4. FISHERIES AND FISH PASSAGE CONSIDERATIONS

4.1 OVERVIEW

The Yakima River basin supports spring chinook salmon, fall chinook salmon, coho salmon, and summer steelhead. Sockeye salmon were present historically, but have been extirpated; however, kokanee exist in all the lakes. The watershed also supports several other resident salmonids including bull trout, rainbow trout, cutthroat trout, and mountain whitefish. Additionally, several non-native salmonids have been introduced to the basin, including the brook trout *(Salvelinus fontinalis)* and the brown trout *(Salmo trutta)*.

Prior to 1855, an estimated 300,000 to 800,000 anadromous salmonids returned to the Yakima River basin each year (WDFW 1993; Neilsen et al. 1991); Davidson (1953) estimated 500,000 chinook salmon (all races); Mullan (1983) estimated about 100,000 coho salmon. The historical total run size of Yakima River sockeye salmon has been estimated from 100,000 (Davidson 1953) to 200,000 (CBFWA 1990).

It is estimated that by 1900, prior to construction of the Project storage dams, the number of returning anadromous salmonid adults to the Yakima River basin had been reduced by about 90 percent, compared to historic runs (Davidson 1965, as cited in Tuck 1993). Salmon and steelhead runs continued to decline and by 1920 only an estimated 11,000 adults returned to the Yakima River basin (USBR 1979, as cited in Tuck 1993), a reduction of more that 98 percent of the historic run (NPPC 1990).

Irrigation projects were developed before Reclamation projects were authorized and constructed. Numerous irrigation diversion dams on the Yakima River mainstem and tributaries precluded anadromous salmonids from accessing portions of the watershed; unscreened diversions entrained salmon and steelhead smolts on their outmigration to the ocean, redirecting them instead to their death in agricultural fields. Dam construction on the mainstem Columbia River (which resulted in additional loss of downstream-migrating smolts) coupled with substantial commercial, tribal and recreational harvest of returning adults further decimated the numbers of anadromous salmonids returning to the Yakima River basin.

Crib dams, initially constructed to enlarge four existing natural glacial lakes, blocked fish passage to tributaries upstream from the dams and contributed to the eventual demise of the sockeye salmon runs by the early 20th century. Later construction by Reclamation of larger storage dams over the four crib dams and a fifth new dam (on the Tieton River) eliminated access to previously productive spawning and rearing habitat for spring chinook salmon, coho salmon, and steelhead, and resident fish populations — especially bull trout — that are now isolated but were formerly interconnected,.

The reservoirs created by the dams inundated a considerable amount of pristine, high-quality fish habitat. The historic natural lakes were notably smaller than the current reservoirs; construction of the dams inundated miles of streams. The lentic and lotic habitat in these historic lake basins were used by sockeye salmon and bull trout. Sockeye salmon generally spawn in flowing water but their young rear in lakes. Bull trout are currently present in all of the reservoirs and spawn in tributary streams. It can reasonably be assumed that other anadromous salmonids, particularly steelhead, used the upper reaches of these tributaries as well. In the case of Tieton Dam, an extensive meadow complex was inundated. The area was almost certainly valuable habitat for bull trout and other native anadromous salmonids, with the probable exception of sockeye salmon.

Even if this habitat were potentially productive, neither it nor any existing habitat upstream has been accessible to anadromous salmonids since construction of the storage dams, and in some cases since the construction of the crib dams several decades earlier. Construction of crib dams without fish passage facilities at Lakes Keechelus and Kachess in 1904 and at Lake Cle Elum in 1905 eliminated sockeye salmon populations in these lakes (Bryant and Parkhurst 1950; Davidson 1953; Fulton 1970; Mullan 1986). Construction of an impassable storage dam at Bumping Lake in 1910 likewise eliminated a sockeye salmon population in that lake, with an estimated annual run of 1,000 fish (Davidson 1953; Fulton 1970).

None of the existing dams are equipped with fish passage facilities. Sockeye salmon were extirpated in the Yakima River basin by 1933, following the completion of the last storage dam on the Cle Elum River. The lack of passage has also isolated local populations of bull trout, reducing or eliminating interconnectedness and the exchange of genetic material among populations, and preventing the recolonization of populations diminished by catastrophic natural events. It should be noted that there are no provisions at the storage dams for safe downstream passage of fish. The diversion dams on the Yakima River are screened to direct fish traveling downstream to a safe, fish bypass route. In contrast, the outlet works for all of the storage dams are unscreened and entrainment through these outlet works can injure and kill fish. The potential for entrainment increases as reservoirs are drawn down late in the irrigation season.

