ATTACHMENT A

BIOLOGICAL REQUIREMENTS, CURRENT STATUS, AND TRENDS:

SNAKE RIVER STEELHEAD

A. General Life History

Steelhead can be divided into two basic run-types based on the state of sexual maturity at the time of river entry and the duration of the spawning migration (Burgner et al. 1992). The stream-maturing type, or summer steelhead, enters fresh water in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type, or winter steelhead, enters fresh water with well-developed gonads and spawns shortly after river entry (Barnhart 1986). Variations in migration timing exist between populations. Some river basins have both summer and winter steelhead, while others only have one run-type.

In the Pacific Northwest, summer steelhead enter fresh water between May and October (Busby et al. 1996; Nickelson et al. 1992). During summer and fall, prior to spawning, they hold in cool, deep pools (Nickelson et al. 1992). They migrate inland toward spawning areas, overwinter in the larger rivers, resume migration in early spring to natal streams, and then spawn (Meehan and Bjornn 1991; Nickelson et al. 1992). Winter steelhead enter fresh water between November and April (Busby et al. 1996; Nickelson et al. 1992), migrate to spawning areas, and then spawn in late winter or spring. Some adults, however, do not enter coastal streams until spring, just before spawning (Meehan and Bjornn 1991). Difficult field conditions (snowmelt and high stream flows) and the remoteness of spawning grounds contribute to the relative lack of specific information on steelhead spawning.

Steelhead are iteroparous, or capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying and most that do so are females (Nickelson et al. 1992). Iteroparity is more common among southern steelhead populations than northern populations (Busby et al. 1996). Multiple spawnings for steelhead range from 3% to 20% of runs in Oregon coastal streams.

Steelhead spawn in cool, clear streams containing suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986; Everest 1973). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation. Cover, in the form of overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, and turbidity (Giger 1973) are required to reduce disturbance and predation of spawning steelhead. Summer steelhead usually spawn further upstream than winter steelhead (Withler 1966; Behnke 1992).

Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months (August 9, 1996, 61 FR 41542) before hatching. Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson et al. 1992).

Juveniles rear in fresh water from 1 to 4 years, then migrate to the ocean as smolts. Winter steelhead populations generally smolt after 2 years in fresh water (Busby et al. 1996). Steelhead typically reside in marine waters for 2 or 3 years prior to returning to their natal stream to spawn at 4 or 5 years of age. Populations in Oregon and California have higher frequencies of age-1-ocean steelhead than populations to the north, but age-2-ocean steelhead generally remain dominant (Busby et al. 1996). Age structure appears to be similar to other west coast steelhead, dominated by 4-year-old spawners (Busby et al. 1996).

Based on purse seine catches, juvenile steelhead tend to migrate directly offshore during their first summer rather than migrating along the coastal belt as do salmon. During fall and winter, juveniles move southward and eastward (Hartt and Dell 1986).

B. Population Dynamics and Distribution

The following section provides specific information on the distribution and population structure (size, variability, and trends of the stocks or populations) of the Snake River ESU. Most of this information comes from observations made in terminal, freshwater areas, which may be distinct from the action area. This focus is appropriate because the species status and distribution can only be measured at this level of detail as adults return to spawn.

The longest consistent indicator of steelhead abundance in the Snake River Basin is based on counts of natural-origin steelhead at the uppermost dam on the lower Snake River (Lower Granite Dam). The abundance of natural-origin summer steelhead at the uppermost dam on the Snake River has declined from a 4-year average of 58,300 in 1964 to an average of 8,300 ending in 1998. In general, steelhead abundance declined sharply in the early 1970s, rebuilt modestly from the mid-1970s through the 1980s, and again declined during the 1990s (Figure 1).

These broad scale trends in the abundance of steelhead were reviewed through the Plan for analyzing and testing hypotheses (PATH) process. The PATH report concluded that the initial, substantial decline coincided with the declining trend in downstream passage survival. However, the more recent decline in abundance, observed over the last decade or more, does not coincide with declining passage survival, but can be at least partially accounted for by a shift in climatic regimes that has affected ocean survival (Marmorek and Peters 1998).

B-run steelhead are distinguished from the A-run component by their unique life history characteristics. B-run steelhead were traditionally distinguished as larger and older, later-timed fish that return primarily to the South Fork Salmon, Middle Fork Salmon, Selway, and Lochsa rivers. The recent All Species Review by the Technical Advisory Committee (TAC) concluded that different populations of steelhead do have different size structures, with populations dominated by larger fish (i.e., greater than 77.5 cm) occurring in the traditionally defined B-run basins (TAC 1999). Larger fish occur in other populations throughout the basin, but at much lower rates (evidence suggests that fish returning to the Middle Fork Salmon and Little Salmon are intermediate in that they have a more equal distribution of large and small fish).

B-run steelhead are also generally older. A-run steelhead are predominately age-1-ocean fish, whereas most B-run steelhead generally spend two or more years in the ocean prior to spawning. The differences in ocean age are primarily responsible for the differences in the size of A- and B-run steelhead. However, B-run steelhead are also thought to be larger at the same age than A-run fish. This may be due, in part, to the fact that B-run steelhead leave the ocean later in the year than A-run steelhead and thus have an extra month or more of ocean residence at a time when growth rates are thought to be greatest.

Historically, a distinctly bimodal pattern of freshwater entry could be used to distinguish A-run and B-run fish. A-run steelhead were presumed to cross Bonneville Dam from June to late August whereas B-run steelhead enter from late August to October. The TAC reviewed the available information on timing and confirmed that the majority of large fish do still have a later timing at Bonneville; 70% of the larger fish crossed the dam after August 26, the traditional cutoff date for separating A- and B-run fish (TAC 1999). However, the timing of the early part of the A-run has shifted somewhat later, thereby reducing the timing separation that was so apparent in the 1960s and 1970s. The timing of the larger, natural-origin B-run fish has not changed.

The abundance of A-run versus B-run components of Snake River Basin steelhead can be distinguished in data collected since 1985. Both components have declined through the 1990s, but the decline of B-run steelhead has been more significant. The 4-year average counts at Lower Granite Dam declined from 18,700 to 7,400 beginning in 1985 for A-run steelhead and from 5,100 to 900 for B-run steelhead. Counts over the last 5 or 6 years have been stable for A-run steelhead and without significant trend (Figure 2). Counts for B-run steelhead have been low and highly variable, but also without apparent trend (Figure 3).

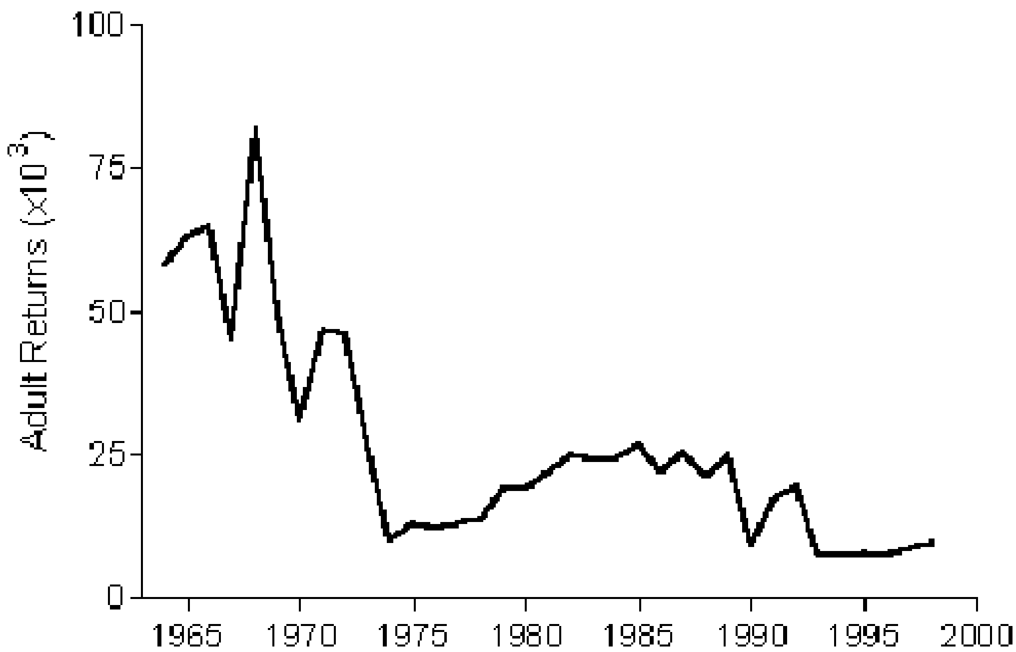
Comparison of recent dam counts with escapement objectives provides perspective regarding the status of the ESU. The management objective for Snake River steelhead stated in the Columbia River Fisheries Management Plan was to return 30,000 natural/wild steelhead to Lower Granite Dam. The All Species Review (TAC 1997) further clarified that this objective was subdivided into 20,000 A-run and 10,000 B-run steelhead. Idaho has reevaluated these escapement objectives using estimates of juvenile production capacity. This alternative methodology lead to revised estimates of 22,000 for A-run and 31,400 for B-run steelhead (pers. comm., S. Keifer, Idaho Department of Fish and Game with P. Dygert, NOAA's National Marine Fisheries Service).

