvement programs.

In the HCP biological opinions, NOAA found it reasonable to expect that project-related deaths (i.e., direct, indirect, and delayed mortality resulting from project effects) for juveniles of each species migrating through each project would be equal to, or less than 7% throughout the term of the HCPs. In addition, NOAA found that total (natural and project-related) mortalities of adults migrating upstream through each project currently range from approximately 2 to 4%. Taking into account natural mortality, NOAA found that the HCP standard of no more than 2% adult mortality resulting from project-related effects was probably met for each species at this time. Thus, NOAA estimated that the total measurable lethal take of adults would be no more than 4% using the methods adopted in the biological opinion until such time that technologies allow for a reasonable differentiation of these sources of mortality. At that time, allowable project-related lethal take shall not exceed 2% for any species.

#### 5.3.3.2 Estuary and Plume Habitat Conditions

The status of the habitat in the estuary and plume for this yearling-type ESU is the same as that described for SR spring/summer chinook salmon (Section 5.3.1.2).

#### 5.3.3.3 Tributary Habitat Conditions

***5.3.3.3.1 Methow***. The Methow still supports of number of pristine to nearly pristine habitats, mostly within designated wilderness areas. A number of important production areas, however, have been and continue to be adversely affected by human activity. Irrigation water withdrawals substantially reduce habitat quality and quantity during base flow periods in the mainstem Methow, lower Chewuck, and lower Twisp rivers. A number of lesser tributaries are completely dried by irrigation withdrawals. Some of the diversions on the mainstem and large tributaries are accomplished with gravel “push-up” dams that can impede passage during low flows and create locally unstable habitat conditions and maintaining these structures destroys redds. Most of the irrigation withdrawals are screened to modern standards, but a few large diversions downstream of important production areas are inadequately screened. Several reaches of the mainstem and tributaries are listed under Section 303(d) of the Clean Water Act as impaired for various parameters, including temperature and instream flow. Most stream reaches downstream of wilderness areas lack sufficient instream flow. Large wood has historically been removed from stream channels following larger floods. Revetments have further limited channel complexity and off-channel habitat in the lower Lost, Chewuck, and Twisp rivers and at various locations on the mainstem. Riparian conditions have also been adversely affected as a result of agricultural, silvicultural, residential, and recreational activities.

The limiting factors are: irrigation-related reductions to base flow, particularly in drier years; loss of off-channel habitats; lack of large wood; passage barriers or impediments at irrigation diversions; inadequate screening at some irrigation diversions; and loss of riparian vegetation. Sedimentation may also be a problem in the lower Chewuck. The nearly annual de-watering of small streams that support spring chinook spring rearing may also be a significant limiting factor if the fish are unable to exit these systems before they dry up.

NOAA's PCTS identified 14 formal and informal consultations completed since December 2000 for actions in the Methow subbasin (USGS HUC 17020008). These actions addressed water diversions, dam maintenance, boat ramp construction, flood control, fish passage, and habitat restoration. Implementation of these actions is expected to have direct or ancillary effects on instream flow, passage, and riparian conditions. The Corps was lead agency on three non-restoration actions including construction of a private pier, installation of a boat ramp in different subbasin tributaries, and construction of a new boat dock on the mainstem Columbia River. These were smaller projects that had short-term local effects and unquantifiable effects on the local population. The BPA completed consultation on a project with the Yakama Nation to replace a culvert on Hancock Springs, which is a tributary to the Methow River. The purpose of this project is to restore salmonid access to the upper portion of Hancock Springs and improve riparian habitat and stream conditions. NOAA concluded that this project was likely to improve population trend to the extent that the loss of passage had contributed to decline.

NOAA consulted with other Federal agencies including batched watershed actions to address habitat and side channel restorations, dike removal and replacement of four culverts by the USFS, which are expected to provide small local benefits to habitat condition and improve fish passage. Other consultations included dam maintenance at the Leavenworth hatchery by the USFWS and culvert repair by the Federal Highway Administration, which is expected to provide a slight improvement in water quality, improved upstream passage of migrating adult spawners, and safer downstream migration of juveniles within the action area. This project will probably provide only incremental improvement to population status since an additional 35 or 40 culverts need replacement.

Based on this review, there will be slight effects, both adverse and beneficial, to factors limiting listed salmonids at the reach scale in the Methow subbasin.

***5.3.3.3.2 Entiat***. Given the likelihood that population size was historically greater still than in the 1960s, the Entiat should be considered as potentially having a very high population capacity, even though it has never produced the number of fish that came from the Wenatchee and Methow rivers.

Spring chinook spawning is presently limited to approximately 10 miles of the mainstem Entiat and the lower reaches of the Mad River. Spring chinook may have historically spawned lower in the mainstem, but the channelization of the lower 14 miles of the river has rendered conditions there unsuitable. This channelization, with associated loss of off-channel habitats and riparian function, is the most significant habitat alteration in the watershed. The Entiat is less severely affected by water withdrawals, most of which are downstream of the spawning areas, but water withdrawals do limit habitat quality and quantity, particularly in drier years. It is believed that all of the irrigation diversions in subbasin are screened to modern standards. Sedimentation from forest lands is also a significant factor. The steep terrain, highly erodible soils, forest road locations, and fire frequency combine to make sedimentation a much more significant problem in the Entiat than in the other subbasins occupied by UCR spring chinook. The Entiat Valley is also growing in popularity as a retirement and vacation getaway. Some of the most desirable building locations are along the floodplain reaches, where spring chinook continue to spawn. Most of the spring chinook production areas are stream reaches bordered by private land.

The primary limiting factors result from channelization and levee construction, and they include the loss of channel sinuosity and off-channel habitat, large woody debris and recruitment of same, habitat complexity, and channel length. Channelization also significantly increased stream gradient in the lower 14 miles of the mainstem. Sedimentation and the effects of water withdrawals to late-season base flows are also limiting factor.

No FCRPS Action Agency consultations were listed in the PCTS for this subbasin. The Forest Service consulted on improvements to the Silver Falls Access Area in the Entiat Ranger District.

***5.3.3.3.3 Wenatchee***. The larger population observed in the 1960s was likely to have been substantially smaller than historical populations in that significant habitat alteration had occurred, and many of the mainstem dams had been constructed by that time. Given the greater number of chinook in the 1960s compared to the 1990s, and given the likelihood that population size was historically greater still than in the 1960s, the Wenatchee should be considered as potentially having a very high capacity to increase population.

Important spawning areas in the White, Little Wenatchee, and Chiwawa rivers remain in healthy, properly functioning condition. Another important spawning area, Nason Creek, has been significantly affected by the highway and railroad construction, which severed a substantial amount of side channel habitat and truncated the floodplain. Highway and railroad construction and, to a lesser extent, residential development have also substantially reduced floodplain connectivity, side channel habitat, and riparian quality along much of the mainstem Wenatchee River. While the most important spawning areas are the previously listed tributaries, the mainstem Wenatchee is an important rearing and overwintering area. Irrigation impacts are minor in the major tributaries, but irrigation withdrawals in lesser tributaries like Peshastin, Mission, and Chumstick creeks have precluded spring chinook in these systems for many years. The lower mainstem Wenatchee is substantially affected by irrigation withdrawals in the late summer and early fall, particularly in drier years. The barrier at the Leavenworth National Fish Hatchery blocks access to nearly 20 miles of suitable spring chinook habitat. Riparian conditions in the major tributaries, except in Nason Creek, are generally excellent. The mainstem Wenatchee downstream from Leavenworth is largely devoid of structural wood.

The primary limiting factors are the loss of off-channel habitat in the mainstem and Nason Creek, which adversely affects late-summer rearing and overwintering conditions; late-season flows in the lower Wenatchee mainstem; and the lack of large, in-channel wood. Flow and passage problems in Mission and Peshastin creeks prevent regular access. The barrier on the Icicle prevents access to the upper river, but a recently formed fall several miles above the hatchery would likely prevent spring chinook access to most of the suitable habitat in that watershed.

The Corp completed consultation on a project to install access to a swimming beach in the Lower White River. The Forest Service completed consultation on a road relocation and bank stabilization project on the White River and culvert replacements on Sand and Little Camas creeks. The White River project is expected to add temporary, construction-related effects to the existing environmental baseline. However, these effects are not expected to have any significance at the population level. The culvert replacements are expected to provide local improvements to fish passage.

