

sale or marketed. The phrase "limited quantities," in this context means:

(i) 200 or fewer units, provided the product is designed solely for operation within one of the Commission's authorized radio services for which an operating license is required to be issued by the Commission; or

(ii) 10 or fewer units for all other products.

(iii) Prior to importation of a greater number of units than shown above, written approval must be obtained from the Chief, Office of Engineering and Technology, FCC.

(iv) Distinctly different models of a product and separate generations of a particular model under development are considered to be separate devices.

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DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

RIN 1018-AB94

Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Klamath River and Columbia River Distinct Population Segments of Bull Trout

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: The Fish and Wildlife Service (Service) determines threatened status for the Klamath River and the Columbia River distinct population segments of bull trout (*Salvelinus confluentus*), with special rules, pursuant to the Endangered Species Act of 1973, as amended (Act). The Klamath River population segment is limited to seven geographically isolated stream areas representing a fraction of the historical habitat. The distribution and numbers of bull trout have declined in the Klamath River basin due to habitat isolation, loss of migratory corridors, poor water quality, and the introduction of non-native species. The Columbia River population segment is represented by relatively widespread subpopulations that have declined in overall range and numbers of fish. A majority of Columbia River bull trout occur in isolated, fragmented habitats that support low numbers of fish and are inaccessible to migratory bull trout. The few remaining bull trout "strongholds" in the Columbia River basin tend to be found in large areas of contiguous habitats in

the Snake River basin of central Idaho mountains, upper Clark Fork and Flathead Rivers in Montana, and several streams in the Blue Mountains in Washington and Oregon. The decline of bull trout is primarily due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, and the introduction of non-native species. The special rules allow the take of bull trout in the Columbia River and Klamath River population segments if in accordance with applicable State and Native American Tribal fish and wildlife conservation laws and regulations and conservation plans approved by the Service.

The listing proposal was restricted by court order to information contained in the 1994 administrative record. This final determination was based on the best available scientific and commercial information including current data and new information received during the comment period. As a result, the threatened listing status for the Columbia River population segment has been retained, however, the listing status for the Klamath River population segment is changed from endangered to threatened. This listing status change occurred because bull trout interagency management and recovery efforts for the Klamath River basin are being implemented and, consequently, threats have been reduced. This rule implements the protection and conservation provisions afforded by the Act for the Klamath River and Columbia River population segments of bull trout.

DATES: Effective July 10, 1998.

ADDRESSES: The complete file for this rule is available for inspection, by appointment, during normal business hours at the U.S. Fish and Wildlife Service, Snake River Basin Field Office, 1387 S. Vinnell Way, Room 368, Boise, Idaho 83709.

FOR FURTHER INFORMATION CONTACT: Robert Ruesink, Supervisor, Snake River Basin Office (see **ADDRESSES** section) (telephone 208-378-5243, facsimile 208-378-5262).

SUPPLEMENTARY INFORMATION:

Background

Bull trout (*Salvelinus confluentus*), members of the family Salmonidae, are char native to the Pacific northwest and western Canada. Bull trout historically occurred in major river drainages in the Pacific Northwest from about 41° N to 60° N latitude, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in Northwest Territories, Canada

(Cavender 1978; Bond 1992). To the west, bull trout range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992). Bull trout are wide-spread throughout tributaries of the Columbia River basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River basin of south central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and the MacKenzie River system in Alberta and British Columbia (Cavender 1978; Brewin and Brewin 1997).

Bull trout were first described as *Salmo spectabilis* by Girard in 1856 from a specimen collected on the lower Columbia River, and subsequently described under a number of names such as *Salmo confluentus* and *Salvelinus malma* (Cavender 1978). Bull trout and Dolly Varden (*Salvelinus malma*) were previously considered a single species (Cavender 1978; Bond 1992). Cavender (1978) presented morphometric (measurement), meristic (geometrical relation), osteological (bone structure), and distributional evidence to document specific distinctions between Dolly Varden and bull trout. Bull trout and Dolly Varden were formally recognized as separate species by the American Fisheries Society in 1980 (Robins et al. 1980). Although bull trout and Dolly Varden co-occur in several northwestern Washington river drainages, there is little evidence of introgression (Haas and McPhail 1991) and the two species appear to be maintaining distinct genomes (Leary et al. 1993; Williams et al. 1995; Kanda et al. 1997; Spruell and Allendorf 1997).

Bull trout exhibit resident and migratory life-history strategies through much of the current range (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish rear from one to four years before migrating to either a lake (adfluvial), river (fluvial), or in certain coastal areas, to saltwater (anadromous), where maturity is reached in one of the three habitats (Fraley and Shepard 1989; Goetz 1989). Resident and migratory forms may be found together and it is suspected that bull trout give rise to offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993).

Bull trout have more specific habitat requirements compared to other salmonids (Rieman and McIntyre 1993). Habitat components that appear to influence bull trout distribution and

abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrates, and migratory corridors (Oliver 1979; Pratt 1984, 1992; Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Howell and Buchanan 1992; Rieman and McIntyre 1993, 1995; Rich 1996; Watson and Hillman 1997). Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide habitat requirements for bull trout to successfully spawn and rear, and that the characteristics are not necessarily ubiquitous throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), the fish should not be expected to simultaneously occupy all available habitats (Rieman et al. *in press*).

Bull trout are found primarily in colder streams, although individual fish are found in larger river systems throughout the Columbia River basin (Fraley and Shepard 1989; Rieman and McIntyre 1993, 1995; Buchanan and Gregory 1997; Rieman et al. *in press*). Water temperature above 15° C (59° F) is believed to limit bull trout distribution, which may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989; Rieman and McIntyre 1995). Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992; Rieman and McIntyre 1993; Rieman et al. *in press*). For example, the only stream with substantial bull trout spawning in the upper Blackfoot River in Montana was Copper Creek, which had maximum water temperatures less than 15° C (59° F) (Hillman and Chapman 1996). Goetz (1989) suggested optimum water temperatures for rearing of about 7 to 8° C (44 to 46° F) and optimum water temperatures for egg incubation of 2 to 4° C (35 to 39° F). In Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest water available in a plunge pool, 8 to 9° C (46 to 48° F) within a temperature gradient of 8 to 15° C (46 to 60° F).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Oliver 1979; Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Pratt 1992; Thomas 1992; Rich 1996; Sexauer and James 1997; Watson and Hillman 1997). Jakober (1995) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the

Bitterroot River drainage, Montana, and suggested that suitable winter habitat may be more restrictive than summer habitat. Maintaining bull trout habitat requires stream channel and flow stability (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period and channel instability may decrease survival of eggs and young juveniles in the gravel during winter through spring (Fraley and Shepard 1989; Pratt 1992; Pratt and Huston 1993).

Preferred spawning habitat consists of low gradient streams with loose, clean gravel (Fraley and Shepard 1989) and water temperatures of 5 to 9° C (41 to 48° F) in late summer to early fall (Goetz 1989). Pratt (1992) indicated that increases in fine sediments reduce egg survival and emergence. High juvenile densities were observed in Swan River, Montana, and tributaries with diverse cobble substrate and low percentage of fine sediments (Shepard et al. 1984). Juvenile bull trout in four streams in central Washington occupied slow-moving water less than 0.5 m/sec (1.6 ft/sec) over a variety of sand to boulder size substrates (Sexauer and James 1997).

The size and age of bull trout at maturity depends upon life-history strategy. Growth of resident fish is generally slower than migratory fish; resident fish tend to be smaller at maturity and less fecund (Fraley and Shepard 1989; Goetz 1989). Bull trout normally reach sexual maturity in 4 to 7 years and live as long as 12 years. Repeat and alternate year spawning has been reported, although repeat spawning frequency and post-spawning mortality are not well known (Leathe and Graham 1982; Fraley and Shepard 1989; Pratt 1992; Rieman and McIntyre 1996).

Bull trout typically spawn from August to November during periods of decreasing water temperatures. However, migratory bull trout frequently begin spawning migrations as early as April, and have been known to move upstream as far as 250 kilometers (km) (155 miles (mi)) to spawning grounds (Fraley and Shepard 1989). In the Blackfoot River, Montana, bull trout began migrations to spawning areas in response to increasing temperatures (Swanberg 1996). Temperatures during spawning generally range from 4 to 10°

C (39 to 51° F), with redds often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989; Pratt 1992; Rieman and McIntyre 1996). Bull trout require spawning substrate consisting of loose, clean gravel relatively free of fine sediments (Fraley and Shepard 1989). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992), and after hatching, juveniles remain in the substrate. Time from egg deposition to emergence may surpass 200 days. Fry normally emerge from early April through May depending upon water temperatures and increasing stream flows (Pratt 1992; Ratliff and Howell 1992).

Growth varies depending upon life-history strategy. Resident adults range from 150 to 300 millimeters (mm) (6 to 12 inches (in)) total length and migratory adults commonly reach 600 mm (24 in) or more (Pratt 1985; Goetz 1989). The largest verified bull trout is a 14.6 kilogram (kg) (32 pound) specimen caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982).

Bull trout are opportunistic feeders with food habits primarily a function of size and life-history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton and small fish (Boag 1987; Goetz 1989; Donald and Alger 1993). Adult migratory bull trout are primarily piscivorous, known to feed on various fish species (Fraley and Shepard 1989; Donald and Alger 1993).

Bull trout evolved with, and, in some areas, co-occur with native cutthroat trout (*Oncorhynchus clarki* ssp.), resident (redband) and migratory rainbow trout (*O. mykiss*), chinook salmon (*O. tshawytscha*), sockeye salmon (*O. nerka*), mountain whitefish (*Prosopium williamsoni*), various sculpin (*Cottus* spp.), sucker (Catostomidae) and minnow species (Cyprinidae spp.) (Mausser et al. 1988; Rieman and McIntyre 1993). Bull trout habitat overlaps with the range of several fishes listed as threatened, endangered, proposed, and petitioned for listing under the Act, including the endangered Snake River sockeye salmon (November 20, 1991; 56 FR 58619); threatened Snake River spring and fall chinook salmon (April 22, 1992; 57 FR 14653); endangered Kootenai River white sturgeon (*Acipenser transmontanus*) (September 6, 1994, 59 FR 45989); threatened and endangered steelhead (August 18, 1997, 62 FR 43937); and westslope cutthroat trout (*O. c. lewisi*) (petitioned for listing in July 1997). Widespread introductions of non-native fishes, including brook trout

(*S. fontinalis*), lake trout (*S. namaycush*) (west of the Continental Divide), and brown trout (*Salmo trutta*), have also occurred across the range of bull trout. These non-native fish have caused local bull trout declines and extirpations (Bond 1992; Ziller 1992; Donald and Alger 1993; Leary et al. 1993; Montana Bull Trout Scientific Group (MBTSG) 1996h).

Bull trout habitat in the coterminous United States is composed of a complex mosaic of land ownership, including Federal lands administered by the U.S. Forest Service (USFS), U.S. Bureau of Land Management (BLM), U.S. National Park Service (NPS), and Department of Defense (DOD); numerous Indian tribal lands; State land in Montana, Idaho, Oregon, Washington and Nevada; and private lands. It is estimated that as much as half of present bull trout habitat is bordered by non-Federal lands.

Migratory corridors link seasonal habitats for all bull trout life-history forms. For example, in Montana, migratory bull trout make extensive migrations in the Flathead River system (Fraley and Shepard 1989) and resident bull trout move to overwinter in downstream pools in tributaries of the Bitterroot River (Jakober 1995). The ability to migrate is important to the persistence of local bull trout subpopulations (Rieman and McIntyre 1993; M. Gilpin, University of California, *in litt.* 1997; Rieman et al. *in press*). Migrations facilitate gene flow among local subpopulations because individuals from different subpopulations interbreed when some stray and return to non-natal streams. Subpopulations that are extirpated by catastrophic events may also become reestablished in this manner.

Metapopulation concepts of conservation biology theory are applicable to the distribution and characteristics of bull trout (Rieman and McIntyre 1993). A metapopulation is an interacting network of local subpopulations with varying frequencies of migration and gene flow among them (Meefe and Carroll 1994). Local subpopulations may become extinct, but can be reestablished by individuals from other subpopulations. Metapopulations provide a mechanism for spreading risk because the simultaneous loss of all subpopulations is unlikely. Habitat alteration, primarily through the construction of impoundments, dams, and water diversions that create unsuitable conditions, has fragmented habitats, eliminated migratory corridors, and isolated bull trout often in the

headwaters of tributaries (Rieman et al. *in press*).

Though wide-ranging in parts of Oregon, Washington, Idaho and Montana, bull trout in the interior Columbia River basin presently occur in only about 44 to 45 percent of the historical range (Quigley and Arbelbide 1997; Rieman et al. *in press*). Declining trends and associated habitat loss and fragmentation have been documented rangewide (Bond 1992; Schill 1992; Thomas 1992; Ziller 1992; Rieman and McIntyre 1993; Newton and Pribyl 1994; Idaho Department of Fish and Game (IDFG), *in litt.* 1995; McPhail and Baxter 1996). Several local extirpations have been reported, beginning in the 1950s (Rode 1990; Ratliff and Howell 1992; Donald and Alger 1993; Goetz 1994; Newton and Pribyl 1994; Berg and Priest 1995; Light et al. 1996; Buchanan et al. 1997; Washington Department of Fish and Wildlife (WDFW) 1997). For example, bull trout were apparently extirpated around 1975 from the McCloud River, California, the southernmost range (Moyle 1976; Rode 1990).