The State of Idaho has conducted redd count surveys in all of the major subbasins since 1990. Although the surveys are not intended to quantify adult escapement, they can be used as indicators of relative trends. The sum of redd counts in natural-origin B-run production subbasins declined from 467 in 1990 to 59 in 1998 (Figure 4). The declines are evident in all four of the primary B-run production areas. Index counts in the natural-origin A-run production areas have not been conducted with enough consistency to permit similar characterization.

Idaho has also conducted surveys for juvenile abundance in index areas throughout the Snake River Basin since 1985. Parr densities of A-run steelhead have declined from an average of about 75% of carrying capacity in 1985 to an average of about 35% in recent years through 1995 (Figure 5). Further declines were observed in 1996 and 1997. Parr densities of B-run steelhead have been low, but relatively stable since 1985, averaging 10% to 15% of carrying capacity through 1995. Parr densities in B-run tributaries declined further in 1996 and 1997 to 11% and 8%, respectively.

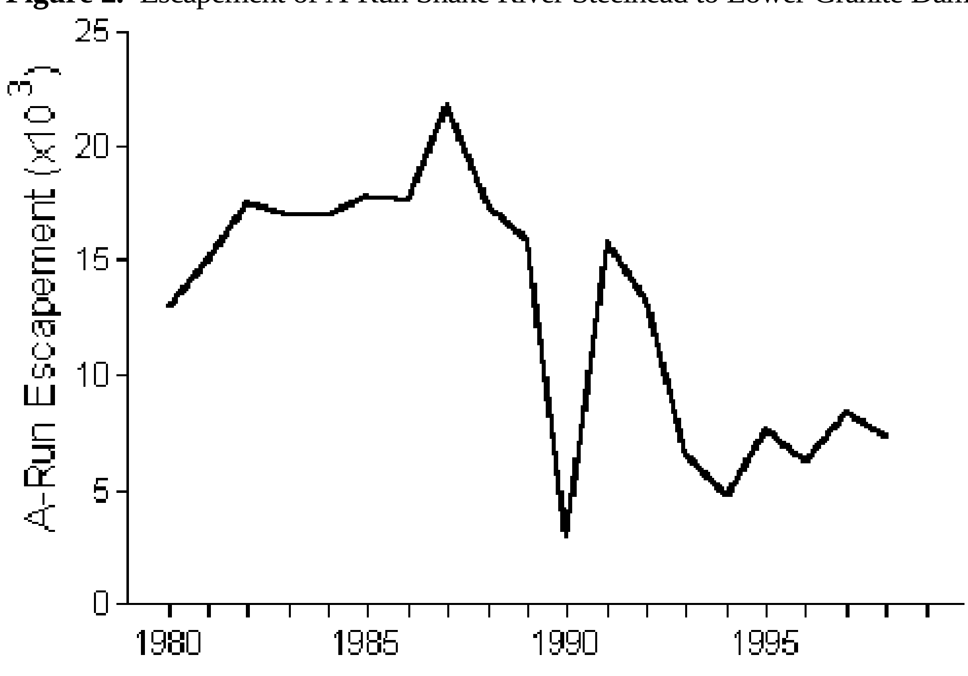
It is apparent from the available data that B-run steelhead are much more depressed than the A-run component. In evaluating the status of the Snake River Basin steelhead ESU, it is pertinent to consider if B-run steelhead represent a "significant portion" of the ESU. This is particularly relevant because the Tribes have proposed to manage the Snake River Basin steelhead ESU as a whole without distinguishing between components, and further, that it is inconsistent with NOAA's National Marine Fisheries Service (NOAA Fisheries) authority to manage for components of an ESU.

Figure 1. Adult Returns of Wild Summer Steelhead to Lower Granite Dam on the Snake River.



Source: Escapement through 1995 from TAC (1997); escapement for 1996–1998 from pers. comm. G. Mauser (IDFG).

Figure 2. Escapement of A-Run Snake River Steelhead to Lower Granite Dam.



Source: Data for 1980 through 1984 from Figures 1 and 2 of Section 8 in TAC (1997). Data for 1985 through 1998 from Table 2 of Section 8
(TAC 1997) and pers. comm . G. Mauser, (IDFG).

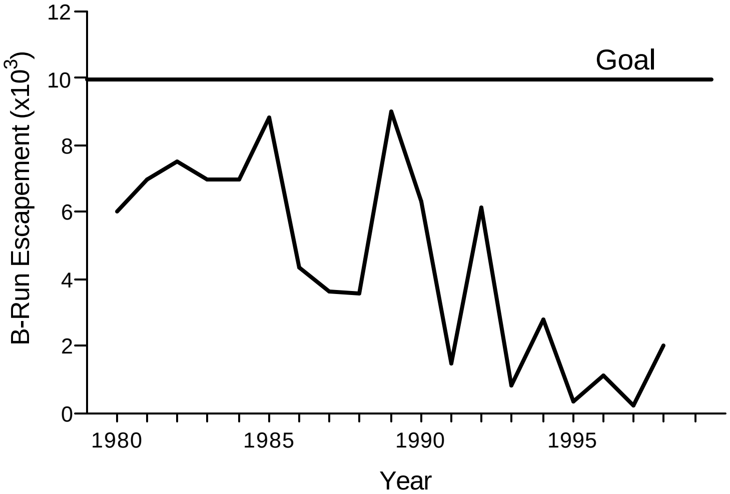


Figure 3. Escapement of B-Run Snake River Steelhead to Lower Granite Dam.

Source: Data for 1980 through 1984 from Figures 1 and 2 of Section 8 in TAC (1997). Data for 1985 through 1998 from Table 2 of Section 8 (TAC 1997) and pers. comm. G. Mauser (IDFG).

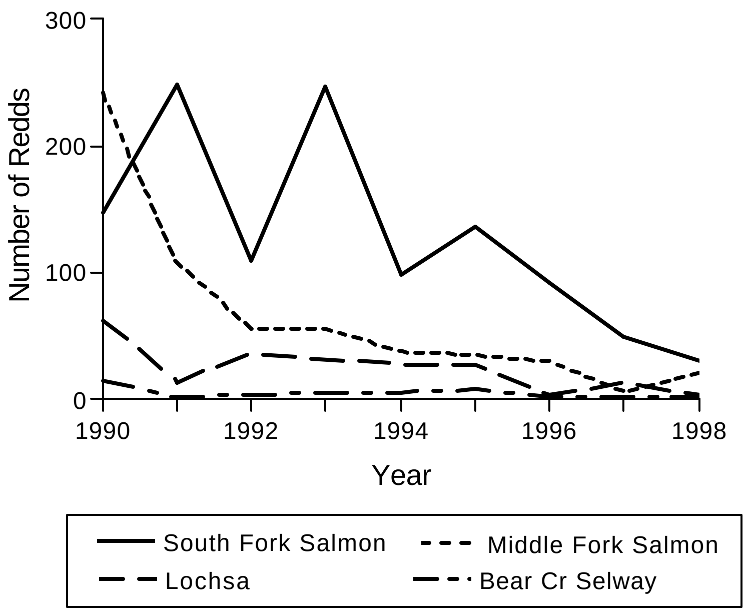
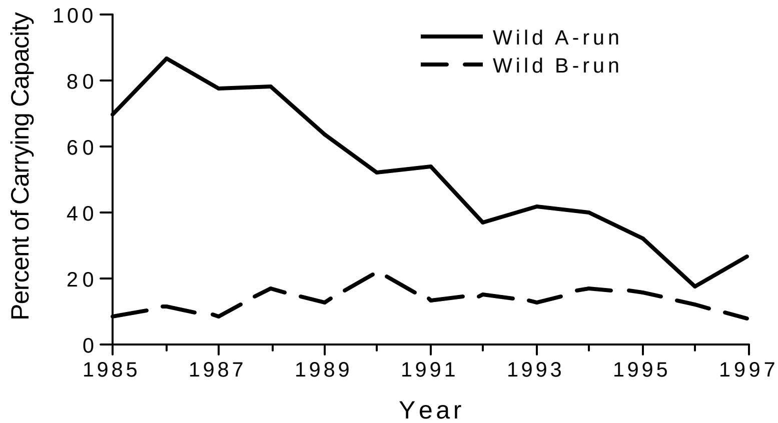


Figure 4. Redd Counts for Wild Snake River (B-Run) Steelhead in the South Fork and Middle Fork Salmon, Lochsa, and Bear Creek-Selway Index Areas.



Data for the
and Crooked
Sources:
(IDFG),
Counts",
IDFG (unpublished).

Lochsa exclude Fish Creek
Fork.
memo from T. Holubetz
"1997 Steelhead Redd
dated May 16, 1997, and

Figure 5. Estimated Carrying Capacity for Juvenile (Age-1+ and -2+) Wild-A and B-Run Steelhead in Idaho Streams

Source: Data for 1985 through 1996 from (Hall-Griswold and Petrosky 1998); data for 1997 from IDFG (unpublished).

It is first relevant to put the Snake River basin into context. The Snake River historically supported over 55% of total natural-origin production of steelhead in the Columbia River Basin and now has approximately 63% of the basin's natural production potential (Mealy 1997). B-run steelhead occupy four major subbasins including two on the Clearwater River (Lochsa and Selway) and two on the Salmon River (Middle Fork and South Fork Salmon), areas that for the most part are not occupied by A-run steelhead. Some natural B-run steelhead are also produced in parts of the mainstem Clearwater and its major tributaries. There are alternative escapement objectives for B-run steelhead of 10,000 (TAC 1997) and 31,400 (Idaho). B-run steelhead, therefore, represent at least 1/3 and as much as 3/5 of the production capacity of the ESU.