4.2 FISH SPECIES AFFECTED BY YAKIMA STORAGE RESERVOIRS

The four natural lakes supported Native American fisheries for sockeye salmon and other anadromous and resident fish. Detailed information is not available for pre-Yakima Project fish populations in these lakes. However, available information suggests that all of the native species currently found in each lake — as well as those found in the river reach downstream from each dam — were historically present in the watersheds above the dams. In addition, sockeye salmon and coho salmon were present but are now extinct. Rimrock Reservoir was not a natural lake so the watershed upstream would not have supported sockeye salmon and burbot that require a lake environment; however, it is likely the river and its tributaries would have been used by the other anadromous species.

The Yakima/Klickitat Fisheries Project (YKFP) is an all-stock initiative that is responding to the need for scientific knowledge for rebuilding and maintaining naturally spawning anadromous fish stocks in both basins (Sampson 2002). It is testing the principles of supplementation as a means to rebuild fish populations through the use of locally adapted broodstock in an artificial production program. This concept is being used on spring chinook salmon and coho salmon within the Yakima River basin. The coho salmon program's principal objective is to determine if naturally spawning coho salmon populations can be reintroduced throughout their biological range in the basin. The objective of the fall chinook salmon program is to determine if supplementation is a viable strategy to increase fall chinook salmon populations in the Yakima River basin.

One purpose of YKFP is to test the hypothesis that new supplementation techniques can be used in the Yakima River basin to increase natural production and to improve harvest opportunities while maintaining the long-term genetic fitness of the wild and native salmonid populations and keeping adverse ecological interactions within acceptable limits (Sampson and Fast 2001). The Yakama Nation — along with Washington Department of Fish and Wildlife — cooperates with the Bonneville Power Administration in YKFP.

Table 4-1 lists the fish species formerly and currently found in the Upper Yakima Basin that could inhabit the watersheds upstream of the storage dams if fish passage were provided.

Table 4-1. Fish Species Found in the Five Major Storage Reservoirs in the Yakima River basin (WDFW 2002c)

Western brook lamprey . ***Lampetra richardsoni***	Longnose dace ..... *Rhinichthys cataractae*
Pacific lamprey ..... ***Lampetra tridentata***	Leopard dace ..... *Rhinichthys falcatus*
	Speckled dace ..... *Rhinichthys osculus*
Mountain whitefish ..... *Prosopium williamsoni*	Chiselmouth ..... *Acrocheilus alutaceus*
Pygmy whitefish ..... *Prosopium coulteri*	Redside shiner ..... *Richardsonius balteatus*
Brown trout* ..... *Salmo trutta*	Peamouth ..... *Mylocheilus caurinus*
Bull trout ..... *Salvelinus confluentus*	Northern pikeminnow ..... *Ptychocheilus oregonensis*
Brook trout* ..... *Salvelinus fontinalis*	Largescale sucker ..... *Catostomus macrocheilus*
Lake trout* ..... *Salvelinus namaycush*	Mountain sucker ..... *Catostomus platyrhynchus*
Cutthroat trout ..... *Oncorhynchus clarki*	Bridgelip sucker ..... *Catostomus columbianus*
Rainbow trout (resident) ... *Onchorynchus mykiss*	
Steelhead trout ..... ***Onchorynchus mykiss***	Burbot ..... *Lota lota*
Coho salmon ..... ***Oncorhynchus kisutch***	
Spring chinook salmon ... ***Oncorhynchus tshawytscha***	Three-spine stickleback .... *Gasterosteus aculeatus*
Sockeye salmon ..... ***Oncorhynchus nerka***	
Kokanee salmon ..... *Oncorhynchus nerka*	Paiute sculpin ..... *Cottus beldingi*
	Torrent sculpin ..... *Cottus rhotheus*
	Mottled sculpin ..... *Cottus bairdi*

Species in Bold are no longer present.
* = indicates species not native to the Yakima River basin

4.3 PASSAGE TIMING REQUIREMENTS FOR UPPER BASIN FISH SPECIES

In order to develop and evaluate fish passage concepts and options for both upstream and downstream migration of anadromous and resident fish, it was necessary to delineate the timing of both adult and juvenile migration for the fish species considered most likely to benefit from providing passage at dams — spring chinook, coho, and sockeye salmon; steelhead; and bull trout. Tables 4-2 and 4-3 show estimated passage timing for all species individually; Tables 4-4 and 4-5 shows all species for upstream and downstream passage. These tables were developed using the experience and professional judgment of the interagency subteam of biologists participating in the assessment, and has also been informed by available data such as the timing of salmon runs in the Lower Yakima Basin.