Distinct Population Segments

The Service's June 13, 1997, proposal to list the Klamath River and the Columbia River population segments of bull trout (62 FR 32268) was based on the 1994 administrative record, as required by the court. The Service's original June 10, 1994 (59 FR 30254), 12-month petition finding found that listing the bull trout was warranted but precluded throughout the coterminous United States. As explained in the proposed rule, the approach to break the range of bull trout into distinct population segments in the reanalysis of the 1994 petition finding was undertaken because the fish occurs in widespread, but fragmented habitats and has several life-history patterns. In addition, the threats to bull trout are diverse, and the quality and quantity of information regarding the population status and trends varies greatly throughout the range. By examining bull trout distinct population segments, the Service was better able to evaluate proposed listing of those segments, based on the 1994 administrative record, that were a priority in need of Federal protection. Future listing actions could, thereby, be based on best available rather than outdated scientific information.

In the process of making this final listing determination, the Service reexamined the appropriateness of applying the bull trout distinct population segments (DPSs) for the purposes of listing. The joint National

Marine Fisheries Service (NMFS) and Service policy regarding the recognition of distinct vertebrate populations published February 7, 1996 (61 FR 4722), was the basis for this reexamination. Three elements are considered in the decision on whether a population segment could be treated as threatened or endangered under the Act—discreteness, significance, and conservation status in relation to the standards for listing. Discreteness refers to the isolation of a population from other members of the species and is based on two criteria—(1) marked separation from other populations of the same taxon resulting from physical, physiological, ecological, or behavioral factors, including genetic discontinuity; and (2) populations delimited by international boundaries. Significance is determined either by the importance or contribution, or both, of a discrete population to the species throughout its range. Four criteria were used to determine significance—(1) persistence of the discrete population segment in an ecological setting unusual or unique for the taxon; (2) evidence that loss of the discrete population segment would result in a significant gap in the range of the taxon; (3) evidence that the discrete population segment represents the only surviving natural occurrence of the taxon that may be more abundant elsewhere as an introduced population outside its historic range; and (4) evidence that the discrete population segment differs markedly from other populations of the taxon in its genetic characteristics. If a population segment is discrete and significant, its evaluation for endangered or threatened status is based on the Act's standards.

Based on the best available information, numerous bull trout subpopulations are isolated from each other by either unsuitable habitat or impassible dams and diversions, or both. Although many subpopulations could be considered discrete, few meet the "significance" criteria. For example, although some genetic differences were identified among subpopulations of bull trout in specific watersheds of the Columbia River basin, the subpopulations did not differ markedly and they inhabit similar habitats. The best available current information supports designating five DPSs in the coterminous United States—(1) Klamath River, (2) Columbia River, (3) Coastal-Puget Sound, (4) Jarbidge River, and (5) St. Mary-Belly River. For purpose of this final determination only the Klamath River and Columbia River DPSs will be addressed. The three remaining DPSs

are the subject of a proposed rule published concurrently.

Although the range of bull trout extends into Canada and Alaska, subpopulations outside the coterminous United States are not being considered in this rulemaking. In accordance with the distinct vertebrate population policy, the Service may determine a population to be discrete at an international border where there are significant differences in the control of exploitation, management of habitat, conservation status, or regulatory mechanisms. Bull trout management and conservation strategy in Canada differs from the United States and such activities are beyond the regulatory scope of the Act. The best available information also disclosed uncertainty regarding the status of bull trout in Canada. Throughout British Columbia and Alberta, data on bull trout status, distribution, and the presence of ongoing threats is incomplete and covers only a portion of the species' range within the provinces. The status of bull trout in Alaska is unknown.

Within the coterminous United States, bull trout distribution is highly fragmented and many subpopulations are geographically isolated. The best available information indicates that bull trout in the coterminous United States, although still wide-ranging, have suffered a significant reduction in range. In addition, bull trout are faced with varying degrees of ongoing threats. The Service now determines that listing bull trout distinct population segments only within the coterminous United States is warranted at this time.

Klamath River

The Klamath River originates in south central Oregon near Crater Lake National Park, and flows southwest into northern California where it meets the Trinity River and empties into the Pacific Ocean. Bull trout in this drainage are discrete because of physical isolation from other bull trout by the Pacific Ocean and several small mountain ranges in central Oregon. Leary et al. (1991) determined genetic characteristics of bull trout in the Klamath River and Columbia River drainages using protein electrophoresis. They concluded that these two groups of fish were reproductively isolated and evolutionarily distinct. In addition, Williams et al. (1995) separated bull trout in the Klamath and Columbia Rivers into different clades (i.e., groups derived from different lineages) based on genetic diversity patterns. As a result, the Klamath River DPS is significant because it differs markedly

in genetic characteristics from bull trout in the Columbia River basin.

Columbia River

The Columbia River DPS occurs throughout the entire Columbia River basin within the United States and its tributaries, excluding bull trout found in the Jarbidge River, Nevada. Although Williams et al. (1995) identified two distinct clades in the Columbia River basin (upper and lower Columbia River) based on genetic diversity patterns, a discrete geographical boundary between the two clades was not documented. The Columbia River DPS is significant because the overall range of the species would be substantially reduced if this discrete population were lost.

Status and Distribution

The Service evaluated the status and distribution of bull trout for each subpopulation in the Klamath River and Columbia River population segments. The complete review of this evaluation is found in a status summary compiled by the Service (Service status summary 1998). A synopsis of the summary is presented in this rule.

To facilitate evaluation of current bull trout distribution and abundance for both the Klamath River and Columbia River population segments, the Service analyzed data on bull trout relative to subpopulations because fragmentation and barriers have isolated bull trout throughout their current range. A subpopulation is considered a reproductively isolated group of bull trout that spawns within a particular area of a river system. In areas where two groups of bull trout are separated by a barrier (e.g., an impassable dam or waterfall, or reaches of unsuitable habitat) that allows only individuals upstream access to those downstream (i.e., one-way passage), both groups were considered subpopulations. In addition, subpopulations were considered at risk of extirpation from naturally occurring events if they were—(1) unlikely to be reestablished by individuals from another subpopulation (i.e., functionally or geographically isolated from other subpopulations); (2) limited to a single spawning area (i.e., spatially restricted); and either (3) characterized by low individual or spawner numbers; or (4) primarily of a single life-history form. For example, a subpopulation of resident fish isolated upstream of an impassable waterfall would be considered at risk of extirpation from naturally occurring events if the subpopulation had low numbers of fish that spawn in a restricted area. In such cases, a natural event such as a fire or

flood affecting the spawning area could eliminate the subpopulation, and reestablishment from fish downstream would be prevented by the impassable waterfall. However, a subpopulation residing downstream of the waterfall would not be considered at risk of extirpation from naturally occurring events because there would be establishment potential by fish from the subpopulation upstream. Because resident bull trout may exhibit limited downstream movement (Nelson 1996), the Service's determination of subpopulations at risk of extirpation from naturally occurring events may overestimate the number of subpopulations that are likely to be reestablished.

The status of subpopulations was based on modified criteria of Rieman et al. (*in press*), including the abundance, trends in abundance, and the presence of life-history forms of bull trout. The Service considered a subpopulation "strong" if 5,000 individuals or 500 spawners likely occur in the subpopulation, abundance appears stable or increasing, and life-history forms were likely to persist; and "depressed" if less than 5,000 individuals or 500 spawners likely occur in the subpopulation, abundance appears to be declining, or a life-history form historically present has been lost. If there was insufficient abundance, trend, and life-history information to classify the status of a subpopulation as either "strong" or "depressed," the status was considered "unknown."

Based on abundance, trends in abundance, and the presence of life-history forms, bull trout were considered strong (i.e., 5,000 individuals or 500 spawners likely occur in the subwatershed or larger area, abundance is stable or increasing with at a minimum of half of historic abundance, and the presence of all life-history forms historically present) in 13 percent of the occupied range in the interior Columbia River basin (Quigley and Arbelbide 1997). Using various estimates of bull trout range, Rieman et al. (*in press*) estimated that bull trout were strong in 6 to 24 percent of the subwatersheds in the Columbia River basin. Bull trout declines have been attributed to the effects of land and water management activities, including forest management and road building, mining, agricultural practices, and livestock grazing (Furniss et al. 1991; Meehan 1991; Nehlsen et al. 1991; Craig and Wissmar 1993; Frissell 1993; McIntosh et al. 1994; Platts et al. 1995). Isolation and habitat fragmentation from dams and agricultural diversions (Rode 1990; Mongillo 1993; Jakober 1995),

fisheries management practices, poaching and the introduction of non-native species (Rode 1990; Bond 1992; Howell and Buchanan 1992; WDFW 1992; Donald and Alger 1993; Leary et al 1993; Pratt and Huston 1993; Rieman and McIntyre 1993; MBTSG 1996h; Palmisano and Kaczynski, Northwest Forest Resources Council (NFRS), *in litt.* 1997) also threaten bull trout populations.

Klamath River Population Segment

Historical records suggest that bull trout were once widely distributed and exhibited diverse life-history traits in the Klamath River basin (Gilbert and Evermann 1894; Dambacher et al. 1992; Ziller 1992; Oregon Chapter of the American Fisheries Society (OCAFS) 1993). The earliest records of bull trout in the basin are from Fort Creek (formerly Linn Creek), a tributary to the Wood River (L. Dunsmoor and C. Bienz, Klamath Tribe, *in litt.* 1997). Records from the late 1800s suggest that migratory fish (adfluvial) inhabited Klamath Lake (OCAFS 1993). Other migratory bull trout (i.e., fluvial) were evidently present in some of the larger streams in the basin as recently as the early 1970s (Ziller 1992). Bull trout are thought to have been extirpated from the Sycan River, the South Fork of the Sycan River, and four streams in the Klamath River basin (Cherry, Sevenmile, Coyote, and Callahan creeks) since the 1970s.

Currently, bull trout in the Klamath River basin occur only as resident forms isolated in higher elevation headwater streams (Goetz 1989) within three watersheds—Upper Klamath Lake, Sprague River, and Sycan River (Light et al. 1996). Factors contributing to isolation include habitat degradation, water diversion, and habitat fragmentation (OCAFS 1993; Light et al. 1996). In addition, long distances separate each isolated subpopulation (Schroeder and Weeks, *in litt.* 1997). According to Light et al. (1996), bull trout occupy approximately 38.2 km (22.9 mi) of streams in the Klamath River basin. More recently, Buchanan et al. (1997) indicated that bull trout occupy approximately 34.1 km (20.5 mi) of streams. The risk of extinction for Klamath River bull trout over the next 100 years was recently estimated at 70 to 90 percent (K. Schroeder and H. Weeks, OCAFS, *in litt.* 1997). The Service identified seven bull trout subpopulations in three watersheds (number of subpopulations in each watershed)—Upper Klamath Lake (2), Sycan River (1), and Sprague River (4). The Service considers six of the subpopulations at risk of extirpation

caused by naturally occurring events due to their isolation, single life-history form and spawning area, and low abundance (Service status summary 1997).

Columbia River Population Segment

The Columbia River DPS includes bull trout residing in portions of Oregon, Washington, Idaho, and Montana. Bull trout are estimated to have occupied about 60% of the Columbia River Basin, and presently occur in 45% of the estimated historical range (Quigley and Arbelbide 1997). The Columbia River population segment is composed of 141 subpopulations. For discussion and analysis, the Service considered four geographic areas of the Columbia River basin—(1) lower Columbia River (downstream of the Snake River confluence), (2) mid-Columbia River (Snake River confluence to Chief Joseph Dam), (3) upper Columbia River (upstream from Chief Joseph Dam), and (4) Snake River and its tributaries (including the Lost River drainage).

Lower Columbia River Geographical Area

The lower Columbia River area includes all tributaries in Oregon and Washington downstream of the Snake River confluence near the town of Pasco, Washington. The Service identified 20 subpopulations in watersheds of nine major tributaries of the lower Columbia River (number of subpopulations in each watershed)—the Lewis River (2), Willamette River (3), White Salmon River (1), Klickitat River (1), Hood River (2), Deschutes River (3), John Day River (3), Umatilla River (2), and Walla Walla River (3). The present distribution of bull trout in the lower Columbia River basin is less than the historic range (Buchanan et al. 1997; Oregon Department of Fish and Wildlife (ODFW) 1993). Bull trout are thought to be extirpated from several tributaries in five river systems in Oregon—the Middle Fork Willamette River, the North and South Forks of the Santiam River, the Clackamas River, the upper Deschutes River (upstream of Bend, Oregon) and the Crooked River (tributary to the Deschutes River) (Buchanan et al. 1997).

Hydroelectric facilities and large expanses of unsuitable, fragmented habitat have isolated these subpopulations. Large dams, such as McNary, John Day, The Dalles, and Bonneville, separate four reaches of the lower Columbia River. Although fish may pass each facility in both upstream and downstream directions, the extent to which bull trout use the Columbia

River is unknown. In addition, the nine major tributaries have numerous facilities, many of which do not provide upstream passage.