As pointed out above, the geographic distribution of B-run steelhead is restricted to particular watersheds within the Snake River Basin (areas of the mainstem Clearwater, Selway, and Lochsa Rivers and the South and Middle Forks of the Salmon River). No recent genetic data are available for steelhead populations in South and Middle Forks of the Salmon River. The Dworshak National Fish Hatchery (NFH) stock and natural populations in the Selway and Lochsa Rivers are thus far the most genetically distinct populations of steelhead in the Snake River Basin (Waples et al. 1993). In addition, the Selway and Lochsa River populations from the Middle Fork Clearwater appear to be very similar to each other genetically, and naturally produced rainbow trout from the North Fork Clearwater River (above Dworshak Reservoir) clearly show an ancestral genetic similarity to Dworshak NFH steelhead. The existing genetic data, the restricted geographic distribution of B-run steelhead in the Snake (Columbia) River Basin, and the unique life history attributes of these fish (i.e. larger, older adults with a later distribution of

run timing compared to A-run steelhead in other portions of the Columbia River Basin) clearly support the conservation of B-run steelhead as a biologically significant component of the Snake River ESU.

Another approach to assessing the status of an ESU being developed by NOAA Fisheries is to consider the status of its component populations. For this purpose a population is defined as a group of fish of the same species spawning in a particular lake or stream (or portion thereof) at a particular season, which to a substantial degree do not interbreed with fish from any other group spawning in a different place or in a the same place at a different season. Because populations as defined here are relatively isolated, it is biologically meaningful to evaluate the risk of extinction of one population independently from any other. Some ESUs may be comprised of only one population whereas others will be constituted by many. The background and guidelines related to the assessment of the status of populations is described in a recent draft report discussing the concept of viable salmonid populations (McElhany et al. 2000).

The task of identifying populations within an ESU will require making judgements based on the available information. Information regarding the geography, ecology, and genetics of the ESU are relevant to this determination. Although NOAA Fisheries has not compiled and formally reviewed all the available information for this purpose, it is reasonable to conclude that, at a minimum, each of the major subbasins in the ESU represent a population within the context of this discussion. A-run populations would therefore include at least the tributaries to the lower Clearwater, the upper Salmon River and its tributaries, the lower Salmon River and its tributaries, the Grand Ronde, Imnaha, and possibly the

Snake River mainstem tributaries below Hells Canyon Dam. B-run populations would be identified in the Middle Fork and South Fork Salmon Rivers and the Lochsa and Selway Rivers (major tributaries of the upper Clearwater), and possibly in the mainstem Clearwater River, as well. These basins are, for the most part, large geographical areas and it is quite possible that there is additional population structure within at least some of these basins. However, because that hypothesis has not been confirmed, NOAA Fisheries assumes that there are at least five populations of A-run steelhead and five populations of B-run steelhead in the Snake River basin ESU. Escapement objectives for A and B-run production areas in Idaho, based on estimates of smolt production capacity, are shown in Table 1.

Table 1. Adult Steelhead Escapement Objectives Based on Estimates of 70% Smolt Production Capacity

A-Run Production Areas		**B-Run Production Areas**	
Upper Salmon	13,570	Mid Fork Salmon	9,800
Lower Salmon	6,300	South Fork Salmon	5,100
Clearwater	2,100	Lochsa	5,000
Grand Ronde	(1)	Selway	7,500
Imnaha	(1)	Clearwater	4,000
Total	**21,970**	**Total**	**31,400**

Note: comparable estimates are not available for populations in Oregon and Washington subbasins.

1. Lower Snake River Subbasin

Information on steelhead distribution, important watersheds, and conditions and trends in the Lower Snake River is summarized from the Lower Snake River Subbasin Biological Assessment (BLM 2000a), except where noted.

a. Species Distribution:

Within the Lower Snake River Subbasin steelhead trout use occurs in most of the accessible streams when stream conditions are suitable. Steelhead trout use the mainstem Snake River for upstream and downstream passage. A limited amount of juvenile rearing and overwintering by adults occurs in the Snake River. Most accessible tributaries are used by steelhead for spawning and rearing. The larger streams used for spawning and rearing include Asotin, Ten Mile, Couse, Captain John, Jim, and Cook Creeks. Other smaller tributary streams with limited rainbow/steelhead use include Tammany, Tenmile, Corral, Cache, Cottonwood, and Cherry Creeks.

b. Location of Important Spawning and Rearing Areas:

Asotin Creek, followed by Captain John, Ten Mile, and Couse Creeks have the highest potential for steelhead production within the subbasin. Priority watersheds include Asotin and Captain John Creeks.

c. Conditions and Trends of Populations:

Despite their relatively broad distribution, very few healthy steelhead populations exist (Quigley and Arbelbide 1997). Recent status evaluations suggest many steelhead stocks are depressed. A recent multi-agency review showed that total escapement of salmon and steelhead to the various Columbia River regions has been in decline since 1986 (Anderson et al. 1996). Existing steelhead stocks consist of four main types: wild, natural (non-indigenous progeny spawning naturally), hatchery, and mixes of natural and hatchery fish. Production of wild anadromous fish in the Columbia River Basin has declined about 95% from historical levels (Huntington et al. 1994). Most existing steelhead production is supported by hatchery and natural fish as a result of large-scale hatchery mitigation production programs. Wild, indigenous fish, unaltered by hatchery stocks, are rare and present in only 10% of the historical range and 25% of the existing range. Remaining wild stocks are concentrated in the Salmon and Selway (Clearwater Basin) rivers in central Idaho and the John Day River in Oregon. Although few wild stocks were classified as strong, the only subwatersheds classified as strong were those sustaining wild stocks.

2. Clearwater River, North Fork Clearwater River, and Middle Fork Clearwater River Subbasins

Information on steelhead distribution, important watersheds, and conditions and trends in the Clearwater River is summarized from the Clearwater River, North Fork Clearwater River and Middle Fork Clearwater River Subbasins Biological Assessment (BLM 2000b), except where noted.

a. Species Distribution:

Within the Clearwater River Subbasin steelhead trout use is widespread and most accessible tributaries are used year-long or seasonally. In the Clearwater River drainage, the primary steelhead producing streams include: Potlatch River; Lapwai, Big Canyon, Little Canyon, Lolo, and Lawyer Creeks. Other Clearwater River mainstem tributary streams providing spawning and/or rearing habitat for steelhead trout include Lindsay, Hatwai, Lapwai, Catholic, Cottonwood, Pine, Bedrock, Jacks, Big Canyon, Orofino, Jim Ford, Big, Fivemile,
Sixmile, and Tom Taha Creeks. Some of these streams provide sub-optimal spawning and rearing habitat because of steep stream gradients, barriers, low flows, limited spawning gravels, and small size of tributaries.

In the 1969 the U.S. Army Corps of Engineers finished construction of Dworshak Dam on the North Fork Clearwater River, which totally blocked access to anadromous fish. To mitigate for the steelhead losses resulting from the dam, Dworshak National Fish Hatchery (NFH) was constructed in 1969. Wild B-run steelhead are collected at the base of the dam and used as the brood stock for Dworshak NFH. Since 1992, steelhead eggs collected at Dworshak NFH have been shipped as eyed eggs to the Clearwater Fish Hatchery, located at the confluence of the North Fork Clearwater River and the Clearwater River, for incubation and rearing. Three satellite facilities are associated with the Clearwater Fish Hatchery: Crooked River, Red River, and Powell. The Kooskia NFH is located on Clear Creek, a tributary to the Middle Fork Clearwater River.

b. Location of Important Spawning and Rearing Areas:

The only watershed identified as a special emphasis or priority watershed for steelhead trout in the Clearwater River Subbasin is Lolo Creek.

c. Conditions and Trends of Populations:

Refer to “Conditions and Trends of Populations” under Lower Snake River Subbasin above.

<u>3. South Fork Clearwater River Subbasin</u>

Information on steelhead distribution, important watersheds, and conditions and trends in the South Fork Clearwater River is summarized from the Draft Clearwater Subbasin Assessment (CPAG 2002), except where noted.

a. Species Distribution:

Within the South Fork Clearwater River Subbasin, steelhead trout use is widespread, and most accessible tributaries are used year-long or seasonally. In the South Fork drainage, the primary steelhead producing drainages include Newsome Creek, American River, Red River, and Crooked River. Other South Fork Clearwater River mainstem tributary streams providing spawning and/or rearing habitat for steelhead trout include Tenmile, Johns, Meadow, and Mill Creeks (Jody Brostrom, Idaho Department of Fish and Game, pers. comm.
March 30, 2001). Low order streams and accessible headwater portions of high order streams provide early rearing habitat (Nez Perce National Forest 1998).

b. Location of Important Spawning and Rearing Areas:

Important spawning habitat in the South Fork Clearwater occurs primarily in Newsome Creek, American River, Red River, and Crooked River.

c. Conditions and Trends of Populations:

The South Fork Clearwater River may have historically maintained a genetically unique stock of steelhead trout, but hatchery supplementation has since clouded the lines of genetic distinction between stocks (Nez Perce National Forest 1998). Robin Waples (In a letter to S. Kiefer, Idaho Department of Fish and Game, August 25, 1998) found that steelhead trout in Johns and Tenmile Creeks are genetically most similar to fish originating from the Selway River system, suggesting that some genetic difference may have existed historically within the South Fork Clearwater drainage. A statewide genetic analysis is currently being conducted using DNA markers, and may provide more information on past and current genetic distinctions between steelhead trout stocks in the Clearwater subbasin (Byrne 2001).