Based on this review, there will be slight adverse and beneficial effects on factors limiting listed salmonids at the reach scale in the Methow subbasin.

#### 5.3.3.4 Harvest Rates

Mainstem harvest rates for UCR spring chinook salmon are covered by the 2001 Interim Agreement on winter/spring/summer fisheries (Table 5.1) and are considered in the associated biological opinion. The opinion will apply indefinitely as long as fisheries are managed in a manner consistent with the assumed total impact limits (Appendix C).

There are no specific estimates of historical harvest impacts on UCR spring chinook runs. Assuming that these fish were equally available to mainstem commercial fisheries as were runs to other areas of the Snake and Columbia rivers, harvest rates in the lower mainstem Columbia commercial fisheries were probably on the order of 20 to 40% of the in-river run. Harvest rates were sharply curtailed beginning in 1980 and were again reduced after the listing of Snake River spring/summer chinook in the early 1990s. Only mainstem Columbia River fisheries harvest Upper Columbia River spring chinook in significant numbers. Mainstem harvest rates depend on run size and can vary from 5.5 to 17% (including Tribal and non-Tribal harvest). Harvest rates have been set under a *U.S. v. Oregon* agreement and are covered by an ESA Section 7 consultation. Harvest rates expected to occur in the action area in the next few years are shown in Table 5.1.

#### 5.3.3.5 Artificial Propagation Programs

Existing artificial propagation programs for UCR chinook salmon and their effects on VSP parameters are described in Appendix F.

### 5.3.4 Upper Willamette Chinook Salmon

#### 5.3.4.1 Mainstem

Juvenile UWR chinook salmon migrate through the mainstem lower Columbia River primarily as yearlings, although subyearlings migrants from this ESU are also moderately common (Fresh *et al.* 2004). Juvenile UWR chinook salmon enter the action area at the mouth of the Willamette River, at approximately RM 100 in the lower Columbia River. Most of the migration moves through the lower Columbia River during February through May, before peak spring runoff and periods of involuntary spill. The primary factors affecting the status of this ESU as juveniles move through the estuary and plume vary with life history strategy. Avian predation and flow are limiting factors for yearlings (Section 5.3.1). Fingerling smolts have a relatively long residence time in the estuary and rely extensively on shallow water habitats to provide both food for high growth rates and shelter from predators (Fresh *et al.* 2004). Thus, the primary estuarine limiting factors for subyearlings are flow and the associated reduction in amount of and access to shallow water habitat.

#### 5.3.4.2 Tributary Habitat Conditions

The Action Agencies have not proposed offsetting measures for effects of the hydrosystem on tributary habitat used by this ESU. Therefore, tributary subbasins are not within the action area for this consultation.

#### 5.3.4.3 Harvest Rates

Mainstem harvest rates for UWR chinook salmon are covered by the 2001 Interim Agreement on winter/spring/summer fisheries (Table 5.1) and are considered in the associated biological opinion. The opinion will apply indefinitely as long as fisheries are managed in a manner consistent with the assumed total impact limits (Appendix C). Harvest rates expected to occur in the action area in the next few years are shown in Table 5.1.

#### 5.3.4.4 Artificial Propagation Programs

Existing artificial propagation programs for UWR chinook salmon and their effects on VSP parameters are described in Appendix F.

### 5.3.5 Lower Columbia River Chinook Salmon

#### 5.3.5.1 Mainstem

Most LCR chinook salmon populations are fall-run and produce primarily subyearling migrants. Subyearlings move through the mainstem lower Columbia River during spring and early summer. Only subyearlings that emerge from the Wind, Little White Salmon, and [Big] White Salmon rivers in Washington and the Hood River in Oregon would encounter Bonneville Dam after entering the Columbia River. NOAA does not know of any empirical information on the survival of small subyearling migrants at Bonneville Dam. Experiments conducted with juvenile SR fall chinook do not apply, because these fish are much larger by the time they reach Bonneville Dam (Section 5.3.2).

Small subyearling migrants are likely to have biological requirements for food in the mainstem Columbia River migration corridor, but NOAA is uncertain whether the abundance or composition of the prey assemblage is enhanced or adversely affected by hydro operations. Smolts from this ESU are generally small (fry and fingerlings), which have long residence times in the estuary and rely extensively on shallow water habitats to provide both food for high growth rates and shelter from predators (Section 5.3.4). The primary estuarine limiting factors are flow and the associated reduction in amount of and access to shallow water habitat.

Three spring-run populations (Hood, Kalama, and Sandy rivers) produce yearling migrants, and juveniles emerging from the Hood River pass Bonneville Dam on their way downstream. NOAA assumes that the survival of yearling smolts emerging from the Hood River and the biological requirements of smolts from all three populations are similar to those of yearling SR spring/summer chinook salmon in the same portion of the action area.

Biological requirements of adults for water quality, quantity, and velocity in the mainstem Columbia River migration corridor are different for the spring- and fall-run components of this ESU. For spring-run chinook salmon, effects are similar to those described above for SR spring/summer chinook salmon (Section 5.3.1). For fall-run fish returning to Upper Gorge spawning areas, low flows during late summer and early fall, related to high temperatures, may delay migration through the Bonneville pool and potentially lead to disease transmission between adults delayed in fish ladders.

Hydro operations affect the quantity, quality, and access to spawning habitat in the Ives Island area below Bonneville Dam, where several early fall-run chinook salmon from the LCR ESU were observed spawning during October 1999. Spill operations at Bonneville Dam, such as spill for debris removal, gas generation/abatement testing, or juvenile fish passage, could create TDG concentrations high enough to kill yolk sac fry in redds in the Ives Island area. This effect can be prevented by providing flows that create a compensation depth over the redds and/or, reducing the effective TDG concentration to 105% of saturation or less. Flow fluctuations can strand subyearling migrants, making them vulnerable to death through desiccation or avian predation. Both flow and spill operations at Bonneville Dam have been managed to protect chum salmon since 1999. Beginning approximately November 1, the Action Agencies provide some operations to maintain minimum tailwater elevations at Bonneville to establish and protect redds, although the extent of these operations depends on the hydrologic forecasts and the ability to implement other seasonal operations. Efforts are also made to limit spill to a level which would not exceed 105% over established redds. These efforts to protect chum also confer protection to established LCR chinook redds and emergent fry.

Average adult survival past Bonneville Dam estimated in the 2000 FCRPS Biological Opinion was 97%. Recent (2001-2002) adult survival estimates, based on SR spring/summer and SR fall chinook per project survival rates, ranges from 97.3-98.2% (Appendix D).

#### 5.3.5.2 Estuary and Plume Habitat Conditions

Most juvenile emigrants from this ESU are ocean-type fish, which migrate to sea early in their first year of life after rearing in freshwater for only a short period. These smaller juveniles rear in shallow, low velocity estuarine habitat, which has diminished due to flow changes and diking. The primary factors affecting the status of ocean-type juveniles as they move through the lower Columbia River are habitat, flow and toxics. For the three populations that produce yearling-type smolts, the status of habitat in the estuary and plume is the same as that described for SR spring/summer chinook salmon (Section 5.3.1.2).

#### 5.3.5.3 Tributary Habitat Conditions

The Action Agencies have not proposed offsetting measures for effects of the hydrosystem on tributary habitat used by this ESU. Therefore, tributary subbasins are not within the action area for this consultation.

#### 5.3.5.4 Harvest Rates

Mainstem harvest rates for LCR chinook salmon are covered by the 2004 Fall Agreement and the 2001 Interim Agreement on winter/spring/summer fisheries for the fall and spring-run components, respectively (Tables 5.1 and 5.2 and Appendix C). For fall chinook, total exploitation rates were as high as 80% before 2001. Since 2001, the harvest cap is 49%. For spring chinook, total exploitation rates were as high as 65% prior to 2001. Since then, exploitation rates have been reduced to 22%. Harvest rates expected to occur in the action area in the next few years are shown in Tables 5.1 and 5.2.