Migratory bull trout are present with resident fish or exclusively in at least 13 of the 20 subpopulations in the lower Columbia River. Many migratory fish are adfluvial and inhabit reservoirs created by dams. However, this area includes the only extant adfluvial subpopulation in Oregon, which exists in Odell Lake in the Deschutes River basin (Ratliff and Howell 1992; Buchanan et al. 1997). The Metolius River-Lake Billy Chinook subpopulation is also found in the Deschutes River basin. It is the only subpopulation considered “strong” and exhibits an increasing trend in abundance. The Service considers 5 of the 20 subpopulations at risk of extirpation caused by naturally occurring events exacerbated by isolation, single life-history form and spawning area, and low abundance.

Mid-Columbia River Geographical Area

The mid-Columbia River area includes watersheds of four major tributaries of the Columbia River in Washington, between the confluence of the Snake River and Chief Joseph Dam. The Service identified 16 bull trout subpopulations in the four watersheds (number of subpopulations in each watershed)—Yakima River (8), Wenatchee River (3), Entiat River (1), and Methow River (4). Historically, bull trout occurred in larger areas of the four tributaries and Columbia River. Bull trout are thought to have been extirpated in 10 streams within the area—Satus Creek, Nile Creek, Orr Creek, Little Wenatchee River, Napecqua River, Lake Chelan, Okanogan River, Eightmile Creek, South Fork Beaver Creek, and the Hanford Reach of the Columbia River. Most bull trout in the mid-Columbia River geographic area are isolated by dams or unsuitable habitat created by water diversions.

Bull trout in the mid-Columbia River area are most abundant in Rimrock Lake of the Yakima River basin and Lake Wenatchee of the Wenatchee River basin. Both subpopulations are considered “strong” and increasing or stable. The remaining 14 subpopulations are relatively low in abundance, exhibit “depressed” or unknown trends, and primarily have a single life-history form. The Service considers 10 of the 16 subpopulations at risk of extirpation because of naturally occurring events due to isolation, single life-history form and spawning area, and low abundance.

Upper Columbia River Geographic Area

The upper Columbia River geographic area includes the mainstem Columbia River and all tributaries upstream of Chief Joseph Dam in Washington, Idaho, and Montana. Bull trout are found in two large basins, the Kootenai River and Pend Oreille River, which include the Clark Fork River. Historically, bull trout were found in larger portions of the area. Numerous dams and degraded habitat have fragmented bull trout habitat and isolated fish into 71 subpopulations in 9 major river basins (number of subpopulations in each basin)—Spokane River (1), Pend Oreille River (3), Kootenai River (5), Flathead River (24), South Fork Flathead River (3), Swan River (3), Clark Fork River (4), Bitterroot River (27), and Blackfoot River (1). Bull trout are thought to be extirpated in 64 streams and lakes of various sizes—Nespelem, Sanpoil, and Kettle rivers; Barnaby, Hall, Stranger, and Wilmont creeks; 8 tributaries to Lake Pend Oreille; 5 tributaries to Pend Oreille River below Albeni Falls Dam; Lower Stillwater Lake; Arrow Lake (Montana); upper Clark Fork River, 12 streams in the Coeur d'Alene River basin; and approximately 25 streams in the St. Joe River basin (e.g., IDFG, *in litt.* 1995).

The upper Columbia River area contains "strongholds" for bull trout. Bull trout are considered "strong" in Hungry Horse Reservoir and Swan Lake. Trends in abundance are stable in Hungry Horse Reservoir, and increasing in Swan Lake. Although high numbers of bull trout are found in Lake Pend Oreille and the upper Kootenai River, trends in abundance are either negative or unknown. The high number of subpopulations (27) in the Bitterroot River basin, Montana, indicates a high degree of habitat fragmentation where numerous groups of resident bull trout are restricted primarily to headwaters. The Service considers 47 of the 71 subpopulations at risk of extirpation because of naturally occurring events due to isolation, single life-history form and spawning area, and low abundance.

Snake River Geographical Area

Bull trout occupy portions of 14 major tributaries in the Snake River basin of Idaho, Oregon, and Washington. The Service identified 34 bull trout subpopulations in the Snake River basin. The area consists of two primary portions separated by Hells Canyon Dam. Downstream of Hells Canyon Dam, major tributaries that support bull trout include (number of subpopulations in each tributary)—Tucannon River (2), Clearwater River

(3), Asotin Creek (2), Grande Ronde River (1), Imnaha River (4), and Salmon River (2). Upstream of Hells Canyon Dam, major tributaries that support bull trout include—Pine Creek (4), Powder River (3), Malheur River (2), Payette River (4), Weiser River (2), and Boise River (2). Although bull trout distribution upstream of Hells Canyon Dam is limited primarily to the basin downstream of Shoshone Falls in southern Idaho, three geographically isolated bull trout subpopulations occur upstream of Shoshone Falls in the Little Lost River drainage. Bull trout subpopulations upstream of Hells Canyon Dam are generally low in abundance, fragmented, and isolated. The current distribution of bull trout in the Snake River basin is less than historically (Ratcliff and Howell 1992; Batt 1996; Buchanan et al. 1997; Quigley and Arbelbide 1997), with recent extirpations documented in Eagle Creek (Powder River basin) and Wallowa Lake (Grande Ronde River basin) (Ratcliff and Howell 1992; Batt 1996; Buchanan et al. 1997); and possibly in South Fork Asotin Creek (WDFW 1997). Numerous impassable dams and large expanses of unsuitable habitat have isolated subpopulations within the historic range. Isolation is most prominent upstream of Hells Canyon Dam (southwest Idaho and southeast Oregon). The basin downstream of Hells Canyon Dam is relatively intact, and connectivity among bull trout subpopulations may still occur.

Bull trout occupy large areas of contiguous habitat in the Snake River basin downstream of Hells Canyon Dam, such as in the Clearwater River and Salmon River basins. High numbers of bull trout have been observed in the Tucannon River, Imnaha River, Clearwater River, Salmon River, and Malheur River subpopulations, however, trends in abundance are largely unknown or declining. The Service considers 9 of the 34 subpopulations at risk of extirpation because of naturally occurring events due to isolation, single life-history form and spawning area, and low abundance.

In summary, the Columbia River population segment of bull trout has declined in overall range and numbers of fish. Though still widespread, there have been numerous local extirpations reported throughout the Columbia River basin. In Idaho, for example, bull trout have been extirpated from 119 reaches in 28 streams (IDFG *in litt.* 1995). The population segment is composed of 141 subpopulations indicating habitat fragmentation, isolation, and barriers that limit bull trout distribution and migration within the basin. Although

some strongholds still exist, bull trout, generally, occur as isolated subpopulations in headwater lakes or tributaries where migratory fish have been lost.

Previous Federal Action

On September 18, 1985, the Service published an animal notice of review in the **Federal Register** (50 FR 37958) designating the bull trout a category 2 candidate for listing in the coterminous United States. Category 2 taxa were those for which conclusive data on biological vulnerability and threats were not currently available to support proposed rules. The Service published updated notices of review for animals on January 6, 1989 (54 FR 554), and November 21, 1991 (56 FR 58804), reconfirming the bull trout category 2 status. The Service elevated bull trout in the coterminous United States to category 1 for Federal listing on November 15, 1994 (59 FR 58982). Category 1 taxa were those for which the Service had on file substantial information on biological vulnerability and threats to support preparation of listing proposals. Upon publication of the February 28, 1996, notice of review (61 FR 7596), the Service ceased using category designations and included the bull trout as a candidate species. Candidate species are those which the Service has on file sufficient information on biological vulnerability and threats to support proposals to list the species as threatened or endangered.

On October 30, 1992, the Service received a petition to list the bull trout as an endangered species throughout its range from the following conservation organizations in Montana—Alliance for the Wild Rockies, Inc., Friends of the Wild Swan, and Swan View Coalition (petitioners). The petitioners also requested an emergency listing and concurrent critical habitat designation for bull trout populations in select aquatic ecosystems where the biological information indicated that the species was in imminent threat of extinction. A 90-day finding, published on May 17, 1993 (58 FR 28849), determined that the petitioners had provided substantial information indicating that listing of the species may be warranted. The Service initiated a rangewide status review of the species concurrent with publication of the 90-day finding.

On June 6, 1994, the Service concluded in the original finding that listing of bull trout throughout its range was not warranted due to unavailable or insufficient data regarding threats to, and status and population trends of, the species within Canada and Alaska. However, the Service determined that

sufficient information on the biological vulnerability and threats to the species was available to support a warranted finding to list bull trout within the coterminous United States. Because the Service concluded that the threats were imminent and moderate to this population segment, the Service gave the bull trout within the coterminous United States a listing priority number of 9. As a result, the Service found that listing a distinct vertebrate population segment of bull trout residing in the coterminous United States was warranted but precluded due to higher priority listing actions.

On November 1, 1994, Friends of the Wild Swan, Inc. and Alliance for the Wild Rockies, Inc. (plaintiffs) filed suit in the U.S. District Court of Oregon (Court) arguing that the warranted but precluded finding was arbitrary and capricious. After the Service issued a "recycled" 12-month finding for the coterminous population of bull trout on June 12, 1995, the Court issued an order declaring the plaintiffs' challenge to the original finding moot. The plaintiffs declined to amend their complaint and appealed to the Ninth Circuit Court of Appeals, which found that the plaintiffs' challenge fell "within the exception to the mootness doctrine for claims that are capable of repetition yet evading review." On April 2, 1996, the circuit court remanded the case back to the district court. On November 13, 1996, the Court issued an order and opinion remanding the original finding to the Service for further consideration. Included in the instructions from the Court were requirements that the Service limit its review to the 1994 administrative record, and incorporate any emergency listings or high magnitude threat determinations into current listing priorities. In addition, reliance on other Federal agency plans and actions was precluded. The reconsidered 12-month finding based on the 1994 Administrative Record was delivered to the Court on March 13, 1997.

On March 24, 1997, the plaintiffs filed a motion for mandatory injunction to compel the Service to issue a proposed rule to list the Klamath River and Columbia River bull trout populations within 30 days based solely on the 1994 Administrative Record. In response to this motion, the Service "concluded that the law of this case requires the publication of a proposed rule" to list the two warranted populations. On April 4, 1997, the Service requested 60 days to prepare and review the proposed rule. In a stipulation between the Service and plaintiffs filed with the Court on April 11, 1997, the Service

agreed to issue a proposed rule in 60 days to list the Klamath River population of bull trout as endangered and the Columbia River population of bull trout as threatened based solely on the 1994 record.

Based upon the Court agreement and stipulation, and information contained solely in the 1994 record, the Service proposed the Klamath River population of bull trout as endangered and Columbia River population of bull trout as threatened on June 13, 1997 (62 FR 32268). The proposal included a 60-day comment period and gave notice of five public hearings in Portland, Oregon; Spokane, Washington; Missoula, Montana; Klamath Falls, Oregon; and Boise, Idaho. The comment period on the proposal, which originally closed on August 12, 1997, was extended to October 17, 1997 (62 FR 42092), to provide the public with more time to compile information and submit comments.

On December 4, 1997, the Court ordered the Service to reconsider several aspects of the 1997 reconsidered finding. On February 2, 1998, the Court gave the Service until June 12, 1998, to respond. The final listing determination for the Klamath River and Columbia River population segments of bull trout and the concurrent proposed listing rule for the Coastal-Puget Sound, Jarbidge River, and St. Mary-Belly River DPSs constitute the Service's response.

The Service published Listing Priority Guidance for Fiscal Years 1998 and 1999 on May 8, 1998 (63 FR 25502). The guidance clarifies the order in which the Service will process rulemakings giving highest priority (Tier 1) to processing emergency rules to add species to the Lists of Endangered and Threatened Wildlife and Plants (Lists); second priority (Tier 2) to processing final determinations on proposals to add species to the Lists, processing new proposals to add species to the Lists, processing administrative findings on petitions (to add species to the Lists, delist species, or reclassify listed species), and processing a limited number of proposed or final rules to delist or reclassify species; and third priority (Tier 3) to processing proposed or final rules designating critical habitat. Processing of this proposed rule is a Tier 2 action.

Summary of Comments and Recommendations

In the June 13, 1997, proposed rule (62 FR 32268), all interested parties were requested to submit comments or information that might contribute to the final listing determination for bull trout. Announcements of the proposed rule

and notice of public hearings were sent to at least 370 individuals, including Federal, State, county and city elected officials, State and Federal agencies, interested private citizens and local area newspapers and radio stations. Announcements of the proposed rule were also published in nine newspapers—the Oregonian, Portland, Oregon; the Spokesman Review, Spokane, Washington; the Yakima Herald, Yakima, Washington; the Missoulian, Missoula, Montana; the Kalispell Interlake, Kalispell, Montana; the Idaho Statesman, Boise, Idaho; the Lewiston Tribune, Lewiston, Idaho; the Post Register, Idaho Falls, Idaho; and the Herald and News, Klamath Falls, Oregon. Public hearings were held on July 1, 1997, in Portland, Oregon; July 8, 1997, in Spokane, Washington; July 10, 1997, in Missoula, Montana; July 15, 1997, in Klamath Falls, Oregon; and July 17, 1997, in Boise, Idaho. In response to numerous requests for additional time to complete compilation of information and meaningfully participate in the public comment process, the Service published a notice on August 5, 1997 (62 FR 42092), extending the comment period to October 17, 1997.

Eighty-four oral and 278 written (including electronic mail) comments were received on the proposed rule. These included comments from 7 Federal agencies, 9 State agencies, 6 counties in Oregon and Idaho, 2 Native American tribes, 6 private timber companies, and 20 industry or trade associations and bureaus. Comments were also received from the Idaho Congressional delegation, and Governors from the states of Montana, Idaho and Oregon.