<u>4. Selway River Subbasin</u>

Information on steelhead distribution, important watersheds, and conditions and trends in the Selway

River is summarized from the Lower Selway Biological Assessment (USFS 1999a), the Biological Opinion on Culvert Replacements on Lolo Creek and Lochsa River (NMFS 2002a), and the Biological Opinion on Recreational Suction Dredge Mining in Lolo Creek (NOAA Fisheries 2003), except where noted.

a. Species Distribution:

High numbers of juvenile steelhead trout have been documented in all of the fifth code watersheds above the Selway-Bitterroot wilderness boundary. In addition, Meadow and Gedney Creeks also support high numbers of both steelhead and resident rainbow trout. Densities of steelhead are less in O'hara, Swiftwater, Goddard, and Falls Creeks (USFS unpublished data 1990 - 1998). Densities in Nineteenmile, Rackliffe, Boyd, and Glover Creeks are limited by small size and accessibility although the species is present. Spawning habitat for steelhead has been documented in most of the surveyed tributaries, including small third order streams such as Renshaw and Pinchot Creeks. In the Selway River, stream survey data and casual observations suggest that the steelhead/rainbow population in the larger tributaries, i.e. Meadow and Moose Creeks, are composed of a significant resident rainbow/redband component (USFS unpublished data 1996, 1997). Survey data and observations revealed the presence of large number of rainbow trout greater than 220 mm, especially in North Moose Creek. In addition, observations suggest the presence of two distinct forms of this species. Steelhead and rainbow of all sizes differed phenotypically; there appeared to be a distinct "steelhead" presmolt form, which was more bullet-shaped and silvery in color, and a distinct "trout" form, which was less bullet-shaped, retained parr marks at larger sizes, and exhibited coloration and spotting more typical of other

inland rainbow populations. It is possible that resident rainbow trout and steelhead trout are reproductively isolated, which may have resulted in genetic divergence. Analysis of the genetic composition of the Moose Creek population may be attempted in future years.

b. Location of Important Spawning and Rearing Areas:

The most important spawning and rearing areas for steelhead are located in the larger tributaries, such as Meadow, Moose, Gedney, Three Links, Marten, Bear, Whitecap, Running, Ditch, Deep, and Wilkerson Creeks. Moose Creek may support the most significant spawning and rearing habitat for steelhead trout of any of these tributaries.

c. Conditions and Trends of Populations:

The Selway River drainage (along with the Lochsa and lower Clearwater River tributary systems) is one of the only drainages in the Clearwater Subbasin where steelhead populations have little or no hatchery influence (Busby et al. 1996; IDFG 2001). The USFS (1999a) identified the Lochsa and Selway River systems as refugia areas for steelhead based on location, accessibility, habitat quality, and number of roadless tributaries. The Idaho Department of Fish and Game (IDFG) estimates that approximately 80% of the wild steelhead in the Clearwater River Subbasin are destined for the Lochsa River and Selway River drainages. The Clearwater River Basin produces the majority of B-run steelhead in the Snake River ESU, and most of the Clearwater steelhead are produced in the Lochsa River Subbasin. The Lochsa River Subbasin has the highest observed densities of age 1+ B-run steelhead parr, and the highest percent carrying capacity (IDFG 1999). Hatchery steelhead were used to supplement natural populations in the Lochsa River drainage before 1982, but current management does not include any hatchery supplementation. Current adult returns are considered to be almost entirely wild steelhead trout progeny.

5. Lochsa River Subbasin

Information on steelhead distribution, important watersheds, and conditions and trends in the

Lochsa River is summarized from the Biological Opinion on Culvert Replacements on Lolo Creek and Lochsa River (NMFS 2002a) and the Biological Opinion on Recreational Suction Dredge Mining in Lolo Creek (NOAA Fisheries 2003), except where noted.

a. Species Distribution:

Adult Snake River steelhead are present in the upper mainstem Clearwater River in September and October, and in the upper mainstem and Middle Fork Clearwater Rivers in the winter.

Spawning and incubation occurs in streams such as the Lochsa River from March through July. Steelhead juveniles then typically rear for 2 to 3 years in the tributaries and larger rivers before beginning a seaward migration during February through May.

b. Location of Important Spawning and Rearing Areas:

Steelhead have been observed in most of the larger tributaries to the Lochsa River, with high steelhead productivity occurring in Fish, Boulder, Deadman, Pete King, and Hungery Creeks (USFS 1999b).

c. Conditions and Trends of Populations:

Refer to "Conditions and Trend of Populations" under Selway River Subbasin above.

<u>6. Lower Salmon River Subbasin</u>

Information on steelhead distribution, important watersheds, and conditions and trends in the Lower Salmon River is summarized from the Lower Salmon River Subbasin Biological Assessment (BLM 2000c).

a. Species Distribution:

Within the Lower Salmon River Subbasin, steelhead trout use occurs in most of the accessible streams when stream conditions are suitable. Steelhead trout use the mainstem Salmon River for upstream and downstream passage. A limited amount of juvenile rearing and adult overwintering may occur in the Salmon River. Most accessible tributaries are used by steelhead for spawning and rearing. The larger streams used for spawning and rearing include China, Eagle, Deer, Cottonwood, Maloney, Deep, Rice, Rock, White Bird, Skookumchuck, Slate, John Day, Race, Lake, Allison, Partridge, Elkhorn, and French Creeks. Other smaller tributary streams with limited rainbow/steelhead use include Flynn, Wapshilla, Billy, Burnt, Round Springs, Telcher, Deer, McKinzie, Christie, Sherwin, China, Cow, Fiddle, Warm Springs, Van, and Robbins Creeks.

b. Location of Important Spawning and Rearing Areas:

Slate Creek, followed by White Bird Creek, has the highest potential for steelhead production within the subbasin. Priority watersheds identified for steelhead trout include China, Eagle, Deer, White Bird, Skookumchuck, Slate, John Day, Race, Allison, Partridge, and French Creeks. Other streams which are important for spawning and rearing include Cottonwood, Maloney, Deep, Rice, Rock, Lake, and Elkhorn Creeks.

c. Conditions and Trends of Populations:

The Bureau of Land Management (BLM) noted that current numbers of naturally spawning steelhead trout in the Salmon River Subbasin are at all time lows, and overall trend is downward. Adult steelhead trout were commonly observed in most larger tributaries during the 1970s through 1980s, but now such observations have significantly declined (BLM 2000c).

The Nez Perce National Forest conducted an ecosystem analysis at the watershed scale for Slate Creek (USFS 2000) and concluded that the distribution of fish species assessed is relatively consistent with historic distribution. Steelhead trout populations are thought to have experienced a great decline from historic levels although the data to describe the extent of this reduction is not available (USFS 2000). The BLM has conducted trend monitoring of fish populations in lower Partridge Creek and French Creek. Partridge Creek densities of age 0 rainbow/steelhead trout in 1988 were 0.30 fish/m2 and age 1 rainbow/steelhead trout densities were 0.19 fish/m2. In 1997, age 0 densities were 0.003 fish/m2 and age 1 densities were 0.01 fish/m2. French Creek densities of age 0 rainbow/steelhead trout in 1991 were 0.07 fish/m2 and age 1 rainbow/steelhead

trout densities were 0.07 fish/m2. In 1997, age 0 densities were 0.0075 fish/m2 and age 1 densities were 0.02 fish/m2. Densities of steelhead trout have significantly declined from the 1980s through the late 1990s.

7. Little Salmon River Subbasin

Information on steelhead distribution, important watersheds, and conditions and trends in the Little Salmon River is summarized from the Little Salmon River Subbasin Biological Assessment (BLM 2000d), except where noted.

a. Species Distribution:

Within the Little Salmon River Subbasin, steelhead trout use occurs in the lower portion of the subbasin and tributaries, downstream from barriers located at river mile (RM) 21 in the Little Salmon River. No recent or historic documentation exists for steelhead trout using streams above RM 24 in the Little Salmon River. Welsh et al. (1965) reports that no known passage by salmon or steelhead exists above the Little Salmon River falls. Ineffectual fish passage facilities were constructed at the falls by the Civilian Conservation Corps during the 1930s (Welsh et al. 1965). Streams and rivers providing important spawning and rearing for steelhead trout include Little Salmon and River Rapid Rivers, and Boulder, Hazard, and Hard Creeks. Other Little Salmon River mainstem tributary streams providing spawning and rearing habitat include Squaw, Sheep, Hat, Denny, Lockwood, Rattlesnake, Elk, and Trail Creeks. Adult steelhead trout have been documented in these streams. Primary steelhead use of these streams is often associated with the mouth area or a small stream segment or lower reach, before steep gradients/cascades or a barrier restricts upstream fish passage. These streams generally provide sub-optimal spawning and rearing habitat because of steep stream gradients, barriers, low flows, limited spawning gravels, and small size of tributaries.

b. Location of Important Spawning and Rearing Areas:

Priority watersheds for steelhead trout include Rapid River, Boulder, Hazard, and Hard Creeks. These streams provide important spawning and rearing habitat for steelhead trout. Rapid River is a stronghold and key refugia area for steelhead trout.

c. Conditions and Trends of Populations:

The BLM noted that current numbers of naturally spawning steelhead trout in the Little Salmon River Subbasin are at all-time lows, and overall trend is downward. The highest number of adult natural spawning steelhead trout counted at the Rapid River weir was 162 in 1993, and the lowest counted was 10 in 1999 (BLM 2000d).