#### 5.3.5.5 Artificial Propagation Programs

Existing artificial propagation programs for LCR chinook salmon and their effects on VSP parameters are described in Appendix F.

### 5.3.6 Snake River Steelhead

#### 5.3.6.1 Mainstem

Juvenile SR steelhead migrate as yearlings, with peak movement past Lower Granite Dam during April and May. Using the SIMPAS model, NOAA has estimated that an average of 75% of the run was transported from the Snake River collector projects during 1994 through 2003 in the reference operation (Appendix D). The direct survival of transported juveniles over the same period was at least 98%, and the average system survival rate of in-river migrants (which migrate past eight mainstem projects) was approximately 33%. The total (transported plus in-river) system survival rate for SR steelhead in the reference operation ranged from 44% to 55%, with a mean value of almost 50%, including differential delayed mortality of transported fish assumed in the analysis. The status of habitat that provides biological requirements in the juvenile migration corridor (e.g., water quality, food) is very similar to that described for SR spring/summer chinook (Section 5.3.1.1).

Based on radio-tracking studies, the mean survival rate of adult migrants between Bonneville and Lower Granite dams is 77%, equivalent to a per-project survival rate of 97% (Table 6.1-1 in the 2000 BiOp). Based on 2001 and 2002 data, the mean survival rate of adult SR steelhead between Bonneville and Lower Granite dams is over 89%, equivalent to a per project survival rate of 98.6% (Appendix D). Few downstream-migrating adult steelhead (kelts) survive to spawn a second time without passing through dams (7% to lower Columbia River tributaries). It is unlikely that kelts survive passage at multiple dams to spawn a second time.

### 5.3.6.2 Estuary and Plume Habitat Conditions

The status of the habitat in the estuary and plume for this yearling-type ESU is the same as that described for SR spring/summer chinook salmon (Section 5.3.1.2).

### 5.3.6.3 Tributary Habitat Conditions

The action area for Snake River steelhead includes three subbasins in which USBR proposed a conservation measure in the proposed action. Those three subbasins are included in the environmental baseline.

***5.3.6.3.1 Little Salmon and Rapid River***. This subpopulation of A-run fish occupies the Little Salmon River and its tributaries, as well as steelhead-supporting tributaries of the lower Salmon River downstream from the mouth of the Little Salmon (Whitebird Creek, Skookumchuck Creek, Slate Creek, and several smaller tributaries). The watersheds occupied by this subpopulation have been degraded from their historical conditions and are believed to be limiting for steelhead by reduced instream flows, altered channel morphology, increased summer water temperatures, livestock grazing, some forestry practices, and road construction, maintenance, and usage. The lack of a properly functioning riparian corridor in the Little Salmon River has increased stream temperatures and affected the structure of the channel by the lack of large woody debris recruitment (NPCC 2004b draft Salmon River Subbasin Plan). Other habitat challenges for steelhead include diversions of stream water for several types of uses, urban and suburban encroachment on the floodplain and riparian habitat conservation areas (RHCA) (i.e., homes are built near the high water mark), and lack of accessibility to most tributaries by spawning adults and outmigrating smolts.

State Highway 95 constricts the channel migration and has helped create a fish passage barrier.

The larger, fish-producing tributaries for this subpopulation include Rapid River, Slate Creek, and White Bird Creek. The anadromous fish productivity from the remaining streams in the bounds of this subpopulation is relatively less important, either because of natural limitations (i.e., small stream size, steepness, or passage barriers like waterfalls or landslides) or anthropogenic alterations, such as instream flow diversions, water consumption, dams and impoundments, and channelization. Fish habitat conditions in this subpopulation area range from near-pristine, mostly unaltered roadless areas in the Rapid River drainage to the significantly altered Little Salmon River, which is severely degraded by poor water quality, cattle grazing, urban encroachment in the riparian zone, and past straightening and channelization of the stream channel to accommodate State Highway 95. Land ownership is a mix of Federal, state, and private, with private lands concentrated along the lower-elevation floodplains.

Many of the watersheds occupied by this subpopulation are degraded from their historical conditions and are believed to be limiting to steelhead by their seasonal lack of instream flows, altered channel morphology, accelerated sediment deposition in stream channels, high water temperatures, and the encroachment of roads on stream channels and their floodplains. Water withdrawals may limit fish productivity because of reduced streamflows in Boulder and White Bird creeks and in many of the smaller tributaries to the lower Salmon River, such as Race Creek and Deer Creek. Many of the small tributaries to the Salmon River have fish passage barriers created by road culverts or by small, unscreened, temporary diversion structures constructed of rocks and plastic sheeting. High summer water temperatures and intermittent summer flows often occur in the lower reaches of most moderate and small-sized streams in this area (fourth-order streams and smaller). Extensive logging road systems have been constructed in portions of the area, adding fine sediments, increasing water temperatures with decreased shading, and decreasing inputs of large woody debris. Elevated sediment inputs and impaired stream flows may be inhibiting fish productivity in the White Bird Creek drainage, and high loading of sediments from roads, cattle grazing, and legacy mining are the significant limiting factors in the Slate Creek drainage.

The anticipated effects of Section 7 consultations completed in this subbasin since December 2000 are described in Section 5.3.1.3.1.

***5.3.6.3.2 Lemhi River***. The watersheds occupied by this population have been degraded from their historical conditions and are believed to be limiting for steelhead because of diminished instream flows, altered natural hydrograph, altered channel morphology, increased water temperatures, degraded water quality, livestock grazing, and some agricultural practices, all of which detract from the ecological functioning of the watershed to produce anadromous salmonids. The hydrologic regime (i.e., peak flows, base flows, flow timing) and connectivity of most Lemhi River tributaries have been altered by irrigation withdrawals. Only 7% of all tributaries remain connected to the mainstem. These changes significantly limit resident and anadromous populations' access to high quality habitat and delay anadromous smolt and adult migration in the lower reaches of the mainstem Lemhi River, which contributes to increased mortality rates (NPCC 2004b draft Salmon River Subbasin Plan). Irrigation diversions result in disconnected tributaries that deny juveniles access to important thermal refugia, create fish passage problems, and, in the case of unscreened diversions, cause take of listed species.

The anticipated effects of Section 7 consultations completed in this subbasin since December 2000 are described in Section 5.3.1.3.2.

***5.3.6.3.3 Salmon River Upper Mainstem (above the confluence with the Pahsimeroi River).*** The watersheds occupied by this population are degraded from their historical conditions and are believed to be limiting for steelhead because of instream flow reductions, altered channel morphology, and the aquatic effects of livestock grazing, some agricultural practices, and road construction, operation, and maintenance. The natural hydrologic regime in the Upper Mainstem Salmon (from the East Fork confluence to the headwaters) is altered by streamflow withdrawals. The effects from these pressures include a reduction in base flow conditions and some modifications to flow timing (NPCC 2004b draft Salmon River Subbasin Plan). Fish are entering irrigation systems when irrigation is turned on before fish screens are in place, during operation of diversions and control structures, and via wastewater return flows and breeched ditches (i.e., 'backdoor' access). Upon entering the hydrologically unstable irrigation system, fish are subject to threats from dewatering (i.e., high temperatures, reduced forage, increased predation, etc.) (NPCC 2004b draft Salmon River Subbasin Plan). Sedimentation from various land use activities has impacted habitat quality and quantity in the mainstem from the East Fork confluence to the headwaters (NPCC 2004b draft Salmon River Subbasin Plan). The diversion of water for irrigation and its subsequent return, combined with reductions in riparian shading, represent the dominant factors contributing to increased water temperatures in the mainstem Salmon River from the “12-mile section” upstream to Challis (NPCC 2004b draft Salmon River Subbasin Plan). Channel confinement and development of riparian areas, from the “12-mile section” upstream to the headwaters, has caused a reduction in the pool:riffle ratio, a reduction in streambank stability, a reduction in shade, and has limited salmonid access to side channel habitat (NPCC 2004b draft Salmon River Subbasin Plan). Because of these disconnects to side channel and tributary habitat, anadromous salmonids are denied access to vital thermal refugia.

The anticipated effects of Section 7 consultations completed in this subbasin since December 2000 are described in Section 5.3.1.3.3.