The Service did not specifically solicit formal scientific peer review of the proposal as outlined in the Service's July 1, 1994, Interagency Cooperative Policy (59 FR 34270) because the proposal was based on the 1994 administrative record and not the best available scientific information. However, in the process of making this final listing determination, a number of professional fishery biologists were consulted and their comments and information were either incorporated into the listing decision as appropriate or are addressed below.

The Service considered all comments, including oral testimony at the five public hearings. A majority of comments supported the listing proposal and 65 comments were in opposition. Opposition was based on several concerns, including conflicts between ongoing State conservation efforts and Federal listing; possible economic impacts from listing the bull

trout; lack of solutions to the bull trout decline that would result from listing; and because the proposed rule was not peer-reviewed or based on the most current information. Seventy-three respondents provided new scientific information considered by the Service for this determination. The states of Idaho and Montana submitted conservation plans for bull trout for consideration by the Service in lieu of listing. The USFS (R. Joslin, USFS, *in litt.* 1997), BLM (A. Thomas, BLM, *in litt.* 1997) and U.S. Bureau of Reclamation (USBR) (M. McClendon, USBR, *in litt.* 1997) provided the Service with information on respective agency efforts to date to assess, evaluate, monitor, and conserve bull trout populations in habitats affected by each agency's management. Because multiple respondents offered similar comments in some cases, comments of a similar nature or point are grouped. These comments and the Service's response are discussed below—

Issue 1: Several respondents urged the Service to list bull trout throughout its entire range. Two respondents recommended that the Service include the Jarbidge River bull trout population as a threatened species. Another respondent stated that the proposal to list the entire Columbia River bull trout population was too broad and suggested that the area be analyzed for listing purposes by major river segments. Conversely, another respondent requested that the Service designate bull trout in the Clark Fork and Kootenai River basins as distinct population segments, citing geographic and historic isolation, and biological significance to the species as a whole as reasons. Additionally, several other commenters suggested that smaller, more manageable distinct population segments be established to avoid listing healthy populations so that conservation efforts can be applied to areas where restoration is truly needed. Other commenters, at the Federal, State and local level suggested other delineations for the distinct population segments, and questioned whether listing would afford protection of bull trout only in currently occupied habitat.

Service response: Based on the best available scientific and commercial information, and consistent with the distinct vertebrate population policy (61 FR 4722, February 7, 1997), the Service has determined that bull trout should be divided into five distinct vertebrate populations for listing purposes, but only in the coterminous United States (see Distinct Population Segment section). The Klamath River and the Columbia River population segments are

the subject of this final rule and the remaining three population segments are addressed in an accompanying proposed rule.

In addressing the appropriateness in designating additional DPSs within the Columbia River basin, the Service reviewed new genetic and other biological data developed since 1994, and determined that there is insufficient information available to further divide this DPS. Although many bull trout groups in the Columbia River basin were discrete according to the DPS policy, they failed to meet criteria for significance (e.g. bull trout in the Little Lost River basin in Idaho and portions of the upper Columbia River basin). However, during the recovery process, further division of the Columbia River DPS into recovery units or zones including separation of the bull trout in the Kootenai River, Clark Fork-Pend Oreille River, Little Lost River, 17 potential genetic conservation groups (GCGs) in the State of Washington, and 8 additional GCGs in Oregon can be considered. For wide-ranging species, designation of recovery units can focus recovery objectives on the specific threats, status and habitat requirements within the defined geographic area. Although recovery units cannot be individually delisted without consideration of the entire listed entity (species or DPS), the Service can develop "special rules" (under section 4(d) of the Act) for individual recovery units (see issue #6 below for more information on special rules).

Issue 2: Several respondents stated that because the proposed rule was based on information gathered prior to June 1994, listing should be deferred until new information is analyzed and updated. Comments that "quality of peer reviewed scientific data is noticeably lacking" were also received. Some respondents questioned why the bull trout is now being considered for listing when the Service's analysis in the proposed rule concluded that bull trout had a widespread range and threats to the fish were only moderate. Respondents also stated that conclusions in the proposed rule regarding population distribution and population trends were inaccurate.

Service response: The U.S. District Court of Oregon ordered the Service on November 13, 1996, to reconsider the original 1994 bull trout finding based only on information available to the agency when it made the original 1994 finding. Therefore, the Service was mandated to move ahead with a listing proposal based on the information contained in the 1994 administrative record. In making this final listing determination,

however, the Service has reviewed and considered new information regarding distribution and life history for the Klamath River and Columbia River population segments of bull trout. This includes, but is not limited to, new bull trout status, distribution, and threats information, and also descriptions of ongoing conservation actions, contained in reports and other written correspondence available since 1994 concerning bull trout in Idaho (Adams and Bjornn 1997; Batt 1996; Bonneau and Scarnecchia 1996; Corley 1997; Elle 1995; Espinoza et al. 1997; N. Horner, IDFG, *in litt.* 1997); Montana (Berg and Priest 1995; Hillman and Chapman 1996; Hansen and DosSantos 1997; Kanda et al. 1997; Long 1995, 1997; Mathieu 1996; McDowell et al. 1997; MBTSG 1995a–e; MBTSG 1996a–h; Rich 1996; Swanberg 1996; Swanberg and Burns 1997); Oregon (Buchanan et al. 1997; Buchanan and Gregory 1997; Capruso 1997; Crabtree 1996; Germond et al. 1996a, b; Ratliff et al. 1996; Spruell and Allendorf 1997); Washington (Faler and Bair 1996; Northrop 1997; Raekes 1996; Sexauer and James 1997; WDFW 1997); the Klamath River basin (Buktenica 1997; Buktenica and Larson 1997; Light et al. 1996; ODFW 1996) and bull trout in the Columbia River basin (Platts et al. 1995; Quigley and Arbelbide 1997; Rieman et al. *in press*; Rieman and McIntyre 1995, 1996; Watson and Hillman 1997; Williams et al. 1995; R. Joslin, *in litt.* 1997; J. Kraft, Plum Creek, *in litt.* 1997; M. McClendon, *in litt.* 1997; Palmisano and Kacynski, *in litt.* 1997; Thomas, *in litt.* 1997).

Based on the best information currently available, bull trout in the Klamath River and Columbia River population segments are not more widespread or found in other areas of the Klamath or Columbia River basins than shown in the 1994 administrative record. Bull trout occur over a large geographic area in four states within the Columbia River drainage. However, bull trout display a generally patchy distribution (Rieman and McIntyre 1993). The best available information indicates that bull trout are in widespread decline across the historic range and restricted to numerous reproductively isolated subpopulations in the Columbia River basin with many recent local extirpations. The largest contiguous areas supporting bull trout are "strongholds" in central Idaho and Montana, such as the upper Flathead River basin. Many remaining bull trout subpopulations are characterized by declining trends, low relative subpopulation size, loss of migratory

fish or the presence of a single life-history form, and isolated from other bull trout by large geographic separation(s). Habitat loss, fragmentation and other changes that have isolated and continue to impact bull trout subpopulations also increase their susceptibility to naturally occurring processes (both demographically and environmentally). Many remaining subpopulations in both the Klamath River and Columbia River population segments are at risk of extirpation from the combined effects of habitat loss and fragmentation, loss of migration corridors, and inability to reestablish extirpated subpopulations through emigration, and recovery actions are required to slow the rate of habitat loss and continued reductions in range. Existing regulations have not arrested the decline of bull trout and newly developed State and local conservation strategies are largely not implemented.

Issue 3: Several respondents opposed the Federal listing or believed it not necessary, and expressed support for various State and local conservation plans developed for bull trout. Two respondents stated that State forest practice rules and regulations are adequate to conserve and restore bull trout. In addition, others recommended that if the bull trout is eventually listed, the Service should defer to the States for management and recovery.

Service response: Section 4(b)(1)(A) of the Act, requires that listing decisions be made solely on the best scientific and commercial data available after conducting a review of the status of the species. The Act also instructs the Service to consider "existing regulatory mechanisms, including taking into account those efforts by State, local and other entities to protect a species, including conservation plans or practices." However, several recent Federal court decisions have limited the extent to which the Service may rely upon land management plans, agreements and other documents that are under development and promise proposed future actions, as a basis for determining that listing is not warranted (*Southwest Center for Biological Diversity v. Babbitt*, 926 F. Supp. 920 (D. Ariz. 1996); *Biodiversity Legal Foundation v. Babbitt*, 943 F. Supp. 23 (D. D.C. 1996)).

The Service has reviewed conservation plans developed by the States of Montana and Idaho, and other local conservation agencies for bull trout. These actions are encouraging for long term bull trout conservation and recovery. It is recognized that individual restoration projects have been

undertaken by States (for instance, the Klamath River Basin Bull Trout Working Group has been implementing conservation activities and planning efforts since 1993), and harvest regulations for bull trout have become more restricted. However, based on the best available information, the Service cannot determine or predict the effectiveness of the conservation actions in reducing threats to the bull trout in the Klamath River and Columbia River population segments to the extent that listing is unnecessary.

The Idaho Bull Trout Conservation Plan (Plan) (Batt 1996), approved in July 1996, addresses bull trout conservation in 59 key watersheds to provide for the conservation and recovery of bull trout statewide. The Plan emphasizes locally developed, site-specific programs with technical assistance from appropriate State and Federal agencies. Although the Plan establishes a mechanism for generating 59 conservation plans by the year 2008, it lacks any description of how specific practices that currently affect bull trout (e.g., timber harvest, mining, grazing, hydropower operations) will be modified. This specificity would provide a basis for the development of future conservation plans and help ensure adequate protection for bull trout. It must also be clear how Federal agencies and private landowners in key watersheds will be required to institute bull trout conservation measures. Given the extent of Federal lands in Idaho, implementation of bull trout conservation measures by the USFS and BLM are critical to the Plan. The Plan also cites hydropower and irrigation practices contributing to the decline of bull trout, but the Plan needs to address these practices in light of the existing Idaho water law, USBR water commitments, and existing Federal Energy Regulatory Commission (FERC) licenses. The Plan provides potential future benefits to bull trout conservation and recovery once adequate funding and full implementation occurs.

The Montana bull trout conservation effort was initiated in 1994. Since 1994, 11 basin-specific status reports and two technical, peer-reviewed papers have been completed. Local watershed groups are being established; however, few on-the-ground local efforts have been completed or are underway. The Service is a member of the Montana Bull Trout Restoration Team which has been formed as part of the State's Montana Bull Trout Plan. Although actions taken to date under the Montana Plan have provided some benefits, not all threats to bull trout have been addressed, partly by lack of State jurisdiction, except in

a few local areas. The Service is encouraged by State of Montana's progress in implementing the Montana plan and developing appropriate strategies to remove threats and promote conservation and recovery of bull trout.

The Wallowa County-Nez Perce Tribe Salmon Recovery Plan (Wallowa County and Nez Perce Tribe, *in litt.* 1997) in Oregon is intended to primarily aid in the recovery of listed chinook salmon and steelhead. Twenty-six stream segments in the County have been identified for restoration, with two to five stream segments scheduled to be addressed each year over the next 15 years. By 2008, some positive steps towards improved land and water management in Wallowa County should occur; however, the limited scope of the plan will not benefit bull trout outside the County or necessarily address threats on Federal lands.

Bull trout conservation and planning efforts in the Klamath River basin were initiated earlier than similar State conservation efforts, and incorporated all land owners of occupied bull trout habitat. The Klamath River Basin Bull Trout Working Group (Working Group) functions under a Memorandum of Understanding, and has been actively implementing portions of the Klamath Basin Bull Trout Conservation Strategy (Light et al. 1996). These proactive interagency efforts to stabilize and expand bull trout in the Klamath River basin are unique in their early initiation and multi-entity approach. The Service supports and encourages the Working Group to continue implementing phases I and II of the Conservation Strategy and complete a formal implementation plan for conservation of bull trout in the Klamath River basin.

Bull trout have declined across much of their former range due to a variety of factors, including effects of dam construction, agricultural practices, introduced non-native fishes, and forest practices. A thorough discussion of the factors affecting bull trout is found in "Summary of Factors Affecting the Species." Existing State law addressing forest practices is discussed under Factor D in the "Summary of Factors Affecting the Species." Although State rules and regulations governing forested land management activities are improving, they are generally not adequate to conserve and recover bull trout or remedy the effects of past damage to bull trout habitats.

Issue 4: Several respondents opposed the proposed listing of bull trout because possible "activity restrictions" and economic impacts might occur.

Service response: Section 4(b)(1)(A) of the Act, requires that a listing

determination be based solely on the best scientific and commercial information available. The legislative history of this provision clearly states the intent of Congress to "ensure" that listing decisions are "based solely on biological criteria and to prevent non-biological considerations from affecting such decisions" (H.R. Rep. No. 97-835, 97th Congress 2nd Session 19 (1982)). Because the Service is specifically prohibited from considering economic and other non-biological impacts of species listing, such impacts are not addressed in this final rule.

Issue 5: Some respondents suggested that bull trout listing and recovery may conflict with recovery of other listed fish, notably endangered Snake River salmon species.

Service response: Concerns regarding the possible adverse environmental and non-biological effects from implementing future recovery measures cannot be considered in a decision to list a species. However, these concerns are important in developing recovery measures that take into account environmental effects on other species, including listed Snake River salmon. The Service will fully evaluate the environmental effects and consequences of implementing future recovery measures for bull trout in the Columbia River and Klamath River basins. It should be noted that bull trout co-evolved with Snake River salmon and recovery actions that benefit one species may also benefit other native fishes.