<u>8. Middle Salmon River Subbasin</u>

Information on steelhead distribution, important watersheds, and conditions and trends in the Middle Salmon River is summarized from the Middle Salmon River and South Fork Salmon River Subbasins Biological Assessment (BLM 2000e), except where noted.

a. Species Distribution:

Within the Middle Salmon River Subbasin, steelhead trout use the mainstem Salmon River for upstream and downstream passage. A limited amount of juvenile rearing and adult overwintering may occur in the Middle Salmon River. Most accessible tributaries are used by steelhead for spawning and rearing.

Key steelhead spawning and rearing is probably occurring in Crooked, Bargamin and Sabe Creeks and the lower Wind River on the north side of the Salmon River and California, Warren, Chamberlain, and Horse Creeks on the south side of the Salmon River.

b. Location of Important Spawning and Rearing Areas:

Priority watersheds for steelhead include Warren and California Creeks. Steelhead use Warren Creek for spawning and rearing habitat. No fish passage barriers exist for steelhead within the drainage. Steelhead were found in Richardson, Stratton, Steamboat, and Slaughter Creeks (Raleigh 1995). Most other tributaries were surveyed, but no steelhead were found. Because of

habitat alterations from past mining (e.g., in-channel dredging, piling of dredged material adjacent to streams) and limited suitable habitat, steelhead use of the upper portion of the Warren Creek subwatershed is limited. Carey and Bear Creeks provide habitat in the lower reaches.

c. Conditions and Trend of Populations:

Refer to "Conditions and Trends of Populations" under Lower Salmon River Subbasin above.

<u>9. South Fork Salmon River Subbasin</u>

Information on steelhead distribution, important watersheds, and conditions and trends in the South Fork Salmon River is summarized from the Middle Salmon River and South Fork Salmon River Subbasins Biological Assessment (BLM 2000e), except where noted.

a. Species Distribution:

Steelhead have been documented in the South Fork Salmon River and lower portions of its major tributaries. Most of the mainstem spawning occurs between the East Fork Salmon River and Cabin Creek. Principle spawning areas are located near Stolle Meadows, from Knox Bridge to Penny Spring, Poverty Flat, Darling cabins, the Oxbow, and from 22 Hole to Glory Hole (USFS 1998).

b. Location of Important Spawning and Rearing Areas:

Primary spawning tributaries in the South Fork Salmon River Subbasin are Burntlog, Lick, Lake, and Johnson Creeks, the East Fork South Fork Salmon and Secesh Rivers (USFS 1998).

c. Conditions and Trends of Populations:

Refer to "Conditions and Trends of Populations" under Lower Salmon River Subbasin above.

10. Upper Salmon River Subbasin

Information on steelhead distribution, important watersheds, and conditions and trends in the Upper Salmon River is summarized from the Biological Opinion on Effects of 2002 Herbicide Treatment of Noxious Weeds on Lands Administered by the Salmon-Challis National Forest (NMFS 2002b).

a. Species Distribution:

Steelhead trout in the Upper Salmon River subbasin occur in most of the accessible streams when stream conditions are suitable. Steelhead use the mainstem for upstream and downstream passage. A limited amount of juvenile rearing and adult overwintering occurs in the Upper Salmon River. Most accessible tributaries are used for spawning and rearing.

b. Location of Important Spawning and Rearing Areas:

Key steelhead spawning and rearing probably occurs in Morgan, Thompson and Panther Creeks, in addition to the Yankee Fork Salmon, Pahsimeroi, North Fork Salmon, East Fork Salmon, and Lemhi Rivers.

c. Conditions and Trends of Populations:

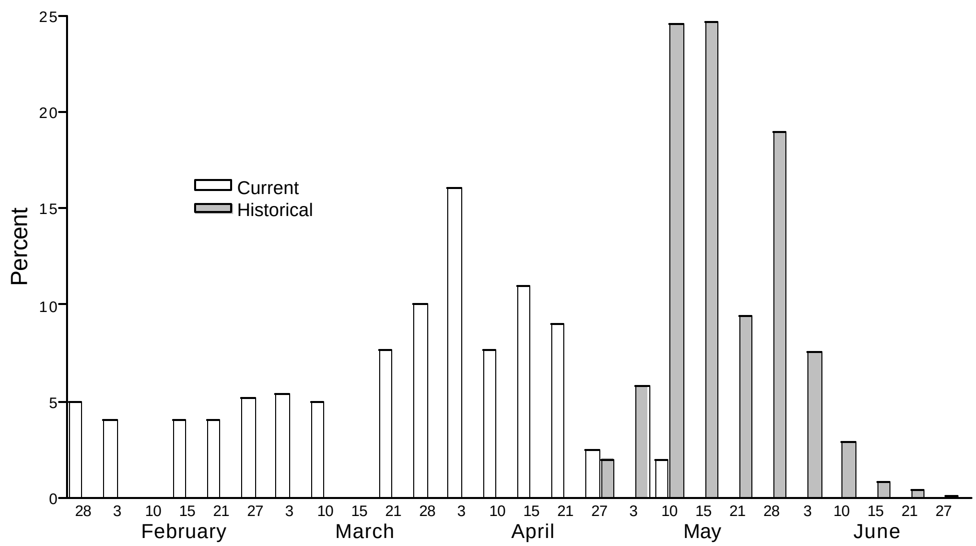
Refer to "Conditions and Trends of Populations" under Lower Salmon River Subbasin above.

C. Hatchery Populations

Hatchery populations, if genetically similar to their natural-origin counterparts, provide a hedge against extinction of the ESU or of the gene pool. The Imnaha and Oxbow hatcheries produce A-run stocks that are currently included in the Snake River basin steelhead ESU. The Pahsimeroi and Wallowa hatchery stocks may also be appropriate and available for use in developing supplementation programs; NOAA Fisheries required in its recent biological opinion on Columbia basin hatchery operations that this program begin to transition to a local-origin broodstock to provide a source for future supplementation efforts in the lower Salmon River (NMFS 1999). Although other stocks provide more immediate opportunities to initiate supplementation programs within some subbasins, it may also be necessary and desirable to develop additional broodstocks that can be used for supplementation in other natural production areas. Despite uncertainties related to the likelihood that supplementation programs can accelerate the recovery of naturally spawning populations, these hatchery stocks provide a safeguard against the further decline of natural-origin populations.

The Dworshak NFH is unique in the Snake River Basin in producing a B-run hatchery stock. The Dworshak stock was developed from natural-origin steelhead from the North Fork Clearwater River, is largely free of other hatchery introductions, and was therefore included in the ESU, although not as part of the listed population. However, past hatchery practices and possibly changes in flow and temperature conditions related to Dworshak Dam have lead to substantial divergence in spawn timing of the hatchery stock compared to historical timing in the North Fork Clearwater River, and compared to natural-origin populations in other parts of the Clearwater Basin. Because the spawn timing of the hatchery stock is much earlier than historically (Figure 6), the success of supplementation efforts using these stocks may be limited. In fact, past supplementation efforts in the South Fork Clearwater River using Dworshak NFH stock have been largely unsuccessful, although improvements in out-planting practices have the potential to yield different results. In addition, the unique genetic character of Dworshak NFH steelhead will limit the degree to which the stock can be used for supplementation in other parts of the Clearwater Subbasin, and particularly in the Salmon River B-run basins. Supplementation efforts in those areas, if undertaken, will more likely have to rely on the future development of local broodstocks. Supplementation opportunities in many of the B-run production areas may be limited because of logistical difficulties associated with high mountain, wilderness areas. Because opportunities to accelerate the recovery of B-run steelhead through supplementation, even if successful, are expected to be limited, it is essential to maximize the escapement of natural-origin steelhead in the near term.

Figure 6. Historical Versus Current Spawn-Timing of Steelhead at Dworshak Hatchery.



D. Conclusion

Finally, the conclusion and recommendations of the TAC's All Species Review (TAC 1997) are pertinent to this status review of Snake River steelhead. Considering information available through 1996, the 1997 All Species Review stated:

> "Regardless of assessment methods for A and B steelhead, it is apparent that the primary goal of enhancing the upriver summer steelhead run is not being achieved. The status of upriver summer steelhead, particularly natural-origin fish, has become a serious concern. Recent declines in all stocks, across all measures of abundance, are disturbing."
>
> "There has been no progress toward rebuilding upriver runs since 1987. Throughout the Columbia River basin, dam counts, weir counts, spawning surveys, and rearing densities indicate natural-origin steelhead abundance is declining, culminating in the proposed listing of upriver stocks in 1996. Escapements have reached critically low levels despite the relatively high productivity of natural and hatchery rearing environments. Improved flows and ocean conditions should increase smolt-adult survival rates for upriver summer steelhead. However, reduced returns in recent years are likely to produce fewer progeny and lead to continued low abundance."
> "Although steelhead escapements would have increased (some years substantially) in the absence of mainstem fisheries, data analyzed by the TAC indicate that effects other than mainstem Columbia River fishery harvest are primarily responsible for the currently depressed status and the long term health and productivity of wild steelhead populations

> in the Columbia River."
>
> "Though harvest is not the primary cause of declining summer steelhead stocks, and harvest rates have been below guidelines, harvest has further reduced escapements. Prior to 1990, the aggregate of upriver summer steelhead in the mainstem Columbia River appears at times to have led to the failure to achieve escapement goals at Lower Granite Dam. Wild Group B steelhead are presently more sensitive to harvest than other salmon stocks, including the rest of the steelhead run, due to their depressed status and because they are caught at higher rates in the Zone 6 fishery."