#### 5.3.6.4 Harvest Rates

Mainstem harvest rates for SR steelhead are covered by both the 2004 Fall Agreement and the 2001 Interim Agreement on winter/spring/summer fisheries (Tables 5.1 and 5.2 and Appendix C). Based on recent observations, harvest rates in the mainstem Columbia River for SR A-run steelhead are expected to range from 11 to 16% (Appendix C). SR B-run steelhead have been subject to a 17% harvest rate limit in recent biological opinions. However, actual harvest rates in recent years have generally been less than the maximum allowed, and it is reasonable to expect that harvest rates on SR B-run steelhead in mainstem fisheries will range up to 17%. Harvest rates expected to occur in the action area in the next few years are shown in Tables 5.1 and 5.2.

#### 5.3.6.5 Artificial Propagation Programs

Existing artificial propagation programs for SR steelhead and their effects on VSP parameters are described in Appendix F.

### 5.3.7 Upper Columbia River Steelhead

#### 5.3.7.1 Mainstem

***5.3.7.1.1 FCRPS Projects***. Juvenile UCR steelhead are yearling migrants, moving through the mainstem Columbia River during spring. The status of biological requirements for this ESU related to mainstem habitat and in the estuary and plume, and potential interactions with out-of-ESU hatchery fish, are the same as those discussed for SR spring/summer chinook salmon (Section 5.3.1). The status of biological requirements for water quality, quantity, and velocity in adult migration corridors is also the same as those discussed for SR spring/summer chinook salmon (Section 5.3.1).

Appendix D estimates that juvenile in-river survival through the lower Columbia River reach in the reference operation ranges from over 28 to 63% during the 1994-2003 study period, with a mean of nearly 50%. These estimates indicate that the habitat-related biological requirements of juveniles, as described in Section 1.2, are not being fully met. This estimate does not include the effect of latent mortality for in-river migrants.

These estimates are lower than estimated survival through free-flowing river sections, which are assumed to approximate the survival rate associated with properly functioning habitat conditions. The 2000 FCRPS Biological Opinion (Appendix A and Incidental Take Statement) estimated free-flowing survival to be approximately 91%.

Average adult survival estimated in the 2000 FCRPS Biological Opinion was 88%, with a per project survival rate of 96.8%. Recent (2001-2002) adult survival is estimated at 93%, with a per project survival rate of over 98% (Appendix D).

***5.3.7.1.2 Habitat Conservation Plans for FERC-licensed Projects in the Mid-Columbia Reach***
The permitted levels of take for juvenile and adult UCR steelhead under the HCPs is described in section 5.3.7.1.2. Project-related mortality of downstream migrating UCR steelhead kelts is generally unknown, although survival of kelts from all tributaries within the action area to below Priest Rapids Dam was estimated at about 18% in 2002. There are no estimates of "natural" mortality rates for these fish, which have gone many months without feeding while expending considerable energy migrating and spawning, but these are thought to be high. NOAA expects that, compared to pre-HCP survival rates, implementing HCP measures at the mid-Columbia PUD projects will substantially improve steelhead kelt survival in future years.

### 5.3.7.2 Estuary and Plume Habitat Conditions

The status of the habitat in the estuary and plume for this yearling-type ESU is the same as that described for SR spring/summer chinook salmon (Section 5.3.1.2).

### 5.3.7.3 Tributary Habitat Conditions

The action area for Upper Columbia River steelhead includes three subbasins which are included in the environmental baseline.

***5.3.7.3.1 Methow***. The Methow subbasin still supports of number of pristine to nearly pristine habitats, mostly within designated wilderness areas. A number of important production areas, however, have been and continue to be adversely affected by human activity. Irrigation water withdrawals substantially reduce habitat quality and quantity during base flow periods in the mainstem Methow, lower Chewuck, and lower Twisp rivers (Appendix E). Irrigation diversions reduce habitat quality and quantity and impede adult steelhead passage in Gold, Libby, and Beaver creeks. A number of lesser tributaries are completely dried by irrigation withdrawals. Those that do not support steelhead spawning are occupied by juvenile steelhead in the late spring and winter. Some of the diversions on the mainstem and large tributaries are accomplished with gravel “push-up” dams that can impede passage during low flows and create locally unstable habitat conditions. Furthermore, maintaining these structures can destroy redds. Most of the irrigation withdrawals are screened to modern standards, but a few large diversions downstream of important production areas are inadequately screened. Several reaches of the mainstem and tributaries are listed under Section 303(d) of the Clean Water Act as impaired for various parameters, including temperature and instream flow. Most stream reaches downstream of wilderness areas lack sufficient instream flow. Large wood has historically been removed from stream channels following larger floods. Revetments have further limited channel complexity and off-channel habitat in the lower Lost, Chewuck, and Twisp rivers and at various locations on the mainstem. Riparian conditions have also been adversely affected as a result of agricultural, silvicultural, residential, and recreational activities.

The limiting factors are irrigation-related substantial reductions to base flow, particularly in drier years; loss of off-channel habitats; lack of large wood; passage barriers or impediments at irrigation diversions; inadequate screening at some irrigation diversions; and loss of riparian vegetation. Sedimentation may also be a problem in the lower Chewuck. The nearly annual dewatering of small streams that support rearing may also be a significant limiting factor if these fish are unable to exit these systems before they dry up.

The anticipated effects of Section 7 consultations completed in this subbasin since December 2000 are described in Section 5.3.3.3.1.

***5.3.7.3.2 Entiat***. Steelhead spawning presently occurs in portions of the mainstem Entiat, the Mad River, and Roaring Creek. The channelization of the lower 14 miles of the river has reduced steelhead spawning habitat suitability in that reach. This channelization and associated loss of off-channel habitats and riparian function are the most significant habitat alterations in the watershed. The Entiat is less severely affected by water withdrawals, most of which are downstream of the spawning areas, but water withdrawals do limit habitat quality and quantity, particularly in drier years. It is believed that all of the irrigation diversions in the subbasin are screened to modern standards. Sedimentation from forest lands is also a significant factor. The steep terrain, highly erodible soils, forest road locations, and fire frequency combine to make sedimentation a much more significant problem in the Entiat than in the other subbasins occupied by UCR spring chinook. The Entiat Valley is also growing in popularity as a retirement and vacation destination. Some of the most desirable building locations are along the productive floodplain reaches. The potential to increase habitat productivity is medium.

The primary limiting factors result from channelization and levee construction and include the loss of: channel sinuosity and off-channel habitat; large woody debris and recruitment of same; habitat complexity; and channel length. Channelization also significantly increased stream gradient in the lower 14 miles of the mainstem. As mentioned previously, sedimentation and the effects of water withdrawals on late-season base flows are also limiting factors.

The anticipated effects of Section 7 consultations completed in this subbasin since December 2000 are described in Section 5.3.3.3.2.

***5.3.7.3.3 Wenatchee***. Important spawning areas in the White, Little Wenatchee, and Chiwawa rivers and Chewaukum Creek remain in healthy, properly functioning condition. Another important spawning area, Nason Creek, has been significantly affected by the highway and railroad construction that severed a substantial amount of side channel habitat and truncated the floodplain (Appendix E). Other significant but lesser tributaries, Peshastin, Chumstick, and Mission creeks, have been substantially altered by road construction, residential development, and water withdrawals. Highway and railroad construction and, to a lesser extent, residential development have also substantially reduced floodplain connectivity, side channel habitat, and riparian quality along much of the mainstem Wenatchee River. While the most important spawning areas are the previously listed tributaries, the mainstem Wenatchee is an important rearing and overwintering area. The lower mainstem Wenatchee is substantially affected by irrigation withdrawals in the late summer and early fall, particularly in drier years. The barrier at the Leavenworth National Fish Hatchery blocks access to nearly 20 miles of highly productive steelhead habitat. Riparian conditions in the major tributaries, except in Nason Creek, are generally excellent. The mainstem Wenatchee downstream from Leavenworth is largely devoid of structural wood. The inherent potential to increase habitat productivity for steelhead in the Wenatchee is medium to high.

The primary limiting factors are the loss of access to the upper Icicle River, loss of off-channel habitat in the mainstem and Nason Creek, all of which adversely affect late-summer rearing and overwintering conditions and the habitat in other significant tributaries like Peshastin, Mission, and Chumstick Creeks. Late-season flows in the lower Wenatchee mainstem and the lack of large, in-channel wood are also significant problems.