Juvenile salmon tend to migrate downstream during the spring (March-June) and fall (late September through November) and are least active during the winter months (December-February). Generally, spring outmigrants are juvenile fish that are seeking habitat in larger streams or rivers or are fish actively migrating to the ocean. A significant exception to this pattern is sockeye salmon, which may migrate upstream to a lake as emergent fry in search of lacustrine habitat (Burgner 1991). In fall, some juvenile fish may also migrate downstream in search of overwintering habitat.

Adult salmon and trout typically migrate upstream seeking spawning habitat. Chinook salmon and steelhead travel thousands of miles throughout their lives and may migrate to a location near their spawning habitat months before they are ready to spawn. Resident fish species such as bull trout or rainbow trout may migrate upstream or downstream throughout a river system and may undertake a protracted spawning migration. Some species, such as rainbow trout and steelhead, spawn in the spring, while other species such as salmon and bull trout spawn in the fall; thus, the time period for upstream migration for all adult salmonids combined could extend from approximately March through November. Bull trout and steelhead are iteroparous (can spawn more than once) and so adult fish could also migrate downstream after the fish have spawned. Time periods for downstream migration of iteroparous species vary, but would probably be early summer or fall, after spawning.

Although the timing of peak adult upstream migration would differ between the Naches River and the upper mainstem Yakima River, peak timing of downstream juvenile migration should be similar in both arms (table 4-5). Because of the number of salmonid species that would be involved eventually in restoration and the different expressions of their life histories, it is reasonable to assume that nearly year-round fish passage would be required, considering all five storage projects.

Table 4-2. Upstream Migration or Passage Timing for Adults (WDFW 2002c)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Spring chinook salmon												
Coho salmon												
Sockeye salmon												
Bull trout												
Steelhead (Naches)												
Steelhead (Yakima)												

= General Migration Period = Peak Migration Period

Table 4-3-a. Downstream Migration or Passage Timing for Juveniles (WDFW 2002c)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Spring chinook salmon												
Coho salmon												
Sockeye salmon												
Bull trout												
Steelhead (Yakima)												
Steelhead (Naches)												

Table 4-3-b. Downstream Migration or Passage Timing for Kelts and Adults (WDFW 2002c)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Steelhead kelts (Yakima)												
Steelhead kelts (Naches)												
Bull trout adults												

= General Migration Period = Peak Migration Period

Table 4-4. Composite Upstream Migration or Passage Timing (WDFW 2002c)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Yakima River												
Naches River												

= General Migration Period = Peak Migration Period

Note: Table represents adult passage only for spring chinook, coho, sockeye salmon; steelhead; and bull trout. Juvenile (and/or subadult) upstream passage timing for sockeye salmon and bull trout is still being researched.

Table 4-5. Composite Downstream Migration or Passage Timing (WDFW 2002c)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Basin-Wide juveniles												
Yakima River adults												
Naches River adults												

= General Migration Period; = Peak Migration Period

* Juveniles for species identified above. Adults are steelhead kelts and bull trout.

4.4 BENEFITS OF PROVIDING FISH PASSAGE

Providing fish passage at Yakima River basin storage projects could increase or enhance populations of Upper Yakima Basin steelhead, coho salmon, and spring chinook salmon by restoring access to historically occupied habitat, restoring life history and genetic diversity of salmonids, allowing reintroduction of sockeye salmon back into the watersheds where they occurred historically, and reconnecting isolated populations of bull trout and other resident fish species. Over time, anadromous salmonids would be expected to recolonize the watersheds upstream from the storage dams if fish passage were provided. Bull trout abundance would be expected to expand due to enhanced connectivity and interaction among the presently isolated populations, and expanded foraging and overwintering habitat.

Sockeye salmon apparently played a substantial ecological role in the upper mainstem Yakima River; the available information suggests that the bulk of the sockeye salmon run returned to Cle Elum Lake, Kachess Lake, and Keechelus Lake. Bumping Lake on the Naches arm was a relatively small contributor to the overall population in the system. The infusion of marine-derived nutrients into the system from these returning sockeye salmon as well as other salmon species would have contributed to the overall productivity of the upper mainstem Yakima River for all species. Restoration of these sockeye salmon and other anadromous salmonid runs would help restore some of this historical nutrient input and associated increased productivity.

Kokanee occur in all lakes and apparently spawn successfully in tributaries. Some shoreline spawning is believed to occur within at least some of the lakes. Successful kokanee reproduction may indicate that restoration of sockeye salmon might be successful there.

Restoring connectivity among presently isolated populations of bull trout would allow for dispersal of fish among local populations, providing a mechanism for supporting weaker populations or refounding those that might become extirpated. It would also allow for gene flow among populations, which prevents the loss of genetic variation that insures survival in variable environments and thus decreases the probability of local extirpations.