Small or isolated populations are much more susceptible to stochastic events such as drought and poor ocean conditions. Harvest can further increase the susceptibility of such populations. The Columbia River Fish Management Plan (TAC 1997) recognizes that harvest management must be responsive to run size and escapement needs to protect these populations. The parties should ensure that TAC 1997 harvest guidelines are sufficiently protective of weak stocks and hatchery broodstock requirements.

For the Snake River steelhead ESU as a whole, the median population growth rate (lambda) from years 1980-1997, ranges from 0.699 to 0.978, depending on the assumed number of hatchery fish reproducing in the river (Table 2). NOAA Fisheries estimated the risk of absolute extinction for A- and B-runs, based on assumptions of complete hatchery spawning success, and no hatchery spawning success. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years is 0.01 for A-run steelhead and 0.93 for B-run fish. At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years is 1.00 for both runs.

Table 2. Annual rate of population change (λ) in Snake River steehead, absolute risk of extinction (1 fish/generation), and risk of 90% decline in 24 and 100 years for the period 1980-1997[†]. The range of reported values assumes that hatchery-origin fish either do not contribute to

Model Assumptions	l	**Risk of Extinction**		**Probability of 90% decrease in stock abundance**	
		24 years	100 years	24 years	100 years
No Correction for Hatchery Fish	0.978	A-Run 0.000 B-Run 0.000	A-Run 0.000 B-Run 0.000	A-Run 0.000 B-Run 0.060 Aggregate 0.000	A-Run 0.000 B-Run 0.520 Aggregate 0.434
No Instream Hatchery Reproduction	0.910	A-Run 0.000 B-Run 0.000	A-Run 0.010 B-Run 0.093	A-Run 0.200 B-Run 0.730 Aggregate 0.476	A-Run 1.000 B-Run 1.000 Aggregate 1.000
Instream Hatchery Reproduction = Natural Reproduction	0.699	A-Run 0.000 B-Run 0.000	A-Run 1.000 B-Run 1.000	A-Run 1.000 B-Run 1.000 Aggregate 1.000	A-Run 1.000 B-Run 1.000 Aggregate 1.000
† From Table B-2a and B-2b. Cumulative Risk Initiative. September 5, 2000, revised appendix B (McClure et al. 2000).					

natural production or are as productive as natural-origin spawners.

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APPENDIX B

BIOLOGICAL REQUIREMENTS, CURRENT STATUS, AND TRENDS:

SNAKE RIVER SPRING/SUMMER CHINOOK SALMON

A. Chinook Salmon Life History

Chinook salmon is the largest of the Pacific salmon. The species' distribution historically ranged from the Ventura River in California to Point Hope, Alaska, in North America, and in northeastern Asia from Hokkaido, Japan, to the Anadyr River in Russia (Healey 1991). Additionally, chinook salmon have been reported in the Mackenzie River area of northern Canada (McPhail and Lindsey 1970). Of the Pacific salmon, chinook salmon exhibit arguably the most diverse and complex life history strategies. Healey (1986), described 16 age categories for chinook salmon, seven total ages with three possible freshwater ages. This level of complexity is roughly comparable to that seen in sockeye salmon (Oncorhynchus nerka), although the latter species has a more extended freshwater residence period and uses different freshwater habitats (Miller and Brannon 1982, Burgner 1991). Two generalized freshwater life-history types were initially described by Gilbert (1912): "stream-type" chinook salmon, which reside in freshwater for a year or more following emergence, and "ocean-type" chinook salmon, which migrate to the ocean within their first year. Healey (1983, 1991) has promoted the use of broader definitions for "ocean-type" and "stream-type" to describe two distinct races of chinook salmon. Healey's approach incorporates life history traits, geographic distribution, and genetic differentiation and provides a valuable frame of reference for comparisons of chinook salmon populations.

The generalized life history of Pacific salmon involves incubation, hatching, and emergence in freshwater; migration to the ocean; and the subsequent initiation of maturation and return to freshwater for completion of maturation and spawning. The juvenile rearing period in freshwater can be minimal or extended. Additionally, some male chinook salmon mature in freshwater, thereby foregoing emigration to the ocean. The timing and duration of each of these stages is related to genetic and environmental determinants and their interactions to varying degrees. Although salmon exhibit a high degree of variability in life-history traits, there is considerable debate as to what degree this variability is shaped by local adaptation or results from the general plasticity of the salmonid genome (Ricker 1972, Healey 1991, Taylor 1991). More detailed descriptions of the key features of chinook salmon life history can be found in Myers et al. (1998) and Healey (1991).

B. Population Dynamics, Distribution, Status and Trends

The following sections provide specific information on the distribution and population structure (size, variability, and trends of the stocks or populations) for the listed evolutionary significant unit (ESU). Most of this information comes from observations made in terminal, freshwater areas, which may be distinct from the action area. This focus is appropriate because the species status and distribution can only be measured at this level of detail as adults return to spawn.

1. Snake River Spring/Summer Chinook Salmon

The present range of spawning and rearing habitat for naturally-spawned Snake River spring/summer chinook salmon is primarily limited to the Salmon, Grande Ronde, Imnaha, and Tucannon Subbasins. Most Snake River spring/summer chinook salmon enter individual subbasins from May through September. Juvenile Snake River spring/summer chinook salmon emerge from spawning gravels from February through June (Perry and Bjornn 1991). Typically, after rearing in their nursery streams for about 1 year, smolts begin migrating seaward in April and May (Bugert et al. 1990; Cannamela 1992). After reaching the mouth of the Columbia River, spring/summer chinook salmon probably inhabit nearshore areas before beginning their northeast Pacific Ocean migration, which lasts 2 to 3 years. Because of their timing and ocean distribution, these stocks are subject to very little ocean harvest. For detailed information on the life history and stock status of Snake River spring/summer chinook salmon, see Matthews and Waples (1991), NMFS (1991), and 56 FR 29542 (June 27, 1991).

Bevan et al. (1994) estimated the number of wild adult Snake River spring/summer chinook salmon in the late 1800s to be more than 1.5 million fish annually. By the 1950s, the population had declined to an estimated 125,000 adults. Escapement estimates indicate that the population continued to decline through the 1970s. Returns were variable through the 1980s, but declined further in recent years. Record low returns were observed in 1994 and 1995. Dam counts were modestly higher from 1996 through 1998, but declined in 1999. For management purposes the spring and summer chinook in the Columbia River Basin, including those returning to the Snake River, have been managed as separate stocks. Historical databases, therefore, provide separate estimates for the spring and summer chinook components. Table 1 reports the estimated annual return of adult, natural-origin Snake River spring and summer chinook salmon returning to Lower Granite Dam since 1979.

Table 1. Estimates of Natural-Origin SR Spring/Summer Chinook Salmon Counted at Lower Granite Dam in Recent Years (Speaks 2000)

Year	Spring Chinook	Summer Chinook	Total
1979	2,573	2,712	5,285
1980	3,478	2,688	6,166
1981	7,941	3,326	11,267
1982	7,117	3,529	10,646
1983	6,181	3,233	9,414
1984	3,199	4,200	7,399
1985	5,245	3,196	8,441
1986	6,895	3,934	10,829
1987	7,883	2,414	10,297
1988	8,581	2,263	10,844
1989	3,029	2,350	5,379
1990	3,216	3,378	6,594
1991	2,206	2,814	5,020
1992	11,285	1,148	12,433
1993	6,008	3,959	9,967
1994	1,416	305	1,721
1995	745	371	1,116
1996	1,358	2,129	3,487
1997	1,434	6,458	7,892
1998	5,055	3,371	8,426
1999	1,433	1,843	3,276
		Recovery Esc Level	31,440

NOAA Fisheries set an interim recovery level for Snake River spring/summer chinook salmon (31,400 adults at Ice Harbor Dam) in its proposed recovery plan (NMFS 1995). The Snake River spring/summer chinook salmon ESU consists of 39 local spawning populations (subpopulations) spread over a large geographic area (Lichatowich et al. 1993). The number of fish returning to Lower Granite Dam is therefore divided among these subpopulations. The relationships between these subpopulations, and particularly the degree to which individuals may intermix is unknown. It is unlikely that all 39 are independent populations per the definition in McElhany et al. (2000), which requires that each be isolated such that the exchange of individuals between populations does not substantially affect population dynamics or extinction

risk over a 100-year time frame. Nonetheless, monitoring the status of subpopulations provides more detailed information on the status of the species than would an aggregate measure of abundance.