The anticipated effects of Section 7 consultations completed in this subbasin since December 2000 are described in Section 5.3.3.3.3.

#### 5.3.7.4 Harvest Rates

UCR steelhead are A-run, so harvest rates and agreements described above (Section 5.3.6) for A-run SR steelhead also apply here. Fisheries authorized only to harvest surplus hatchery-origin fish are covered under ESA Section 10(a)(1)(A) permit number 1395. Harvest rates expected to occur in the action area in the next few years are shown in Tables 5.1 and 5.2.

#### 5.3.7.5 Artificial Propagation Programs

Existing artificial propagation programs for UCR steelhead and their effects on VSP parameters are described in Appendix F.

### 5.3.8 Mid-Columbia River Steelhead

#### 5.3.8.1 Mainstem

Juvenile MCR steelhead are yearling migrants, moving through the mainstem lower Columbia River during spring. Depending on natal tributary, smolts from this ESU pass one to four FCRPS and USBR projects in the lower Columbia River. The status of biological requirements for this ESU related to mainstem habitat and in the estuary and plume, and potential interactions with out-of-ESU hatchery fish, are discussed for SR spring/summer chinook salmon (Section 5.3.1). The status of biological requirements for water quality, quantity, and velocity in adult migration corridors is also the same as those discussed for SR spring/summer chinook salmon (Section 5.3.1).

Appendix D derived the estimated in-river survival in the reference operation for each case, as shown in Table 5.3. These estimates indicate that the habitat-related biological requirements of juveniles, as described in Section 1.2, are not being fully met.

**Table 5.3.** Estimates of in-river survival for juvenile MCR steelhead, derived from Appendix D.

| Major Pop. Group – Pop. (No. FCRPS Projects) | Range (percent) | Mean (percent) |
|---|---|---|
| Yakima River – Satus and Toppenish creeks, Naches River, and Upper Yakima River (4 FCRPS projects) | 28-63 | 50 |
| Walla Walla and Umatilla rivers – Touchet River and Walla Walla River (4 FCRPS projects) | 28-63 | 50 |
| Rock Creek (3 FCRPS projects) | 40-73 | 59 |
| Walla Walla and Umatilla rivers – Umatilla River (3 FCRPS projects including John Day pool) | 40-73 | 59 |
| John Day River – Upper Mainstem John Day River, South Fork John Day River, Middle Fork John Day River, North Fork John Day River, and Lower Mainstem John Day River (3 FCRPS projects) | 42-84 | 67 |
| Cascade Eastern Slope – Deschutes River Westside Tributaries and Deschutes River Eastside Tributaries (2 FCRPS projects) | 44-88 | 70 |
| Cascade Eastern Slope – Fifteen Mile Creek and Klickitat River (1 FCRPS project) | 64-95 | 84 |

These estimates are lower than estimated survival through free-flowing river sections, which are assumed to approximate the survival rate associated with properly functioning habitat conditions. The 2000 FCRPS Biological Opinion (Appendix A and Section Incidental Take Statement) estimated free-flowing survival to be approximately 91-99%, depending upon the number of dams each population passes.

Average adult survival estimated in the 2000 FCRPS Biological Opinion was 88-97%, depending upon the number of dams a population passes, with a per project survival rate of 96.8%. Recent (2001-2002) estimated average adult survival through the system, based on SR steelhead adult survival rates, is 95.9% (three dams), with a per-project survival rate of 98.6% (Appendix D).

### 5.3.8.2 Estuary and Plume Habitat Conditions

The status of the habitat in the estuary and plume for this yearling-type ESU is the same as that described for SR spring/summer chinook salmon (Section 5.3.1.2).

### 5.3.8.3 Tributary Habitat Conditions

The action area for Mid-Columbia River steelhead includes three subbasins which are proposed as conservation measures by Reclamation and are, consequently, included in the environmental baseline analysis.

***5.3.8.3.1 North Fork John Day River***. The USFS manages 31% of the lands, much of it in the higher elevations within the subbasin. Wilderness areas within the subbasin include the North Fork John Day Wilderness, Strawberry Wilderness, Black Canyon Wilderness, and Bridge Creek Wilderness. Large portions of the SFJD and NFJD are managed by the BLM under the John Day River Management Plan, completed in 2001.

All steelhead numbers for the North Fork John Day (NFJD) are believed to be wild fish, given that the small amount of straying of hatchery fish in the John Day system occurs in the lower mainstem of the river.

The NFJD River from Camas Creek upstream to its headwaters was designated in 1988 under the Wild and Scenic Rivers Act of 1968 as either "Wild, Scenic, or Recreational," depending on the reach. Most of these reaches are on the Umatilla and Wallowa Whitman National Forests. The NFJD plus the MFJD contribute 60% of the flow to the mainstem John Day River. According to the ODEQ, the NFJD has some of the best overall chemical, physical, and biological water quality in the John Day subbasin.

The ODEQ has identified several streams in the NFJD River watershed as water quality limited for sediment, high temperatures, and/or biological criteria, primarily because of vegetation disturbance, stream straightening/relocation, livestock grazing, timber harvest, road building, irrigation water withdrawals, and historical mining and dredging. In addition, fire suppression practices have affected both the composition and structure of forestlands in the subbasin. Use of ground-based logging equipment on steep (greater than 30%) slopes and high road densities often contribute sediment to streams, adversely impacting steelhead spawning and rearing areas.

Past or ongoing livestock management practices that result in high intensity riparian grazing and/or season-long use of riparian areas cause bank destabilization, excessive sedimentation, and increased stream temperatures, because the width-to-depth ratio of the channel is increased when livestock trample banks, collapsing those that are undercut.

A high number of pushup dams are used for irrigation, with some of these temporary dams resulting in intermittent passage and interrelated impacts such as sedimentation, reduced flows, channel alteration, and associated water quality impacts (NWPPC 2001). Additionally, there are still many state-authorized water diversions that are unscreened or have screens that do not meet current NOAA or state screen criteria (NWPPC 2001).

The Draft John Day Subbasin Plan (NPCC 2004a) described the primary limiting factors for fish species (including steelhead) in the NFJD: temperature was identified as a limiting factor throughout the North Fork, flow, habitat diversity, sediment load, and key habitat quantity are limiting factors in all but one of the fifth-field watersheds, channel stability was identified as a limiting factor in over half of the fifth-field watersheds in the North Fork John Day subbasin.

NOAA's PCTS identified 3 formal consultations completed since December 2000 for actions in the North Fork John Day subbasin (USGS HUC 17070202). These actions addressed Federal land grazing management and a suite of ecosystem projects with variable short and long-term effects on the following limiting factors in this subbasin, water quality and riparian condition.

No FCRPS Action Agency consultations were listed in the PCTS for this subbasin. Two consultations addressed Federal lands grazing management in a manner that would keep reach-scale habitat degradation to a minimum and improve aquatic habitat condition over the long-term on tributaries exposed to these Federal grazing actions. The Forest Service also completed consultation on Tower Ecosystem Restoration Projects (TERP). The activities proposed in the TERP included planting, trail relocation, slope stabilization, hazard tree removal, thinning, fencing, road repair, road obliteration/decommissioning, fish habitat improvement, soil compaction reduction, big game forage enhancement, recreation site rehabilitation, fuel reduction and wood fiber salvage, and herbicide application. NOAA that these actions will cause some short-term increases in stream turbidity and sedimentation rates in watersheds located within the action area. However, the actions are not expected to impair currently properly functioning habitats, appreciably reduce the functioning of already impaired habitats, or retard the long-term progress of impaired habitats toward proper functioning habitat condition.

Based on this review, there will be slight effects, both adverse and beneficial, to factors limiting listed salmonids at the reach scale in the North Fork John Day subbasin.