Issue 6: The Service received several comments on the proposed special rule that would allow for take of bull trout within the Columbia River population segment when it is in accordance with applicable State fish and wildlife conservation laws and regulations. While some respondents supported the proposed special rule, others were opposed to the special rule in its current form. Various activities were cited that continue to threaten bull trout, including poaching, electrofishing, and mis-identification of bull trout by fisherman.

Service response: Based on comments received during the public comment period, the Service modified the special rule to address those concerns. The 4(d) special rule conditions in this final rule relate to existing State and Tribal conservation laws and harvest regulations pertaining to bull trout at the time of publication of this rule. The Service has determined that, as currently constituted, the applicable State and Tribal fishing regulations provide conservation of bull trout. In the event any of these laws and regulations are modified in a manner

that is inconsistent with conservation of bull trout, the 4(d) rule would not allow the take of bull trout.

The Service also has discretion under section 4(d) of the Act to issue special regulations for activities other than harvest regulations for a threatened species that are deemed necessary and advisable for its conservation. The Service recognizes that on-going and future land-use activities will occur on non-Federal lands that may result in take of bull trout. In the future, the Service will consider issuing special rules that would define the conditions under which take associated with State permitted, or other activities deemed necessary and advisable for the species' conservation, would be authorized for bull trout. Special rules allow for more efficient management of threatened species, and encourage and enhance the conservation of species through the development of regulations the Service deems necessary and advisable to provide for conservation of the species. For example, conservation actions or other activities implemented as part of the Idaho Governor's bull trout plan, Wallowa County-Nez Perce Salmon Plan, Montana Bull Trout Recovery Plan, and Klamath Basin Bull Trout Conservation Strategy may qualify for consideration under a special rule. The Service will consider the development and approval of special rules that will lead to the conservation of bull trout, allowing certain specific land management activities that may allow take of bull trout to continue or occur, with certain restrictions. Under a special rule, this take of bull trout as a result of these activities would not be considered a violation of section 9 of the Act.

This process can provide non-Federal landowners with the flexibility to develop prescriptions or restrictions for their lands which would achieve the level of bull trout conservation consistent with the special rule.

Issue 7: Several respondents stated that since hatcheries will be relied on for bull trout restoration efforts, habitat threats would not be addressed and hatchery-reared fish could transmit and introduce disease to wild bull trout.

Service response: According to section 2(b) of the Act, one of the purposes of the Act is "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved." Once a species becomes listed as threatened or endangered, section 4(f) of the Act directs the Service to develop and implement recovery plans for that species. Recovery means improvement in the status of a listed

species to the point at which listing is no longer appropriate under the criteria provided in section 4 of the Act (50 CFR 402.02). Two goals of the recovery process are: (1) The maintenance of secure, self-sustaining wild populations of the species; and (2) restoration of the species to the point where it is a viable, self-sustaining component of its ecosystem.

The Service recognizes that captive propagation and hatchery supplementation can be valid conservation tools and assist in recovery efforts, but by themselves, do not contribute to secure, self-sustaining bull trout populations in the wild. For example, the Service agrees with the findings of the Montana Bull Trout Scientific Group that stocking or supplementation is a potential tool in the restoration of bull trout and should only be used if the actual cause(s) of local extirpations are identified and corrected first (MBTSG 1996g). Any such project "* * * involving stocking must be appropriate in scope, judiciously applied, rigorously designed, and thoroughly monitored."

Issue 8: Several respondents stated that the introduction of exotic fishes, hybridization with brook trout, and past agency efforts to eradicate bull trout are the primary causes of decline.

Response: The Service agrees that the introduction of exotic fishes by fish management agencies, ongoing hybridization with brook trout, and past efforts to eradicate bull trout have contributed to the decline of the species. The significance of these threats, however, varies by subpopulation location and habitat characteristics (See Factors B, C and E of the "Summary of Factors Affecting the Species" section).

Issue 9: Several respondents requested that the Service designate critical habitat as part of the final rulemaking process. A representative of the Oregon Cattlemen's Association, stated that "* * * the delineation of critical habitat should be based on repeatable, verifiable scientific data followed by a common sense approach to economics."

Service response. A majority of the comments in this regard were standardized requests advocating critical habitat designation with special attention on roadless areas and riparian buffers. These comments included no sight-specific analysis and provided no information to aid the Service in delineation of critical habitat. The proposed rule included a "not determinable" finding for designation of critical habitat based on the 1994 administrative record and solicited comments on whether any habitat

should be determined critical bull trout habitat. The Service received no substantial new information regarding critical habitat during the open comment period for the proposed rule. Therefore, based on the best scientific information currently available, the Service finds in this final rule that critical habitat designation is "not determinable" (see Critical Habitat section).

Summary of Factors Affecting the Species

After a thorough review and consideration of all information available, the Service has determined that the Klamath River and Columbia River distinct population segments of bull trout should be classified as threatened. Procedures found at Section 4(a)(1) of the Act and regulations (50 CFR part 424) were followed. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1). These factors and their application to the Klamath River and Columbia River population segments of bull trout (*Salvelinus confluentus*) are as follows—

A. *The present or threatened destruction, modification, or curtailment of bull trout habitat or range.* Land and water management activities that degrade and continue to threaten bull trout and its habitat include dams, forest management practices, livestock grazing, agriculture and agricultural diversions, roads, and mining (Beschta et al. 1987; Chamberlain et al. 1991; Furniss et al. 1991; Meehan 1991; Nehlsen et al. 1991; Sedell and Everest 1991; Craig and Wissmar 1993; Frissell 1993; U.S. Department of Agriculture (USDA) and U.S. Department of the Interior (USDI) 1995; Henjum et al. 1994; McIntosh et al. 1994; Wissmar et al. 1994; Light et al. 1996; MBTSG 1995a–e, 1996a–h; USDA and USDI 1996, 1997).

Dams

Dams affect bull trout by changing various biological and physical processes. Dams can alter habitats; flow, sediment, and temperature regimes; migration corridors; and interspecific interactions, especially between bull trout and introduced species (Rode 1990; Washington Department of Wildlife (WDW) 1992; Craig and Wissmar 1993; ODFW, *in litt.* 1993; Rieman and McIntyre 1993; Wissmar et al. 1994; T. Bodurtha, Service, *in litt.* 1995; USDA and USDI 1996, 1997). Impassable dams have caused declines of bull trout primarily by preventing access of migratory fish to spawning and

rearing areas in headwaters and precluding recolonization of areas where bull trout have been extirpated (Rieman and McIntyre 1993).

Existing dams can be passage and migratory barriers for bull trout and these structures may isolate bull trout subpopulations, eliminate individuals from subpopulations, reduce or eliminate genetic exchange, and separate spawning areas from productive overwintering and foraging areas (Ratliff and Howell 1992; Rieman and McIntyre 1993; MBTSG 1995a, 1996b,c). Dams have fragmented bull trout habitat and resulted in numerous isolated subpopulations. Within the Columbia River population segment, 66 percent of bull trout subpopulations are isolated by dams or indirectly by dam or water diversion operations that alter habitat conditions. Individuals that pass downstream over or through dams are often lost from the upstream subpopulations. Dams have converted historic rearing habitats for migratory fish in the larger river system to reservoirs with conditions that frequently are unsuitable for bull trout (MBTSG 1996b), especially where non-native salmonids occur.

Although the predominant effects of dams affect the long term viability of bull trout subpopulations (Rieman and McIntyre 1993; Gilpin, *in litt.* 1997), dams can benefit bull trout by preventing introduced non-native species access to upstream areas. For example, dams on the Swan River and South Fork Flathead River, Montana, have prevented lake trout from moving into these major river systems (MBTSG 1995e, 1996a). Dams may also increase the potential forage base for bull trout by creating reservoirs that support prey species (Faler and Bair 1991; Pratt 1992; ODFW, *in litt.* 1993).

The extirpation of bull trout in the McCloud River basin, California, has been attributed primarily to construction and operation of McCloud Dam, which began operation in 1965 (Rode 1990). McCloud Dam inundated bull trout spawning and rearing habitats, and isolated these fish from habitats used by migratory adults. The dam also altered the stream flow regime and elevated water temperature to levels detrimental to bull trout.

Klamath River Population Segment

Dams are not known to affect bull trout subpopulations in the Klamath River basin.

Columbia River Population Segment

Bull trout passage is prevented or inhibited at hydroelectric, flood-control, or irrigation dams in almost every major

river in the Columbia River basin except the Salmon River in Idaho. For instance, six dams were constructed without fish passage in the Boise River, Idaho, and of these, Arrowrock and Anderson Ranch dams isolate bull trout subpopulations. Historically, bull trout in the Boise River likely functioned as a single subpopulation with migratory adults moving among areas that are now isolated (Rieman and McIntyre 1995). Similarly, bull trout were thought to have ranged throughout the Yakima River, Washington, prior to construction of several dams beginning in 1905 (WDFW 1997). Storage dams (Tieton, Bumping Lake, Keechelus Lake, Kachess Lake, and Cle Elum Lake dams) now isolate five of eight bull trout subpopulations in the Yakima River basin, with agricultural diversion dams isolating three additional bull trout subpopulations (WDFW 1997). Operation of irrigation diversion dams also disrupts annual migrations of fluvial bull trout in five of seven spawning streams in the Methow River basin, Washington (WDFW 1997). In the mainstem Methow River, up to 79 percent of the average flow is removed from a 64 km (40 mi) reach, occasionally stranding and killing bull trout (Mullan et al. 1992). Due primarily to temperature constraints in partially dewatered tributaries to the Methow River, 60 percent of the total spawning and rearing areas for bull trout has been lost (Mullan et al. 1992; WDFW, *in litt.* 1995). Also in Washington, bull trout in the North Fork Lewis River were separated into two subpopulations by the construction of Swift and Yale reservoirs, and the Condit Dam on the White Salmon River also isolated a subpopulation (WDFW 1997). In Oregon, bull trout were thought to have historically occurred throughout the Willamette River basin, but are presently found only in the McKenzie River basin. Dams in the basin (Trailbridge and Carmen) isolate bull trout into three subpopulations.

In the mainstem Clark Fork River, Idaho and Montana, bull trout moved and migrated freely from Lake Pend Oreille upstream to the headwaters of the Clark Fork and Flathead rivers prior to construction of five dams (Pratt and Huston 1993; MBTSG 1996b; Frissell 1997). The construction of Albeni Falls, Cabinet Gorge, Noxon Rapids, Thompson Falls, and Milltown dams isolated four bull trout subpopulations in the mainstem Clark Fork-Pend Oreille rivers. The uppermost dam, Milltown, isolates downstream fish from those in the upper Clark Fork River and prevents fish downstream of the dam from

moving into the Blackfoot River, a major tributary of the upper Clark Fork River. Annually, some bull trout congregate below Milltown Dam, attempting to move upstream. Radio-tagged bull trout collected below Milltown Dam and released above the dam moved into Rock Creek, a tributary to the upper Clark Fork system (Swanberg 1996). Movement of bull trout from the mainstem Clark Fork River to the Flathead Lake system is prevented by Kerr Dam on the lower Flathead River. Sport harvest of bull trout from Lake Pend Orielle, Idaho, abruptly declined more than 50 percent after Albeni Falls and Cabinet Gorge dams blocked access to historic spawning streams and reduced adult numbers (Ellis 1940; Pratt and Huston 1993).

Major tributaries of the Flathead River basin, Montana, were historically interconnected so that migratory bull trout were widely distributed throughout the drainage (MBTSG 1995d). Bull trout from the Flathead River system had access to the South Fork Flathead River drainage and the Swan River drainage. However, upstream passage from the Flathead River has been blocked by dams on the South Fork Flathead River (Hungry Horse Dam) and the Swan River (Bigfork Dam).

On the Kootenai River, Montana, Libby Dam is an upstream passage barrier to bull trout. The dam also has altered the flow regime, water temperature, and sediment load in the Kootenai River (MBTSG 1996e). Dam operation has typically reduced spring flows, which has made upstream passage over Kootenai Falls, located downstream of Libby Dam, impossible. Therefore, fish below the falls do not have the opportunity to interbreed with fish above (MBTSG 1996e).

An additional effect of dams on bull trout is the loss of individuals from a subpopulation. During a 7-month study in the Boise River, bull trout were marked in Arrowrock Reservoir and 5 percent of them were recaptured in Lucky Peak Reservoir (USBR, *in litt.* 1997). Lucky Peak Dam is downstream of the Arrowrock and Anderson Ranch subpopulations, and neither Lucky Peak Reservoir nor the reach downstream of the dam provide any known spawning habitat. Thus, fish entering Lucky Peak Reservoir are lost from the upstream subpopulations.

Forest Management Practices

Forest management activities, including timber extraction and road building, affect streams habitats by altering recruitment of large woody debris, erosion and sedimentation rates,

runoff patterns, the magnitude of peak and low flows, and annual water yield (Cacek 1989; Furniss et al. 1991; Wissmar et al. 1994; Spence et al. 1996). Activities that promote excessive substrate movement lower bull trout production by increasing egg and juvenile mortality, and reduce or eliminate habitat important to later life-history stages, such as when pools are filled with substrates (Shepard et al. 1984; Fraley and Shepard 1989; Brown 1992). The length and timing of bull trout egg incubation and juvenile development (typically more than 200 days during winter and spring) and the strong association of juvenile fish with stream substrate make bull trout vulnerable to changes in peak flows and timing that affect channels and substrate (Shepard et al. 1984; Goetz 1989; Pratt 1992).