Seven of these subpopulations have been used as index stocks for the purpose of analyzing extinction risk and alternative actions that may be taken to meet survival and recovery requirements. The Snake River Salmon Recovery Team selected these subpopulations primarily because of the availability of relatively long time series of abundance data. The Biological Requirements Work Group (BRWG 1994)) developed recovery and threshold abundance levels for the index stocks, which serve as reference points for comparisons with observed escapements (Table 2). The threshold abundances represent levels at which uncertainties (and thus the likelihood of error) about processes or population enumeration are likely to be biologically significant, and at which qualitative changes in processes are likely to occur. They were specifically not developed as indicators of pseudo-extinction or as absolute indicators of "critical" thresholds. In any case, escapement estimates for the index stocks have generally been well below threshold levels in recent years (Table 2).

Table 2. Number of Adult Spawners, Recovery Levels, and BRWG Threshold Abundance Levels

Brood year	Bear Valley	Marsh	Sulphur	Minam	Imnaha	Poverty Flats	Johnson
1979	215	83	90	40	238	76	66
1980	42	16	12	43	183	163	55
1981	151	115	43	50	453	187	102
1982	83	71	17	104	590	192	93
1983	171	60	49	103	435	337	152
1984	137	100	0	101	557	220	36
1985	295	196	62	625	699	341	178
1986	224	171	385	357	479	233	129
1987	456	268	67	569	448	554	175
1988	1109	395	607	493	606	844	332
1989	91	80	43	197	203	261	103
1990	185	101	170	331	173	572	141
1991	181	72	213	189	251	538	151
1992	173	114	21	102	363	578	180
1993	709	216	263	267	1178	866	357
1994	33	9	0	22	115	209	50
1995	16	0	4	45	97	81	20
1996	56	18	23	233	219	135	49
1997	225	110	43	140	474	363	236
1998	372	164	140	122	159	396	119
1999	72	0	0	96	282	153	49
2000	*58*	*19*	*24*	*240*	na	*280*	*102*
Recovery Level	**900**	**450**	**300**	**450**	**850**	**850**	**300**
BRWG Threshold	**300**	**150**	**150**	**150**	**300**	**300**	**150**

These values are for SR spring/summer chinook salmon index stocks. Spring chinook index stocks: Bear Valley, Marsh, Sulphur and Minam. Summer-run index stocks: Poverty Flats and Johnson. Run-timing for the Imnaha is intermediate. Estimates for 2000 (shown in italics) are based on the preseason forecast.

As of June 1, 2000, the preliminary final aggregate count for upriver spring chinook salmon at

Bonneville Dam was 178,000, substantially higher than the 2000 forecast of 134,000[9]. This is the second highest return in 30 years (after the 1972 return of 179,300 adults). Only a small portion of these are expected to be natural-origin spring chinook destined for the Snake River (5,800). However, the aggregate estimate for natural-origin Snake River spring chinook salmon is substantially higher than the contributing brood year escapements. Comparable returns to the Columbia River mouth in 1995 and 1996 were 1,829 and 3,903, respectively. The expected returns to the index areas were estimated by multiplying the anticipated return to the river mouth by factors that accounted for anticipated harvest (approximately 9%), interdam loss (50%), prespawning mortality (10%), and the average proportion of total natural-origin spring chinook salmon expected to return to the index areas (14.3%). This rough calculation suggests that the returns to each index area would just replace the primary contributing brood year escapement (1996) (Table 2). These results also suggest that other areas may benefit more than the index areas in terms of brood year return rates. The index areas, on average, account for about 14% of the return of natural-origin spring chinook stocks to the Snake River. The substantial return of hatchery fish will also provide opportunities to pursue supplementation options designed to help rebuild natural-origin populations subject to constraints related to population diversity and integrity. For example, expected returns of the Tucannon River (500 listed hatchery and wild fish), Imnaha River (800 wild and 1,600 listed hatchery fish), and Sawtooth Hatchery (368 listed hatchery fish) all represent substantial increases over past years and provide opportunities for supplementation in the local basins designed to help rebuild the natural-origin stocks.

The 2000 forecast for the upriver summer chinook stocks is 33,300, which is again the second highest return in over 30 years, but with only a small portion (2,000) being natural-origin fish destined for the Snake River. The return of natural-origin fish compares to brood year escapements in 1995 and 1996 of 534 and 3,046 and is generally lower than the average returns over the last 5 years (3,466). The expect returns to the Poverty Flats and Johnson Creek index areas using methods similar to those described above indicates that returns will approximately double the returns observed during 1996, the primary contributing brood year (Table 2) and would be at least close to threshold escapement levels. Again, the substantial returns of hatchery fish can be used in selected areas to help rebuild at least some of the natural-origin stocks. Unfortunately, with the exception of the Imnaha, local brood stocks are not currently available for the spring and summer chinook index areas.

The probability of meeting survival and recovery objectives for Snake River spring/summer chinook under various future operation scenarios for the hydrosystem was analyzed through a process referred to as PATH (Plan for Analyzing and Testing Hypotheses). The scenarios analyzed focused on status quo management, and options that emphasized either juvenile transportation or hydro-project

[9] Source: June 1, 2000, E-mail from R. Bayley (NOAA Fisheries) to S. H. Smith (NOAA Fisheries). "Spring chinook update (end-of-season at Bonneville Dam)."

drawdown. PATH also included sensitivity analyses to alternative harvest rates and habitat effects. PATH estimated the probability of survival and recovery for the seven index stocks using the recovery and escapement threshold levels as abundance indicators. The forward simulations estimated the probability of meeting the survival thresholds after 24 and 100 years.

A 70% probability of exceeding the threshold escapement levels was used to assess survival. Recovery potential was assessed by comparing the projected abundance to the recovery abundance levels after 48 years. A 50% probability of exceeding the recovery abundance levels was used to evaluate recovery by comparing the eight-year mean projected abundance. In general, the survival and recovery standards were met for operational scenarios involving drawdown, but were not met under status quo management or for the scenarios that relied on juvenile transportation (Marmorek et al. 1998). If the most conservative harvest rate schedule was assumed, transportation scenarios came very close to meeting the survival and recovery standards.

For the Snake River spring/summer chinook ESU as a whole, NOAA Fisheries estimates the median population growth rate (lambda), from 1980-1994, ranges from 1.012 to 0.796 (Table 3), depending on the assumed success of hatchery fish spawning in the wild. Lambda decreases with increasing success of instream hatchery fish reproduction, compared to fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000). NOAA Fisheries estimated the risk of absolute extinction for the aggregate Snake River spring/summer chinook population to be zero in 24 years regardless of hatchery fish reproduction, and from 0.00 to 1.00 in 100 years, depending the success of instream hatchery fish reproduction (Table 3). This analysis period does not include the higher returns observed since 1996. Since 1996, the average proportional increase in hatchery fish compared to wild fish has been substantially greater, consequently, even though the number of recruits per spawner has increased for natural fish since lambda was calculated, the estimate of lambda for natural fish may actually decline from the values in Table 3, due to the disproportionate increase in hatchery fish.

Model Assumptions	l	**Risk of Extinction**		**Probability of 90% decrease in stock abundance**	
		24 years	100 years	24 years	100 years
No Correction for Hatchery Fish	1.012	0.00	0.00	0.014	0.072
No Instream Hatchery Reproduction	0.964	0.00	0.04	0.002	0.914
Instream Hatchery Reproduction = Natural Reproduction	0.796	0.00	1.00	0.996	1.000

† From Table B-2a and B-2b. Cumulative Risk Initiative. September 5, 2000, revised appendix B (McClure et al. 2000).

Table 3. Annual rate of population change (λ) in Snake River Spring Chinook salmon, absolute risk of extinction (1 fish/generation), and risk of 90% decline in 24 and 100 years for the period 1980-1994†. The range of reported values assumes that hatchery-origin fish either do not contribute to natural production or are as productive as natural-origin spawners.

2. Lower Snake River Subbasin

Information on spring/summer chinook salmon distribution, important watersheds, and conditions and trends in the Lower Snake River is summarized from the Lower Snake Subbasin Biological Assessment (BLM 2000a).

a. Species Distribution:

Spring/summer chinook salmon use the mainstem Snake River for upstream and downstream migration and, to a limited extent, juvenile rearing. Migrating adult salmon may use the Snake River for staging prior to migrating to natal streams to spawn. Accessible tributary streams are used for spawning and/or juvenile rearing when stream conditions are suitable. Asotin Creek is the only tributary stream that is currently used for spawning and rearing by chinook salmon. Juvenile rearing may occur at the mouth or lower reach of accessible tributary streams. The Snake River has elevated summer water temperatures that are sub-optimal for rearing, therefore, tributary streams provide cool water refugia for juveniles. Often these tributary streams may have low water barriers, but are accessible during high spring flows (i.e., June). Low numbers of

rearing juvenile chinook salmon may be found in the lower reaches of larger tributary streams. It should be noted that other smaller accessible tributaries may potentially be used if stream conditions are favorable.

b. Location of Important Spawning and Rearing Areas:

Asotin Creek is an important spawning and rearing watershed for spring/summer chinook in the Lower Snake River Subbasin. Historically, other larger tributaries within the subbasin (i.e., Captain John Creek) may have been used for spawning and rearing. Priority watersheds identified for spring/summer chinook salmon include Asotin and Captain John Creeks.

c. Conditions and Trend of Populations:

The Bureau of Land Management (BLM) noted that current numbers of naturally spawning spring/summer chinook salmon in the Lower Snake River Subbasin are at all time lows, and the overall trend is downward. Asotin Creek is the only tributary stream that is used by chinook salmon for spawning. Current use of Asotin Creek by spring/summer chinook is at very low levels and does not have a stable return of adults (BLM 2000a).