***5.3.8.3.2 Middle Fork John Day River***. The 75 miles of Middle Fork John Day River (MFJD) drain approximately 506,853 acres, of which 53% are within USFS ownership. Since the 1960s, the USFS has conducted harvest activities on over 25% of its lands in the MFJD subbasin. Elevations range from 8,110 feet at its headwaters within the Elkhorn Mountains to 2,185 feet where it joins the Mainstem John Day River. Over 90% of the appropriated water in the MFJD sub-basin goes to irrigation and mining, with half of the mining water rights being authorized post-1970. Within three subwatersheds of the MFJD (Galena, Upper Middle Fork, and Camp Creek), there exist a total of 113 mining sites: two tunnel mines, 39 placer claims, and 72 lode claims. Road density of this watershed is considered high, as it averages 3.56 mi/mi$^2$. The MFJD is listed under Oregon's Clean Water Act 303(d) as a water quality limited streams for high summer temperatures and flow modification (irrigation) (USDA 2001 MFJD Biological Assessment; NPCC 2004a).

The John Day River probably represents the largest native, naturally spawning stock of steelhead in the region (NMFS 2000). All steelhead numbers for the Middle Fork John Day River are believed to be wild fish, given that the small amount of straying of hatchery fish that does occur in the John Day system occurs in the lower mainstem of the river. The NFJD plus the MFJD contribute 60% of the flow to the mainstem John Day River. The area historically supported healthy riparian and upland areas, good water quality, and a natural hydrograph.

ODEQ has identified several streams in the MFJD River watershed as water quality limited for high temperatures, dissolved oxygen, or biological criteria, with the most serious water quality problem being elevated summer temperatures caused by vegetation disturbance, stream straightening/relocation, livestock grazing, timber harvest, road building, irrigation water withdrawals, and historical mining and dredging. In addition, fire suppression practices have affected both the composition and structure of forestlands in the subbasin. Use of ground-based logging equipment on steep (greater than 30%) slopes and high road densities often contribute sediment to streams, adversely impacting steelhead spawning and rearing areas.

Past or ongoing livestock management practices that result in high intensity riparian grazing and/or season-long use of riparian areas cause bank destabilization, excessive sedimentation, and increased stream temperatures, because the width-to-depth ratio of the channel is increased when livestock trample banks, collapsing those that are undercut. Heavy and often summer-long grazing has resulted in several areas in the upper reaches of the MFJD River now lacking adequate riparian vegetation and shrubs necessary to prevent bank erosion and an increase of instream water temperatures.

A high number of pushup dams are used for irrigation. Some of these temporary dams result in intermittent passage and interrelated impacts such as sedimentation, reduced flows, channel alteration, and associated water quality impacts (NWPPC 2001). Additionally, there still exist many legal water diversions which remain unscreened or have screens that do not meet current NOAA screen criteria (NWPPC 2001).

Many parts of the mainstem Middle Fork were dredge-mined (particularly near Galena at RM 45 and near the mouth of Granite Boulder Cr at RM 57), and several tributaries (such as Davis, Vincent, Vinegar, Ruby, Ragged and Butte creeks, among others) were placer-mined.

The Draft John Day Subbasin Plan (NPCC 2004a) described the primary limiting factors for fish species (including steelhead) in the MFJD: flow, habitat diversity, temperature, and key habitat quantity were identified as limiting factors throughout the Middle Fork John Day River, sediment load and channel stability were found to be limiting factors in all but one of the fifth-field watersheds.

NOAA's PCTS identified 4 formal and informal consultations completed since December 2000 for actions in the Middle Fork John Day subbasin (USGS HUC 17070203). These actions addressed emergency fire suppression, grazing management on Federal lands, and culvert restoration with variable short and long-term effects on the following limiting factors in this subbasin, instream flow and passage.

Reclamation completed consultation on the Grant County SWCD Irrigation Diversion and Fish Passage Improvement Program. Reclamation coordinated with SWCD, CTWS to implement this action which in parts of the John Day mainstem, MFJD, as well as Camp Creek and Long Creek of MFJD. A total of 14 actions were proposed including elimination of 3 push-up berms; open ditch conversion to pipeline; installation of 4 infiltration galleries; 2 lay-flat stantion diversions; and 2 miles of riparian fencing. This project is likely to improve flow and passage conditions with some benefit to riparian condition. Two consultations addressed Federal lands grazing management in a manner that would keep reach-scale habitat degradation to a minimum and improve aquatic habitat condition over the long-term on tributaries exposed to these Federal grazing actions. The Forest Service also consulted on the Blue Culverts Project, Malheur National Forest; an action to replace or improve six road crossings to facilitate fish passage and to restore natural stream- channel morphology at the crossings. The action is expected to reduce chronic sediment inputs in the long term, improve fish passage in the action area, and maintain the current condition of all other relevant habitat indicators. An emergency fire suppression action with minimal effects was also listed for this subbasin.

Based on this review, there will be slight effects, both adverse and beneficial, to factors limiting listed salmonids at the reach scale in the Middle Fork John Day subbasin. In the aggregate, the distribution and scope of these projects will not measurably affect the status of the environmental baseline in this portion of the action area.

***5.3.8.3.3 John Day River Upper Mainstem and South Fork John Day.*** The upper mainstem John Day River area historically had healthy riparian and upland areas, good water quality, and a natural hydrograph. Much of the degradation tied to mining activities is not associated with current activities.

ODEQ has identified several streams in the Upper John Day River and the SFJD River watershed as water quality limited for high temperatures, dissolved oxygen, or biological criteria, with the most serious water quality problem being elevated summer temperatures caused by vegetation disturbance, stream straightening/relocation, livestock grazing, timber harvest, road building, and irrigation water withdrawals. In addition, fire suppression practices have affected both the composition and structure of forestlands in the subbasin.

Agricultural practices have changed hydrology, contributing to degraded stream and riparian conditions throughout the subbasin. Draining and conversion of wetlands to pastures, diking and channelization of streams, and removal of extensive beaver colonies and large trees in the riparian corridor have all had adverse effects on the river's interaction with its floodplain (NPCC 2004a).

Steelhead in the upper mainstem can become seasonally isolated due to high water temperatures and reduced flows in the connecting mainstems. Multiple agricultural diversions on Strawberry Creek prevent all upstream fish passage. A section of Indian Creek is virtually dewatered during the summer.

Mining activity in the upper mainstem John Day River was extensive in the past and included large-scale dredging of the upper John Day River and lode mines in the Canyon Creek watershed and above Prairie City. Although active claims exist in a number of tributaries, the majority of current activity consists of small-scale placer mining along area streams, such as Canyon Creek. It is believed that if the price of precious metals increased significantly, mining activities would increase, as well.

All steelhead numbers for the South Fork John Day are believed to be wild fish, given that the small amount of straying of hatchery fish that does occur in the John Day system occurs in the lower mainstem of the river.

The South Fork John Day River from Smokey Creek upstream to the Malheur National Forest boundary was classified in 1988 as "Recreational" under the Wild and Scenic Rivers Act of 1968 and is managed by BLM. The area historically supported healthy riparian and upland areas, good water quality, and a natural hydrograph. However, habitat condition is degraded at present.

The ODEQ has identified several streams in the Upper John Day River and the SFJD River watershed as water quality limited for high temperatures, dissolved oxygen, or biological criteria, with the most serious water quality problem being elevated summer temperatures caused by vegetation disturbance, stream straightening/relocation, livestock grazing, timber harvest, road building, and irrigation water withdrawals. In addition, fire suppression practices have affected both the composition and structure of forestlands in the subbasin.

The Draft John Day Subbasin Plan (NPCC 2004a) described the primary limiting factors for fish species (including steelhead) in the SFJD: key habitat quantity, flow, and temperature are the greatest limiting factors on the South Fork John Day River. These factors are rated as moderate or high, channel stability, habitat diversity, and sediment load are also severe limiting factors. Half of the fifth-field watersheds are rated high for all three of these factors, and obstructions range from high to low throughout the South Fork John Day River, averaging moderate.

NOAA's PCTS identified 13 formal and informal consultations completed since December 2000 for actions in the Upper John Day subbasin (USGS HUC 17070201). These actions addressed fire suppression, timber management, grazing management, water diversions and habitat restoration. These projects are expected to have varying short- and long-term effects on instream flow, passage, and riparian conditions.