Logging and road building in riparian zones reduce stream shading and widen stream channels, allowing greater sunlight penetration, surface water warming, and winter anchor ice formation (Beschta et al. 1987; Chamberlain et al. 1991). Timber extraction in riparian areas that results in increased water temperatures in spawning and rearing areas may cause bull trout to decline (Goetz 1989; Pratt 1992; Rieman and McIntyre 1993). Logging in riparian areas reduces recruitment of large woody debris, thereby reducing stream habitat complexity. Loss of riparian vegetation destabilizes streambanks and increases erosion and sediment delivery to streams. Road construction that involves channelizing streams may cause reduced habitat complexity and increased sediment delivery.

Although bull trout occur in watersheds affected by past timber extraction, bull trout strongholds persist in a greater percentage of watersheds experiencing little or no past timber harvest, such as the wilderness areas of Central Idaho and the South Fork Flathead River drainage in Montana (Henjum et al. 1994; MBTSG 1995e; USDA and USDI 1997; Rieman et al. *in press*). One bull trout stronghold subject to extensive logging and road construction is in the Swan River basin (Watson and Hillman 1997). It is difficult to assess the overall effects of forestry practices on bull trout in parts of the basin because of the complex geomorphology and geology of the drainage (MBTSG 1996a). However, the Swan River tributaries also drain large areas of contiguous roadless lands that provide important protected bull trout habitat.

Timber harvest has occurred throughout the Columbia River (Henjum

et al. 1994; USDA and USDI 1996, 1997) and Klamath River basins (Light et al. 1996; USDA and USDI 1996, 1997). The effects of timber harvest on streams are long lasting, and recovery is slow (Furniss et al. 1991; Henjum et al. 1994). The MBTSG ranked forestry, especially the legacy left by past forestry practices, as a limitation to bull trout restoration in all major watersheds in Montana (MBTSG 1995a–e, 1996a–f).

Klamath River Population Segment

Much of the forest in the Klamath River basin has been managed for timber production, with substantial activity beginning in 1940. Extensive harvesting, including partial cutting with overstory removal, clearcutting, and selective logging for old-growth pine occurred on private lands, and low intensity harvest occurred on some of the USFS lands. Past forest management activities in the Klamath River basin have temporarily reduced riparian vegetative cover and increased water temperature in some streams, including Threemile Creek (Light et al. 1996). Roads were built in the basin for access to timber, causing increased sedimentation and substrate embeddedness. Sediment from existing roads continues to degrade stream habitat (Light et al. 1996). Weyerhaeuser Timber Company began an improved road maintenance program in 1994 to reduce sediment inputs from roads on its lands adjacent to occupied bull trout stream reaches in the Klamath River basin, and U.S. Timberlands is presently continuing the practice (B. Johnson, pers. comm. 1997). Two recent timber harvest activities occurred on U.S. Timberlands property along Boulder Creek in 1994 and Long Creek in 1995 (Johnson, U.S. Timberlands, pers. comm. 1997). A review of the activities concluded that leaving buffer strips and obliterating existing roads left the riparian habitat in better condition than before the timber harvest (B. Johnson, pers. comm. 1997). No timber harvests are currently planned for areas adjacent to streams occupied by bull trout. Six of the seven bull trout subpopulations identified in the Klamath River basin have been affected by past forest management practices.

Columbia River Population Segment

Perhaps the greatest threat to bull trout involving forest practices and roads stems from the ongoing and latent adverse effects caused by over a century of logging. Latent threats are illustrated by approximately 2,300 land slides correlated with high logging road density on national forest lands in the Clearwater and Spokane rivers basins during high runoff events in 1995 and

1996 (L. McLaud, Idaho Conservation League, *in litt.* 1997; R. Patten, Panhandle National Forest, *in litt.* 1997). The same runoff events also triggered an estimated 2,000 land slides on adjacent non-Federal timber lands in the Clearwater River basin (McLaud, *in litt.* 1997). On over half of the non-wilderness lands within National Forests across northern Idaho and western Montana, the environmental effects of past forest practices now constrain forest management (USFS map, *in litt.* 1994). For example, 70 percent of stream miles on the Wallowa-Whitman National Forest are degraded beyond Land and Resource Management Plan (LRMP) standards for fine sediment and temperature parameters on the forest (Wissmar et al. 1994). On the Panhandle National Forest, Idaho, pool volumes, quality and frequency in managed watersheds (mainly watersheds with past timber extraction and road construction) were reduced compared to non-managed watersheds. Further, decreases in pool volume and frequency were correlated with decreases in the distribution and abundance of bull trout (Cross and Everest 1995). In the Lake Pend Oreille and Priest River basins, 31 percent of streams in National Forest lands are degraded beyond LRMP standards, and 51 percent of streams are in the most degraded category (B. Kasun, USFS, *in litt.* 1993). Streams in the most degraded category generally do not support bull trout because of stream morphology changes, increased cobble embeddedness and high summer temperatures. Jones and Espinosa (1992) determined that 71 percent of the stream or watershed areas in the managed portion of the Clearwater National Forest did not meet LRMP standards, and that streams in poor condition generally did not support bull trout. Similarly, 67 percent of the non-wilderness portion of the Nez Perce National Forest did not meet LRMP standards, and streams in the most degraded category increased 12 percent over a five year period between 1987 and 1992 (Gloss and Gerhardt 1992).

In the Wenatchee National Forest, Washington, bull trout spawning and rearing is correlated with streams not subject to past timber harvest (Brown 1992). Timber harvest activities were responsible in the decline and isolation of bull trout in Pataha Creek, Washington (WDFW 1997), a tributary in the Tucannon River drainage. In the North Fork Boise River basin, Idaho, the majority of bull trout spawning and rearing habitat for the Arrowrock Reservoir subpopulation exists in the

roadless headwaters of the Crooked, Bear, and North Fork Boise rivers (Boise National Forest, *in litt.* 1995).

The long-lasting effects of past timber management activities on aquatic habitats is illustrated by conditions in the 3,289 km² (1,270 mi²) South Fork Salmon River watershed, Idaho. The watershed was first logged in the 1940's and logging activity peaked in 1961 (Chapman et al. 1991). Sedimentation in the South Fork Salmon River increased approximately 350 percent above pre-logging levels (Chapman et al. 1991). Resident and anadromous salmonids, including bull trout, declined after timber extraction and associated road building. Despite a 25-year logging moratorium in the watershed, fish habitat has not returned to pre-logging quality, and salmon production has not recovered (Chapman et al. 1991).

A relationship between forest management, watershed conditions, aquatic habitat degradation, and loss of occupied bull trout range has been documented in the Spokane River basin, Idaho. Streambed aggradation and loss of pool habitat are attributed to forest management and associated roads in the basin (G. Kappesser, Panhandle National Forest, *in litt.* 1993). The loss of pool habitat correlates to reductions in bull trout range and abundance in managed watersheds (Cross and Everest 1995). Sixty-one percent of the basin's managed watersheds do not meet forest plan standards (B. Kasun, Panhandle National Forest, *in litt.* 1992). The Nez Perce National Forest, Idaho, provides an example of the rate of watershed degradation. Significantly degraded watersheds with forest management increased by 12 percent in only 5 years; 40 percent of all non-wilderness land were in degraded condition (Gloss and Gearhardt 1992).

The USFS classified watersheds in the Bitterroot National Forest, Montana, into three categories, "healthy," "sensitive," and "high risk" based on sediment yield from road construction and increased water yield and peak flow from timber harvest (Decker 1991 *in* MBTSG 1995b). About one third of all watersheds were assigned to each of the three categories. Bull trout with estimable numbers were found only in watersheds rated as "healthy" or "sensitive drainages" (Clancy 1993). The effects of past forest practices, including road construction, continue to affect Bitterroot tributaries (MBTSG 1995b). Generally, bull trout numbers were higher where stream substrates were larger, but numbers tended to be lower in areas high in fine sediments (Clancy 1993). In contrast, habitat where brook trout were found were

characteristic of areas degraded by land use activities (Rich 1996). Eighty-five percent of the drainages classified as "high risk" supported brook trout (Clancy 1993) (see Factor E).

Extensive logging activity has impaired water quality in many tributaries of the Blackfoot River, Montana, including the North Fork Blackfoot River (Montana Department of Health and Environmental Sciences (MDHES) 1994). Wide-spread canopy removal, alterations to riparian vegetation, and water irrigation returns have increased the historic temperature regime of the Blackfoot River (MBTSG 1995c; Pierce et al. 1997). Water temperatures in the mainstem Blackfoot frequently exceeded the bull trout preferred range of 15°C (60°F) in 1994, 1995 and 1996, making coldwater refuges during this time critical for bull trout (Pierce et al. 1997). The effect of forest practices was considered a limitation to bull trout restoration in the Blackfoot River drainage (MBTSG 1995c).

Timber management is the dominant land use in the Kootenai River watershed, Montana. Extensive road construction to support forestry activities exists throughout the watershed. Many reaches of streams in the Kootenai drainage have impaired water quality as a result of silviculture activities (MDHES 1994). As a result of salvage logging in 1996, the number of timber sales and clearcuts have substantially increased over the past three years (Kootenai National Forest 1997).

Past forest practices, including road construction, log skidding, riparian tree harvest, clearcutting, and splash dams, are considered a cause in the historic decline of bull trout and have limited restoration opportunities in the Flathead Lake basin (MBTSG 1995d). This basin supports over 30 subpopulations in wilderness, national park, national forest, and private lands of Montana. Because bull trout are sensitive to habitat and water quality degradation, Fraley and Shepard (1989) considered timber harvest and road construction in both the North and Middle Fork Flathead River drainages to be threats to bull trout spawning and rearing habitat. Although forest practices have improved, effects of past activities still affect bull trout because the existing road systems continue to erode, cause sedimentation, and increase water yield to streams. Silvicultural activities have contributed to 323.2 km (202 mi) in 17 streams being classified as water quality impaired in the Flathead basin (MDHES 1994). Existing roads in two National Forests of Idaho (Boise and Payette)

created slides and slumps during 1997, a high water year. In some areas of Montana and Idaho, culverts, that are passage barriers for bull trout, are being replaced at road crossings (P. Batt, Governor of Idaho, *in litt.* 1997, P. Graham, Montana Fish and Wildlife and Parks (MFWP), and B. Clinch, Montana Department of Natural Resources and Conservation (MDNRC), *in litt.* 1997).

Future proposed timber harvests also threaten bull trout. For instance, in Oregon, the Malheur National Forest proposes to salvage trees and build roads in a roadless area containing bull trout, site of the 1996 Summit Fire in the John Day River watershed, and a designated riparian habitat conservation area in the Environmental Assessment for the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH) (USDA 1995). The project has not been completed, but it would likely degrade bull trout habitat if implemented as presently planned.

In summary, forestry activities that adversely affect bull trout and its habitat are primarily timber extraction and road construction, especially when impacting riparian areas. These activities, when conducted without adequate protective measures, alter bull trout habitat by increasing sedimentation, reducing habitat complexity, increasing water temperature, and promoting channel instability. Although certain forestry practices have been prohibited or altered in recent years to improve protection of aquatic habitats, the consequences of past activities continue to affect bull trout and their habitat. Within the Columbia River population segment, approximately 74 percent of bull trout subpopulations are threatened by forestry management practices.

Livestock Grazing

Livestock grazing degrades aquatic habitat by removing riparian vegetation, destabilizing streambanks, widening stream channels, promoting incised channels and lowering water tables, reducing pool frequency, increasing soil erosion, and altering water quality (Platts 1981; Kauffman and Krueger 1984; Henjum et al. 1994; Overton et al. 1993). These effects increase summer water temperatures, promote formation of anchor ice in winter, and increase sediment into spawning and rearing habitats. Cover for bull trout is reduced. Occupied bull trout habitat is also negatively affected by livestock grazing (Howell and Buchanan 1992; Mullan et al. 1992; Platts et al. 1993; R. Ueberuaga, Payette National Forest, *in litt.* 1993;

Henjum et al. 1994; MBTSG 1995a,b,c; USDA and USDI 1996,1997).

Livestock grazing impacts on bull trout habitat maybe minimized if grazing is managed appropriately for conditions at a specific site. Practices generally compatible with the preservation and restoration of bull trout habitat may include fences to exclude livestock from riparian areas, rotation schemes to avoid overuse of areas, and stock tanks so that livestock would concentrate outside of riparian areas for water.

Klamath River Population Segment

Intensive livestock grazing historically occurred throughout most of the Klamath River basin, and continues to be widespread (Light et al. 1996). Livestock grazing is a major land use within the Sprague River drainage, mostly in the lowland meadows and to a lesser extent in some forested areas. Grazing has been eliminated along bull trout streams on U.S. Timberlands property (B. Johnson, U.S. Timberlands, *in litt.* 1997) and adjacent National Forest lands. However, documented cattle trespass on Long and Deming creeks indicates that livestock continue to locally affect bull trout habitats (Light et al. 1996; Buchanan et al. 1997). The meadows in upper Long Creek exhibit bank instability and diminished availability of undercut banks caused by livestock (Buchanan et al. 1997). Channelization and intense grazing by cattle degraded lower Sun Creek and an adjoining stream in the Klamath River basin and may have contributed to the extirpation of migratory bull trout in Sun Creek (Dambacher et al. 1992).