3. Lower Salmon River Subbasin

Information on spring/summer chinook salmon distribution, important watersheds, and conditions and trends in the Lower Salmon River is summarized from the Lower Salmon River Subbasin Biological Assessment (BLM 2000b), except where noted..

a. Species Distribution:

Spring/summer chinook salmon use the mainstem Salmon River for upstream and downstream migration and, to a limited extent, juvenile rearing. Migrating adult salmon may use the Salmon River for staging prior to migrating to natal streams to spawn. Accessible tributary streams are used for spawning and/or juvenile rearing when stream conditions are suitable. Slate Creek and White Bird Creek are the only tributary streams that are currently used for spawning and rearing. Stray adult chinook salmon may be found occasionally in other tributary streams (i.e., John Day Creek and French Creek). Juvenile chinook salmon rearing may occur at the mouth or lower reach of accessible tributary streams. The Salmon River has elevated summer water temperatures that are sub-optimal for rearing, therefore, tributary streams may provide cool water refugia for juveniles. Often these tributary streams have low water barriers, but are accessible during high spring flows (i.e., June). Tributary streams that may be used by juvenile chinook salmon for rearing include China, Eagle, Deer, Cottonwood, Maloney, Deep, Rice, Rock, Skookumchuck, John Day, Race, Lake, Allison, Partridge, Elkhorn, and French Creeks. It should be noted that other smaller accessible tributaries may potentially be used if stream conditions are favorable.

b. Location of Important Spawning and Rearing Areas:

Slate Creek and White Bird Creek are important spawning and rearing watersheds for spring/summer chinook salmon in the lower Salmon River drainage. Historically, other larger tributaries may have been used for spawning and rearing. Priority watersheds identified for spring/summer chinook salmon within the subbasin include China, Eagle, Deer, White Bird, Skookumchuck, Slate, John Day, Race, Partridge, and French Creeks.

c. Conditions and Trend of Populations:

The BLM noted that current numbers of naturally spawning spring/summer chinook salmon in the Lower Salmon River Subbasin are at all time lows, and the overall trend is downward. Slate Creek is the only tributary stream that is used by chinook salmon annually for spawning. White Bird Creek may be used by stray adults on occasion, but such use is expected to be very low (BLM 2000b).

<u>4. Little Salmon River Subbasin</u>

Information on spring/summer chinook salmon distribution, important watersheds, and conditions and trends in the Little Salmon River is summarized from the Little Salmon River Subbasin Biological Assessment (BLM 2000c), except where noted.

a. Species Distribution:

Spring/summer chinook salmon occur in the lower portion of the Little Salmon River and its tributaries, downriver from barriers located on the mainstem at river mile (RM) 24. An 1879 account of a trip through the Little Salmon River valley stated: "That salmon did not come into the valley because of rapids and falls below apparently prevented them" (Wiley 1879). No recent or formal historic documentation exists for spring/summer chinook salmon using streams above the RM 21 barrier. Welsh et al. (1965), reports that no known passage by salmon or steelhead exists above the Little Salmon River falls (RM 21). Ineffectual fish passage facilities were constructed at the falls by the Civilian Conservation Corps during the 1930s (Welsh et al. 1965). Streams and rivers providing spawning and rearing for spring/summer chinook salmon include the Little Salmon and Rapid Rivers, and Boulder, Hazard, and Hard Creeks. Mainstem Little Salmon River tributary streams providing potential rearing habitat at the mouth and/or lower reach area only (below barrier) include Squaw, Sheep, Hat, Denny, Lockwood, Rattlesnake, Elk, and Trail Creeks. These streams provide sub-optimal rearing habitat because of steep stream gradients, barriers, and small size of tributaries.

b. Location of Important Spawning and Rearing Areas:

Priority watersheds for spring/summer chinook salmon in the Little Salmon River Subbasin include Rapid River and Boulder, Hazard, and Hard Creeks. These streams provide spawning and rearing habitat for spring/summer chinook salmon. Rapid River is a stronghold and key refugia area for spring/summer chinook salmon.

c. Conditions and Trend of Populations:

The BLM noted that current numbers of naturally spawning spring/summer chinook salmon in the Little Salmon River Subbasin are at all time lows, and the overall trend is downward. The highest number of intercepted adult natural spawning chinook salmon counted at the Rapid River weir was 1,269 in 1985, and the lowest counted was 4 in 1997. In 1998, a total of 42 adult natural spawning chinook salmon were counted and in 1999 a total of nine natural spawning chinook salmon were counted (BLM 2000c).

5. Middle Salmon River Subbasin

Information on spring/summer chinook salmon distribution, important watersheds, and conditions and trends in the Middle Salmon River is summarized from the Middle Salmon River and South Fork Salmon River Subbasins Biological Assessment (BLM 2000d), except where noted.

a. Species Distribution:

Spring/summer chinook salmon use the mainstem Middle Salmon River for upstream and downstream passage. A limited amount of juvenile rearing may also occur in the Salmon River. Spawning and rearing for spring/summer chinook salmon occurs in lower Wind River and

Crooked, Bargamin, Chamberlain, and Horse Creeks. Other accessible tributaries may be used for juvenile rearing when flow conditions and water temperatures are acceptable. Use generally occurs in the mouth area or lower reaches of tributary streams.

b. Location of Important Spawning and Rearing Areas:

Priority watersheds for spring/summer chinook salmon in the Middle Salmon River Subbasin include Bargamin and Warren Creeks. These streams provide spawning and rearing habitat for adult and juvenile spring/summer chinook salmon. Spring/summer chinook salmon juveniles were observed in Warren Creek from the mouth to RM 2.4 (USFS 1998). Raleigh (1995), conducted snorkeling surveys in Warren Creek in late August 1994, and found juvenile chinook salmon in the lower reach only (RM 2.4). Spring/summer chinook salmon may use the mouth area or lower reaches of accessible tributaries such as Carey, California, and Bear Creeks for rearing.

c. Conditions and Trend of Populations:

The BLM noted that current numbers of naturally spawning spring/summer chinook salmon in the Middle Salmon River Subbasin are at all time lows, and the overall trend is downward (BLM 2000d).

6. South Fork Salmon River Subbasin

Information on spring/summer chinook salmon distribution, important watersheds, and conditions and trends in the South Fork Salmon River is summarized from the Middle Salmon River and South Fork Salmon River Subbasins Biological Assessment (BLM 2000d), except where noted.

a. Species Distribution:

Most spring/summer chinook salmon spawning areas within the South Fork Salmon River are found upstream of the confluence of the Secesh River and the South Fork Salmon River. The largest spawning concentration occurs in the Poverty Flats to Fourmile area and in Stolle Meadows.

b. Location of Important Spawning and Rearing Areas:

Concentrated spawning areas for Snake River spring/summer chinook salmon are found in the Glory Hole, Oxbow, Lake Creek, and Dollar Creek areas, the Icehole area in Johnson Creek, and the Secesh Meadows in the Secesh River. Rearing and overwintering occurs throughout the South Fork Salmon River.

c. Conditions and Trend of Populations:

Historically, the South Fork Salmon River was the single most important summer chinook spawning stream in the Columbia River Basin (Mallet 1974). Redd counts in the South Fork have declined from

3,505 redds in 1957, to 810 in 1992. The Secesh River and Lake Creek redd counts (combined) were more than 500 redds in 1960 and declined to a low of 10 redds in 1975. Counts of 112 redds in 1991 dropped to 28 redds in 1995 (IDFG 1995). Based on standard transects (IDFG 1992), chinook parr densities are estimated to be less than 15% of potential habitat carrying capacity.

7. Upper Salmon River Subbasin

Information on chinook salmon distribution, important watersheds, and conditions and trends in the Upper Salmon River is summarized from the Biological Opinion on Effects of 2002 Herbicide Treatment of Noxious Weeds on Lands Administered by the Salmon-Challis National Forest (NMFS 2002a), and the Biological Opinion on L3A Irrigation Diversion Modification in the Lemhi River (NMFS 2002b)

a. Species Distribution:

Spring/summer chinook salmon in the Upper Salmon River Subbasin may occur in most of the accessible streams when stream conditions are suitable. Chinook salmon use the mainstem Salmon River for upstream and downstream passage. Spawning and rearing may also occur in the mainstem Salmon River. In addition, most accessible tributaries may be used by spring/summer chinook salmon for spawning and rearing.

b. Location of Important Spawning and Rearing Areas:

Important spring/summer chinook salmon spawning and rearing areas in the Upper Salmon River Subbasin probably occurs in Yankee Fork Salmon, Pahsimeroi River, East Fork Salmon River, Lemhi River and Pole, Alturas Lake, Valley, and Loon Creeks.

c. Conditions and Trend of Populations:

Compared to the greatly reduced numbers of returning adults for the last several decades, increased numbers of adult chinook salmon returned to the Upper Salmon River drainage in 2000 and 2001. These large returns are thought to be a result of favorable ocean conditions, and above average flows in the Columbia River Basin when the smolts migrated downstream. However, these large returns are only a fraction of the returns of the late 1800s. Recent increases in the population are not expected to continue, and the long-term trend for this species indicates a decline (NMFS 2002b).

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