BPA, in cooperation with CTWSRO, was the lead agency on three consultations in the Upper John Day subbasin:

- In 2002, consulted on the proposed John Day Watershed Program 2002 program. All of the proposed projects were improvements to irrigation diversions or to existing irrigation systems. NOAA expects actions that will replace gravel push-up berms with infiltration galleries to lead to improved fish passage conditions. These will benefit both juveniles rearing in these reaches, which are swimming upstream to find cool water in the spring, and out-migrating smolts. There may be short-term negative effects of sedimentation in the various watersheds, but fish passage will be improved (long-term benefit) at many of the project sites.

- In 2003, consulted on nine projects to improve fish passage and other habitat features while continuing to provide irrigation for legal water withdrawals. Although these projects are expected to have short-term negative effects on the stream, the long-term reach-level effects should improve conditions.

- In 2004, consulted on actions to construct four permanent diversion structures to eliminate the need for annual push-up gravel berms, and to install a pumping station to eliminate the need for an annual push-up gravel berm. The diversion structures and pump station are designed to improve the effectiveness of the diversion while providing fish passage and eliminating the need for annual streambed disturbance from reforming the push-up berms. The proposed action is expected to improve habitat access and reduce chronic sedimentation and passage will be provided at diversion structures, which may have been partial barriers in the past.

NOAA has completed seven consultations on grazing management with the Forest Service and Bureau of Land Management. Actions in these consultations contain conservation measures for FS and BLM grazing programs on tributary streams sufficient to keep reach scale habitat degradation to a minimum and to provide long-term improvements to aquatic habitat indicators such as water temperature, sediment, substrate embeddedness, width/depth ratio, and streambank condition on tributary streams. BLM also completed consultation on the Little Canyon Mountain Timber Sale and Stewardship Project. This action included fuels reduction, road relocation and resurfacing, road closures and culvert replacement. This project will have a long-term, positive effect on habitat condition delineated by this action. Restoring access to a watershed that MCR steelhead currently attempt to use is expected to increase the abundance of spawners and to benefit the population's spatial structure. Other consultations included one with the Farm Service Administration for a CREP project. Lastly, a USFS emergency fire suppression action with minimal effects completed consultation.

Based on this review, there will be slight effects, both adverse and beneficial, to factors limiting listed salmonids at the reach scale in the Upper John Day subbasin.

#### 5.3.8.4 Harvest Rates

The MCR steelhead ESU comprises primarily of A-run summer populations, but there are also two or three winter-run populations in the ESU. Mainstem harvest rates are covered by both the 2004 Fall Agreement and the 2001 Interim Agreement on winter/spring/summer fisheries (Tables 5.1 and 5.2 and Appendix C). In recent years, non-Indian winter and spring season mainstem fisheries have been subject to a 2% harvest rate limit on winter steelhead (Appendix C). Because of their timing and location, additional impacts to winter-run populations from the treaty Indian fisheries above Bonneville Dam are negligible (less than 2%). Harvest rates expected to occur in the action area in the next few years are shown in Tables 5.1 and 5.2.

#### 5.3.8.5 Artificial Propagation Programs

Existing artificial propagation programs for MCR steelhead and their effects on VSP parameters are described in Appendix F.

### 5.3.9 Upper Willamette Steelhead

#### 5.3.9.1 Mainstem

Juvenile UWR steelhead migrate as yearlings, entering the action area at the mouth of the Willamette River, at approximately RM 100 in the lower Columbia River during spring. The primary factors affecting the status of this stream-type ESU as juveniles move through the estuary and plume are avian predation and flow (Section 5.3.1; Fresh *et al.* 2004). The status of biological requirements for water quality, quantity, and velocity in adult migration corridors is the same as those discussed for SR spring/summer chinook salmon (Section 5.3.1).

#### 5.3.9.2 Tributary Habitat Conditions

The Action Agencies have not proposed offsetting measures for effects of the hydrosystem on tributary habitat used by this ESU. Therefore, tributary subbasins are not within the action area for this consultation.

#### 5.3.9.3 Harvest Rates

Mainstem harvest rates for UWR chinook salmon are covered by the 2001 Interim Agreement on winter/spring/summer fisheries (Table 5.1) and are considered in the associated biological opinion (Appendix C). Harvest rates expected to occur in the action area in the next few years are shown in Table 5.1.

#### 5.3.9.4 Artificial Propagation Programs

Existing artificial propagation programs for UWR steelhead and their effects on VSP parameters are described in Appendix F.

### 5.3.10 Lower Columbia River Steelhead

#### 5.3.10.1 Mainstem

Juvenile LCR steelhead are yearling migrants, moving through the mainstem lower Columbia River during spring. Smolts emerging from the Hood and Wind rivers pass Bonneville Dam. The status of biological requirements for this ESU related to mainstem habitat and in the estuary and plume is discussed for SR spring/summer chinook salmon (Section 5.3.1). The status of biological requirements for water quality, quantity, and velocity in adult migration corridors is also the same as those discussed for SR spring/summer chinook salmon (Section 5.3.1).

Appendix D estimated that juvenile inriver survival through the lower Columbia River reach in the reference operation ranged from 64 to 95% during 1994-2003 with a mean of nearly 84%. These estimates indicate that the habitat-related biological requirements of juveniles, as described in Section 1.2, are not being fully met. These Hood and Wind River population estimates are lower than estimated survival through free-flowing river sections, which are assumed to approximate the survival rate associated with properly functioning habitat conditions. The 2000 FCRPS Biological Opinion (Appendix A and Incidental Take Statement) estimated free-flowing survival to be approximately 99%. This estimate includes the effect of latent mortality for inriver migrants.

Average adult survival estimated in the 2000 FCRPS Biological Opinion was 97% for populations passing Bonneville Dam. Recent (2001-2002) adult survival estimate, based on SR steelhead per project survival rates, is 98.6% (Appendix D).

#### 5.3.10.2 Estuary and Plume Habitat Conditions

The status of the habitat in the estuary and plume for this yearling-type ESU is the same as that described for SR spring/summer chinook salmon (Section 5.3.1.2).

#### 5.3.10.3 Tributary Habitat Conditions

The Action Agencies have not proposed offsetting measures for effects of the hydrosystem on tributary habitat used by this ESU. Therefore, tributary subbasins are not within the action area for this consultation.

#### 5.3.10.4 Harvest Rates

The LCR steelhead ESU includes both A-run summer and winter populations. Mainstem harvest rates are covered primarily by the 2001 Interim Agreement on winter/spring/summer fisheries (Table 5.1) and are considered in the associated biological opinion. In recent years, non-Indian winter and spring season fisheries have been subject to a 2% harvest rate limit on winter steelhead (Appendix C). Because of their timing and location, impacts to winter run populations from the treaty Indian fisheries above Bonneville Dam are probably less than 2%. Harvest rates expected to occur in the action area in the next few years are shown in Tables 5.1 and 5.2.

#### 5.3.10.5 Artificial Propagation Programs

Existing artificial propagation programs for LCR steelhead and their effects on VSP parameters are described in Appendix F.

### 5.3.11 Columbia River Chum Salmon

#### 5.3.11.1 Mainstem

Juvenile CR chum salmon are subyearling migrants, moving through the mainstem lower Columbia River during late winter and early spring. The status of biological requirements of juvenile chum salmon for water quality in the mainstem migration corridor is the same as those discussed for SR spring/summer chinook salmon (Section 5.3.1). Although chum salmon spawned historically in the lower reaches of several tributaries to the Bonneville pool and along the Washington shoreline, this habitat was inundated by the Bonneville pool in 1938 (Fulton 1970). Spawner surveys since 2000 have seen only one adult chum salmon carcass in this area (Big White Salmon River). Thus, it is unlikely that any year class is affected by project passage.

Water stored in upper Columbia and Snake river reservoirs can be used to augment mainstem flows below Bonneville Dam, creating access to and increasing the extent of spawning habitat in the Ives Island area. Hydro system reservoir operations do not affect temperatures in the Ives Island area during November and December, when chum salmon spawn.