Columbia River Population Segment

Livestock grazing has caused habitat degradation in stream reaches supporting bull trout. On Squaw Creek, a tributary of the Payette River, Idaho, livestock grazing has damaged streambank and riparian vegetation. While fencing and grazing changes are underway to reduce impacts in this area, future damage from grazing will not be eliminated (M. Huffman, Boise National Forest (BNF), *in litt.* 1997). Livestock grazing continues to affect bull trout habitat for spawning, rearing, and migration in Bear Valley Creek and its tributaries in the BNF, Idaho (T. Burton, BNF, pers. comm. 1997). Livestock grazing was a factor in the decline of bull trout habitat in Pataha Creek, Washington (WDFW 1997). In Montana, severe overgrazing occurs in the Bitterroot River valley bottom streams and along the mainstem Clark Fork River in the Deerlodge valley, Flint Creek valley, and parts of Rock Creek,

and limits bull trout restoration in these drainages (MBTSG 1995a,b; Maxell 1996). Overall, livestock grazing in portions of the Wieser, Grande Ronde, Imnaha, and Malheur rivers has degraded streamside habitat (Adams 1994; Buchanan et al. 1997). Of the 141 subpopulations the Service identified in the Columbia River population segment, approximately 50 percent were threatened by ongoing livestock grazing.

Agricultural Practices

Agricultural practices, such as cultivation, irrigation, and chemical application can affect bull trout. Agriculture has been identified a source of nonpoint source pollution in some areas within the range of bull trout (Idaho Department of Health and Welfare (IDHW) 1991; Washington Department of Ecology (WDE) 1992; MDHES 1994). These practices can release sediment, nutrients, pesticides and herbicides into streams, increase temperature, reduce riparian vegetation, and alter the hydrologic regime, typically with low flows in the spring and summer. Irrigation diversions also affect bull trout by altering stream flow and through entrainment. Bull trout may enter unscreened irrigation diversions and become stranded in ditches and agricultural fields. Diversion dams, without proper passage facilities, prevent bull trout from migrating and may isolate subpopulations (Dorratcaque 1986; Light et al. 1996).

Klamath River Population Segment

Historical agricultural use in the Klamath River basin has had a profound effect on bull trout habitat in the larger tributaries and mainstem rivers (Buchanan et al. 1997). Channelization, water diversions, removal of streamside vegetation, and disturbances have altered the aquatic environment by elevating water temperature, reducing water quantity and quality, and increasing sedimentation (Light et al. 1996). Deming, Long, Threemile, and Sun creeks have diversions immediately downstream of occupied bull trout habitat (Dunsmoor and Bienz, *in litt.* 1997). Unscreened diversions result in the transport of fish into irrigation canals (e.g., Deming and Sun creeks), often resulting in mortality (Light et al. 1996).

Columbia River Population Segment

In 1988, the Idaho Department of Environmental Quality (IDEQ) conducted an assessment of nonpoint source pollution of the Salmon River basin. Of 4,080 km (2,550 mi) of streams assessed, an estimated 2,059 km (1,287

mi) were affected by nonpoint sources, of which 1,374 km (859 mi) were affected by agricultural practices (IDHW 1991). Dewatering of stream reaches due to irrigation has restricted bull trout migration and isolated bull trout into subpopulations. Examples include the Powder, Malheur, Grande Ronde, Umatilla, and John Day rivers in Oregon (Buchanan et al. 1997); the Tucannon, Snake, Yakima, Methow, and Walla Walla rivers in Washington (WDW 1992; WDFW 1997); the upper Salmon and Lemhi rivers in Idaho (Dorratcaque 1986; Chapman et al. 1991); and the Clark Fork, Blackfoot, and Bitterroot rivers in Montana (Clancy 1993; MBTSG 1995a,b,c; 1996b,c; Swanberg 1996).

The mainstem Umatilla River is frequently dry during the irrigation season, effectively isolating bull trout (M. Northrop, Umatilla National Forest, pers. comm. 1997). Moreover, two diversion facilities in the Umatilla River inhibit migration during portions of the year (Buchanan et al. 1997). Walla Walla River basin bull trout subpopulations are segregated in the Touchet River, Mill Creek, and South Fork and North Fork of the Walla Walla River by four irrigation diversion dams (Buchanan et al. 1997; WDFW 1997). Streams are also channelized in agricultural areas, reducing stream length and area of aquatic habitat, altering stream channel morphology, and diminishing aquatic habitat complexity.

In Idaho, Dorratcaque (1986) documented chronic flow and passage problems on the Lemhi River, where the stream has been dewatered during the irrigation season. An irrigation diversion dewateres the upper Salmon River in Idaho from mid-July to the end of the irrigation season, preventing chinook salmon access to spawning areas. Juvenile chinook salmon, which are used as prey by bull trout, are, thereby, no longer available (Chapman et al. 1991). Streamflows in the Umatilla River basin in Oregon have been fully appropriated during the irrigation season since 1920 (Oregon Water Resources Division (OWRD), in litt. 1988). Over-appropriations have resulted in dewatered stream reaches that limit bull trout distribution within the basin. Similarly, the Oregon State Game Commission (OSGC) first recognized the negative effects of irrigation diversions on fisheries resources in the Deschutes River as early as 1950 (OSGC, in litt. 1950). In Washington, over 80 percent of the annual stream flow in the Yakima River basin is seasonally diverted for irrigation (WDW 1992). Bull trout in the basin are isolated into eight subpopulations in upper watershed

tributaries by reduced summer flows and dams (WDW 1992). The lower reaches of the Walla Walla River in Washington are often dewatered during the irrigation season, isolating three bull trout subpopulations in perennial headwater reaches (Martin et al. 1992).

In 1991, MFWP listed Montana streams that support or contribute to important fisheries and are substantially dewatered from diversions and appropriated streamflows (MFWP, in litt. 1991). Within the range of bull trout, 101 stream reaches totaling 958.4 km (599 mi) were listed as chronically dewatered due to irrigation withdrawals and an additional 220.8 km (138 mi) were listed as periodically dewatered. Although bull trout do not occur in all streams cited, all are within the range of bull trout and dewatering likely affects fish migration and connectivity among subpopulations.

The extirpation of bull trout in the mainstem Bitterroot River, Montana, and the loss of migratory fish are attributed to chronic dewatering of the mainstem Bitterroot and the lower reaches of most of its tributaries (Clancy 1993, 1996; MBTSG 1995b). Some diversions on the mainstem Bitterroot are fish passage barriers or entrain downstream migrants into irrigation ditches (MBTSG 1995b). Nearly 104 km (65 mi) of 18 tributary streams are chronically dewatered in the Bitterroot River basin (MBTSG 1995b). Dewatering of tributary streams is a limitation to restoration of bull trout in the Bitterroot River basin (MBTSG 1995b) and the cause of habitat fragmentation isolating 27 subpopulations.

In the Clark Fork River basin, Montana, irrigation diversions, canals, and dams in the Jocko and lower Flathead rivers eliminated bull trout access to spawning and rearing areas; however, some of these structures are in the process of being modified (MBTSG 1996c; Hansen and DosSantos 1997; MBTRT 1997). The lower reaches of the Jocko River are severely affected by grazing and irrigated agriculture (Hansen and DosSantos 1997). Because migratory bull trout can no longer ascend Grant Creek from the mainstem Clark Fork River due to irrigation diversions, only resident bull trout exist upstream (MBTSG 1996c; R. Berg, MFWP, pers. comm. 1997). Dewatering, irrigation return flows, and denuded riparian areas have increased water temperatures in the Blackfoot River and Clark Fork River basins, Montana (MBTSG 1995a,c). Water temperatures in the mainstem upper Clark Fork River frequently exceed 20°C (68° F) and temperatures in tributaries, including the Little Blackfoot and Flint Creek, may

exceed bull trout tolerance limits (MBTSG 1995a). In the Blackfoot River basin, irrigation returns have contributed to the warming of this historic coldwater river (MBTSG 1995c; Pierce et al. 1997). Irrigation diversions, particularly in the Little Blackfoot River and in Flint Creek of the upper Clark Fork River, are physical and thermal passage barriers to bull trout (MBTSG 1995a). Diversion for irrigation is the primary cause of 622 km (389 mi) of streams in the upper Clark Fork basin being chronically dewatered (MDHES 1994). Irrigation diversions also continue to limit restoration of migratory bull trout in the Blackfoot River basin (MBTSG 1995c). Recently, several diversions have been renovated to provide passage and eliminate ditch entrainment (MBTRT 1997).

Unscreened irrigation diversions in eastern Washington are known to trap or divert bull trout in Ahtanan Creek (Yakima River basin), Ingalls and Peshastin creeks (Wenatchee River basin), Roaring Creek (Entiat River basin), and Buttermilk, Little Bridge, Eagle, and Wolf Creeks (Methow River basin) (J. Easterbrooks, WDFW, pers. comm. 1997). Channelization has altered 56 km (35 mi) of the Methow River (Mullan et al. 1992). Approximately 72 km (45 mi) of the lower Coeur d'Alene, St. Joe, and St. Maries rivers of the Spokane River basin have been channelized. These streams were once considered important rearing areas and migratory corridors for migratory (fluvial) bull trout.

Approximately 47 percent of the bull trout subpopulations in the Columbia River population segment are affected by the past and ongoing effects from agricultural practices, including diversions.

Road Construction and Maintenance

Non-forest roads degrade salmonid habitat by creating flow constraints in ephemeral, intermittent, and perennial channels; increasing erosion and sedimentation; creating passage barriers; channelization; and reducing riparian vegetation (Furniss et al. 1991; Ketcheson and Megahan 1996).

Klamath River Population Segment

Streamside roads may have multiple locations of elevated sediment delivery. Some level of sedimentation is normal, and can be documented along parts of Boulder, Deming, Threemile, Brownsworth, and Leonard creeks. In contrast, Long and Sun creeks have relatively little sediment delivery from roads in reaches occupied by bull trout (Light et al. 1996). Streamside roads inadequately constructed with

misplaced water bars and culverts still discharge sediment laden waters directly into streams. Over-road flow can lead to gullyng and direct sediment delivery, as found in parts of Deming Creek (Light et al. 1996). Streamside roads can also reduce large woody debris recruitment and vegetation shade by occupying the growing space next to streams. In addition, road construction may require stream straightening or channel reconfiguration next to roads, resulting in channelization as along Boulder and Deming creeks (Light et al. 1996; Dunsmoor and Bienz, *in litt.* 1997). Habitat degradation from channelization includes decreased pool habitat, decreased sediment transport, increased embeddedness, and reduced interstitial space in substrates (Dunsmoor and Bienz, *in litt.* 1997).

Columbia River Population Segment

Construction and improvement of Interstate 90 is a contributing factor to the decline and suppression of bull trout in Gold Creek, a tributary of the Yakima River, Washington (Craig and Wissmar 1993). In Montana, Interstate 90 and a railroad system parallel to the Clark Fork and St. Regis rivers has contributed to channelization and increased the risk of hazardous spills (MBTSG 1996b,c). Approximately 18 percent of the bull trout subpopulations in the Columbia River basin are affected by road construction and ongoing maintenance.

Mining

Mining can degrade aquatic habitat by altering water acidity or alkalinity, changing stream morphology and flow, and causing sediment, fuel, and heavy metals to enter streams (Martin and Platts 1981; Spence et al. 1996). The types of mining that occur within the range of bull trout include extraction of hard rock minerals, coal, gas, oil, and nonminerals. Past and present mining activities have adversely affected bull trout and bull trout habitats in Idaho, Oregon, Montana, and Washington (Martin and Platts 1981; Johnson and Schmidt 1988; Moore et al. 1991; WDW 1992; Platts et al. 1993; MBTSG 1995a,c, 1996b,c).

Klamath River Population Segment

Mining effects are not known to be a factor affecting bull trout subpopulations in the Klamath River basin.

Columbia River Population Segment

Mining severely impacts large portions of the Spokane River basin. Effects include roading, stream diversion and alteration, watershed

degradation from airborne emissions, and the discharge of massive quantities of waste materials, including the release into the South Fork Coeur d'Alene River of 72 million tons of hazardous mine wastes laden with heavy metals such as lead, zinc, and cadmium (Coeur d'Alene tribe of Idaho et al. 1991). During the early 1930s, the South Fork Coeur d'Alene River and about 20 miles of the lower Coeur d'Alene River were considered devoid of aquatic life due to mining waste discharge (Ellis 1940). Although some aquatic species have returned to the river, bull trout are not among them. In Montana, bull trout have not recolonized the upper mainstem Clark Fork River where mining-related stream degradation extirpated all fish prior to the turn of the century (MBTSG 1995a; Titan Environmental Corp. 1997). The lingering effects of mining done over the past century in the Butte and Anaconda reaches of the upper Clark Fork River has resulted in four Superfund sites being designated. Mining continues to impair water quality in 558 km (349 mi) of stream in these reaches (MDHES 1994). Eleven fish kills documented between 1959 and 1991 were attributed to mining contamination of the river (Titan Environmental Corporation 1997).