The Action Agencies can use reservoir storage from the upper Columbia and Snake river basins to augment mainstem flows below Bonneville Dam, creating access to and increasing the areal extent of spawning habitat in the Ives Island area. Both flow and spill operations at Bonneville Dam have been managed to protect chum salmon since 1999. Beginning approximately November 1, the Action Agencies provide some operations to maintain minimum tailwater elevations at Bonneville to establish and protect redds, although the extent of these operations depends on the hydrologic forecasts and the ability to implement other seasonal operations. Efforts are also made to limit spill to a level which would not exceed 105% over established redds. These efforts to protect chum also confer protection to established LCR chinook redds and emergent fry.

Adult CR chum salmon do not have biological requirements for food, cover, shelter, or riparian vegetation associated with spawning habitat. Reservoir storage does not affect temperatures in the Ives Island area during November and December, when chum salmon spawn.

The primary factors affecting the status of this ocean-type ESU as juveniles move through the lower Columbia River are flow and the associated reduction of shallow water habitat (Section 5.1.2; Fresh *et al.* 2004).

#### 5.3.11.2 Estuary and Plume Habitat Conditions

The status of the habitat in the estuary and plume for this subyearling-type ESU is the same as that described for LCR chinook salmon (Section 5.3.5.2).

#### 5.3.11.3 Tributary Habitat Conditions

The Action Agencies have not proposed offsetting measures for effects of the hydrosystem on tributary habitat used by this ESU. Therefore, tributary subbasins are not within the action area for this consultation.

#### 5.3.11.4 Harvest Rates

Mainstem harvest rates for CR chum chinook salmon are covered by the 2004 Fall Agreement (Table 5.2) and are considered in the associated biological opinion. In recent biological opinions, the harvest rate on CR chum in mainstem fisheries has been limited to a maximum of 5% (Appendix C). Harvest rates expected to occur in the action area in the next few years are shown in Table 5.2.

#### 5.3.11.5 Artificial Propagation Programs

Existing artificial propagation programs for CR chum salmon and their effects on VSP parameters are described in Appendix F.

### 5.3.12 Snake River Sockeye Salmon

#### 5.3.12.1 Mainstem

Juvenile SR sockeye salmon are yearling migrants, with peak movement past Lower Granite Dam during May. Although there are no empirical data, the primary factors affecting the status of this stream-type ESU as juveniles move through the estuary and plume are likely to be avian and cormorant predation and flow (Section 5.3.1; Fresh *et al*. 2004). Due to similarities in the timing and size of fish at migration, NOAA assumes that survival rates described for SR spring/summer chinook salmon (Section 5.3.1) can be used to generally characterize this ESU.

Average adult survival estimated in the 2000 FCRPS Biological Opinion was 86%.

#### 5.3.12.2 Estuary and Plume Habitat Conditions

The status of the habitat in the estuary and plume for this yearling-type ESU is the same as that described for SR spring/summer chinook salmon (Section 5.3.1.2).

#### 5.3.12.3 Tributary Habitat Conditions

As described in Appendix E, habitat in the mainstem Salmon River between the confluences of the North Fork Salmon and Pahsimeroi rivers is limited by a modified hydrologic regime, inadequate pool/riffle ratios, and structural migration barriers (NWPCC 2004). Tributaries are disconnected by irrigation diversions that reduce instream flows and eliminate most thermal refugia used by sockeye salmon smolts migrating in the mainstem Salmon River between the cities of Salmon and Challis, Idaho. The natural hydrologic regime in the upper mainstem Salmon River is also altered by water withdrawals. Effects include a reduction in base flow conditions and some modifications to flow timing (NWPCC). Sockeye survival declines significantly with decreases in mean flows in the Salmon River during May (Arthaud *et al.* 2004).

Sockeye salmon enter irrigation systems when the systems are turned on before fish screens are in place, when diversions and control structures are in operation, and when there is “backdoor access” provided by wastewater return flows and breeched ditches. Upon entering a hydrologically variable irrigation system, fish are subject to threats from dewatering such as increased temperatures, reduced forage, increased predation, and desiccation (NWPCC 2004).

The diversion and subsequent return of irrigation water and reductions in riparian shading represent the primary factors contributing to increased temperatures in the mainstem Salmon River from the 12-mile section upstream to Challis (NWPCC 2004). Along the Salmon River, diking, alluvial groundwater pumping, and encroachment by residential and road development have reduced access to sloughs, side channels, and springs that are heavily influenced by cooler groundwater sources, compounding the thermal stresses of the mainstem and reducing the area of thermal refugia along the migratory route. Legacy forestry, irrigation, and existing grazing and forestry practices have also contributed to major tributary warming, which in turn results in warming of the mainstem Salmon River. Chemical contamination including inputs of heavy metals and other toxics from historical and extant mining districts in the Yankee Fork and Panther Creek drainages may also interfere with the extraordinary migrations and homing of the Redfish Lake population of Snake River sockeye salmon between Idaho and the Pacific Ocean.

#### 5.3.12.4 Harvest Rates

Mainstem harvest rates for SR sockeye are covered by both the 2004 Fall Agreement and the 2001 Interim Agreement on winter/spring/summer fisheries (Tables 5.1 and 5.2 and Appendix C). Sockeye are infrequently caught in Columbia River mainstem recreational fisheries, because they rarely strike lures or bait. Small numbers of sockeye are taken in Tribal mainstem fisheries. SR sockeye salmon are caught in spring and summer season fisheries in the mainstem Columbia River. Allowable harvest rates have been limited to 8% in recent years, but actual harvest rates have ranged between 5 and 15% over the last five years (Appendix C). Harvest rates expected to occur in the action area in the next few years are shown in Tables 5.1 and 5.2.

#### 5.3.12.5 Artificial Propagation Programs

Existing artificial propagation programs for SR sockeye salmon and their effects on VSP parameters are described in Appendix F.

### 5.3.13 Lower Columbia River Coho Salmon

#### 5.3.13.1 Mainstem

Lower Columbia River coho salmon migrate through the lower mainstem Columbia River both as yearling and subyearlings. The primary factors affecting the status of this ESU as juveniles move through the estuary and plume vary with life history strategy (Fresh *et al.* 2004).

NOAA does not know of any empirical information on survival through the Bonneville pool and dam for this ESU. However, assuming that survival is similar to that demonstrated by other yearling migrants such as SR yearling chinook, survival past Bonneville Dam in the reference operation is estimated to range from 83-95%, with a mean survival of over 89%. These estimates indicate that the habitat-related biological requirements of juveniles, as described in Section 1.2, are not being fully met. This estimated survival rate is lower than the estimated survival through a free-flowing river. The 2000 FCRPS Biological Opinion (Appendix A and Incidental Take Statement) estimated free-flowing survival to be approximately 98% for yearling chinook.

Recent (2001-2002) adult survival estimate, based on SR fall chinook per project survival rates, is 97.6% passing Bonneville Dam (Appendix D).

#### 5.3.13.2 Estuary and Plume Habitat Conditions

The status of the habitat in the estuary and plume for this yearling-type ESU is the same as that described for SR spring/summer chinook salmon (Section 5.3.1.2).

#### 5.3.13.3 Tributary Habitat Conditions

The Action Agencies have not proposed offsetting measures for effects of the hydrosystem on tributary habitat used by this ESU. Therefore, tributary subbasins are not within the action area for this consultation.

#### 5.3.13.4 Harvest Rates

Mainstem harvest rates for LCR coho chinook salmon are covered by the 2004 Fall Agreement (Table 5.2) and are considered in the associated biological opinion. LCR coho are harvested primarily in commercial and recreational fisheries below Bonneville Dam, where the combined (hatchery- and natural-origin) harvest rate has ranged from 2 to 9% (average = 6%) over the last five years (Appendix C). Early-run populations tend to be subject to higher harvest rates than late-run populations. Harvest rates expected to occur in the action area in the next few years are shown in Table 5.2.

#### 5.3.13.5 Artificial Propagation Programs

*Not available for this draft.*

## 5.4 ADEQUACY OF CONDITIONS IN DESIGNATED CRITICAL HABITAT

Essential features of designated critical habitat (i.e., for three ESUs of SR salmon) include substrate, water quality, water quantity, water temperature, food, riparian vegetation, access, water, velocity, space, and safe passage. The status of these features in currently designated critical habitat is similar to the conditions described in Sections 5.3.1 (SR spring/summer chinook), 5.3.2 (SR fall chinook), and 5.3.12 (SR sockeye salmon).