Numerous abandoned mines, such as the Blackbird and Cinnabar mines in the Salmon River drainage, Idaho, degrade water quality where toxic heavy metals continue to leach from mine sites into streams or groundwater. Old mine tailings in the floodplains of Newsome Creek, American River, and Crooked River, tributaries to the Clearwater River in Idaho, continue to prevent recovery of riparian areas (N. Gearhardt, Nez Perce National Forest, pers. comm. 1997). In Idaho, mine tailings abandoned decades ago contaminated a tributary of the Middle Fork Boise River with heavy metals, including arsenic, during flood flows in 1997 when migrating bull trout were present (R. Barker, Idaho Statesman, *in litt.* 1997; S. West, IDEQ, *in litt.* 1997). In Montana, historic mining in many tributaries of the Middle Clark Fork River has impaired water quality in 245 km (153 mi) of stream (MDHES 1994). The MBTSG (1995c) ranked mining in the Blackfoot River drainage as a limitation to bull trout restoration. Many mines exist in the western and southern portions of the Blackfoot River basin causing direct loss of bull trout habitat and contamination of waters from mine effluents (MBTSG 1995c). Fishes in the upper Blackfoot River are still affected by the washout of the Mike Horse

tailings dam in 1975, which spilled contaminated tailings into the Blackfoot River (MBTSG 1995c). Research in the Blackfoot drainage demonstrated that heavy metal contaminants released in the headwaters affect chemical trends, metal concentrations, metal bioavailability, and fish for 25 km (15.6 mi) from the contaminant source (Moore et al. 1991).

New open-pit mines using cyanide leach pads are planned for watersheds currently occupied by bull trout in the Middle Fork Boise River basin, Idaho, and in the Stibnite area of the East Fork South Fork Salmon River, Idaho (G. Visconty, Boise National Forest, *in litt.* 1996; Payette National Forest (PNF), *in litt.* 1996). In Montana, a large underground copper-silver mine proposed for Rock Creek in the lower Clark Fork River basin is currently in the permitting process. Tailings would be stored at the confluence of Rock Creek and the Clark Fork River (MBTSG 1996b; R. Stewart, USDI, *in litt.* 1995). Rock Creek is one of only two bull trout "core" areas in this subpopulation (MBTSG 1996b). A proposal for a large open-pit gold mine using cyanide heap leach processing is proposed for the upper Blackfoot River basin, Montana. Much of the ore body occurs below the water table, requiring pumping of groundwater. Thus, the hydrology of the upper Blackfoot River system could be affected and an increase in contamination risks could result (S. Cody, Environmental Protection Agency (EPA), *in litt.* 1997; K. McMaster, Service, *in litt.* 1997).

The North Fork Flathead River headwaters in Canada contain a large coal deposit that could be developed (MBTSG 1995d). Mining this deposit could destroy spawning habitat and degrade water quality in the Montana portion of the Flathead River system (MBTSG 1995d).

Approximately 20 percent of the bull trout subpopulations in the Columbia River population segment are threatened by past, ongoing, or potential future mining activities.

Residential Development

Residential development is rapidly increasing within portions of the range of bull trout. Development increases threaten to alter stream and riparian habitats through streambank modification and destabilization, increased nutrient loads, and increased water temperatures (MBTSG 1995b). Indirectly, urbanization within floodplains alters groundwater recharge by routing water into streams through drains rather than through more gradual subsurface flow (Booth 1991).

Klamath River Population Segment

Residential development is not known to be factor affecting existing bull trout subpopulations in the Klamath River basin.

Columbia River Population Segment

In Montana, rural residential development is rapidly increasing, particularly in drainages of the Bitterroot, Blackfoot, and Flathead rivers (MBTSG 1995b,c,d). The lower Bitterroot River is a major non-point source of nutrient pollution, primarily from sewage effluent and land development (U.S. Environmental Protection Agency (EPA) 1993 in MBTSG 1995b). Efforts to mitigate effects of rural development in the Blackfoot River basin have been encouraged by an active local group, the Blackfoot Challenge, which has been working to acquire conservation easements, among other projects. Residential development in the Flathead Lake system is considered a limitation for restoration of bull trout because of the threat to water quality from domestic sewage and changes to stream morphology (MBTSG 1995d).

Approximately 26 percent of the bull trout subpopulations in the Columbia River population segment are threatened by the effects of residential development.

B. Overutilization for commercial, recreational, scientific, or educational purposes. Declines in bull trout have prompted states to institute restrictive fishing regulations on all waters throughout bull trout range. Recent observations of increased numbers of adult bull trout in some areas have been attributed to more restrictive regulations. However, illegal harvest and incidental harvest still continue to threaten bull trout.

Klamath River Population Segment

Legal harvest of bull trout in the Klamath River basin was eliminated in 1992 when ODFW imposed a fishing closure. Because recreational fishing for other trout species continues in the basin, incidental fishing mortality of bull trout likely occurs (OCAFS 1993). During recent ODFW angler surveys in the Klamath River basin, all anglers contacted were aware of the no harvest regulation for bull trout (D. Bertram, ODFW, *in litt.* 1995; Light et al. 1996). Incidental bull trout mortality due to angling is unknown, but is not suspected to be suppressing bull trout subpopulations in the Klamath River basin (Light et al. 1996). However, Dunsmoor and Bienz (*in litt.* 1997) consider angling to be a factor

negatively affecting bull trout, especially subpopulations with low numbers and proximity to highway access, such as Threemile Creek.

Columbia River Population Segment

Overharvest of bull trout in the Columbia River basin, historically, likely contributed to their decline. In the past, harvest included legal recreational angling, poaching, and State-sponsored eradication programs (Thomas 1992). Bull trout were often targeted for removal by anglers and government agencies because bull trout preyed on salmon and other desirable species (Simpson and Wallace 1982; Bond 1992). As recently as 1990, State and Federal agencies instituted programs to eradicate bull trout through bounties and poisoning of waterways (Ratliff and Howell 1992; ODFW 1993; Newton and Pribyl 1994; Palmisano and Kaczynski, *in litt.* 1997). For instance, during the 1940's and 1950's in Oregon, several hundred bull trout migrating from Wallowa Lake to spawn in Wallowa River were trapped in a weir and exterminated (B. Smith, WDFW, *in litt.* 1997). Bull trout were recently re-introduced to Wallowa Lake in summer 1997 in an effort to re-establish the fish.

In recognition of the decline of bull trout, State management agencies in Idaho, Montana, Washington, and Oregon suspended harvest in the Columbia River basin except in Lake Billy Chinook (Oregon) and Swan Lake (Montana). State regulations still allow catch and release fishing for bull trout, and the harvest of other salmonid species is allowed in most bull trout waters. However, in Montana, (MFWP 1996), the revised regulations are believed to be partially responsible for increasing bull trout numbers in the Swan River basin where the taking or intentional fishing for bull trout is prohibited (MBTSG 1996a). Mortality from incidental catch and release angling of bull trout and harvest as a result of misidentification still continues under existing fishing regulations. For example, about half or fewer of anglers surveyed were able to correctly identify bull trout from other salmonids in west-central Montana (Kelly et al. 1996; M. Long and S.P. Whalen, MFWP, *in litt.* 1997). In 1997, the day after two radio tagged bull trout were released into Wallowa Lake, Oregon, one of the fish was unintentionally, but illegally harvested by a young angler. The MBTSG (1995d) is concerned with the catch and release mortality of bull trout as a result of intense fishing pressure on lake trout in Flathead Lake and the Flathead River. Legal and illegal harvest can seriously

affect declining subpopulations already subjected to other factors such as competition, degraded habitat, and isolation (WDW 1992; Donald and Alger 1993; Pratt and Huston 1993; Swanberg and Burns 1997).

Poaching of bull trout likely continues, and can be especially detrimental to small, isolated subpopulations of migratory fish (WDFW 1992; Craig and Wissmar 1993; Pratt and Huston 1993; Long 1997). A study in the Metolius River suggested that 2 of 22 radio-tagged adult bull trout were illegally harvested (Ratliff et al. 1996). Illegal harvest of bull trout in northwest Montana has been a recurring problem for over 50 years, especially in drainages of the Blackfoot, Kootenai, South Fork Flathead, and Clark Fork rivers (MBTSG 1995e; Swanberg 1996; Long 1997). In response, the MFWP instituted a program in 1994 funded by the Bonneville Power Administration to reduce the illegal harvest of bull trout, disperse information to improve anglers' fish identification skills, and increase understanding of the importance of native species (Long 1994). Additionally, the Montana legislature increased the penalties for bull trout poaching, and the Bonneville Power Administration, until recently, funded increased enforcement (M. Racicot, Governor of Montana, *in litt.* 1995).

Approximately 21 percent of the bull trout subpopulations in the Columbia River population segment are threatened by the effects of poaching.

C. Disease or predation. Although diseases affecting salmonids are likely present in both the Klamath River and Columbia River basins, they are not thought to be a major factor affecting bull trout. However, interspecific interactions, including predation, are thought to negatively affect bull trout where non-native salmonids have been introduced (Palmisano and Kaczynski, *in litt.* 1997).

Klamath River Population Segment

Diseases have not been documented affecting bull trout in the Klamath River basin. However, brook trout and brown trout have been introduced in the basin, and either one or both species co-exist with bull trout in all subpopulations except Deming Creek (Buchanan et al. 1997). Brown trout predation on bull trout is evidenced by a direct observation in Boulder Creek (Light et al. 1996). Overall, bull trout co-occur with brown trout and brook trout in about half of the occupied habitat. Buchanan et al. (1997) indicated that bull trout occupy approximately 34.1 km (20.5 mi) of streams. However, allopatric (occurring in different

geographic areas or in isolation) bull trout have been estimated to occupy only 13.4 to 15.7 km (8.3 to 9.8 mi) within the basin (Buchanan et al. 1997; Schroeder and Weeks, *in litt.* 1997).

Columbia River Population Segment

Health samples from 207 juvenile bull trout collected from 8 streams in the Flathead River basin in 1992 and 1993 were negative in tests for furunculosis, enteric redmouth, bacterial kidney disease, and viral hemorrhagic septicemia (VHS) or infectious pancreatic necrosis (IPN) (Fredenberg 1993). Bull trout are susceptible to whirling disease, caused by a protozoan parasite (*Myxobolus cerebralis*), and recently detected in bull trout waters in Montana (Montana Whirling Disease Task Force 1996). However, bull trout are less susceptible to whirling disease than rainbow trout (McDowell et al. 1997). Whirling disease is currently untreatable in the wild, and the parasite appears to be rapidly spreading into previously uninfected waters. The consequences of whirling disease on bull trout may not be apparent for years.

Bull trout are most vulnerable to predation as juveniles. Several non-native fishes, such as lake trout, brown trout, brook trout and northern pike (*Esox lucius*) are considered potential predators (and competitors, see Factor E below) of many bull trout subpopulations in the Columbia River basin (Donald and Alger 1992; Pratt and Huston 1993; Rieman and McIntyre 1993; MBTSG 1995d, 1996a; MFWP 1997).

Dramatic declines in the Priest Lake, Idaho, bull trout harvest began about 20 years ago. Between 1956 and 1970, an annual average of 1,200 fish were harvested. In 1978, a record 2,320 were harvested, declining in 1983 to 159 (Mausser et al. 1988). There has been no legal harvest of bull trout since 1984. Bull trout were extirpated from Priest Lake through interactions with introduced lake trout (Pratt and Huston 1993). Mausser et al. (1988) described bull trout in Priest Lake as "functionally extinct as long as lake trout abundance is high." Similarly, lake trout introduced into Flathead Lake feed on juvenile bull trout entering the lake from the Flathead River, and are thought to be a factor in recent declines of the bull trout subpopulation (MBTSG 1995d). Introduced non-native fishes limit bull trout restoration in all the major drainages in Montana (MBTSG 1995a-e, 1996a-f).

For bull trout in the Columbia River population segment, disease is not considered a listing factor; however, approximately 62 percent of the

subpopulations are threatened by introduced non-native fishes, including the effects of predation.

D. *The inadequacy of existing regulatory mechanisms.* Although efforts are underway to conserve bull trout (e.g., Batt, *in litt.* 1997; Joslin, *in litt.* 1997; Thomas, *in litt.* 1997), the implementation and enforcement of existing Federal and State laws designed to conserve fishery resources, maintain water quality, and protect aquatic habitat have not prevented past and ongoing habitat degradation. This inadequacy has led to bull trout declines and isolation and is a factor in the determination to list bull trout population segments. Regulatory mechanisms, including the National Forest Management Act, the Federal Land Policy and Management Act, the Public Rangelands Improvement Act, the Clean Water Act, the National Environmental Policy Act, the Federal Power Act, State Endangered Species Acts and numerous State laws and regulations govern an array of land and water management activities that affect bull trout and their habitat.

National Forest Management Act

The National Forest Management Act (NFMA) and the Federal Land Policy and Management Act (FLPMA) require the USFS and BLM to develop and implement land and resource management plans (LRMPs) and Resource Management Plans (RMPs), respectively) to protect fish and wildlife resources and produce forest and range products. However, reviews by the U.S. Department of Agriculture (USDA) of LRMP monitoring and evaluation reports for 28 national forests indicate that many watersheds do not meet NFMA Forest Plan standards. Compliance with LRMPs and effectiveness of best management practices on current projects is improving, but, a majority of streams that had been affected by past practices were not healing as fast as anticipated (USDA 1995).

Reviews of existing LRMPs implemented outside the range of the northern spotted owl, even as amended by the Environmental Assessment for the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH) (USDA 1995), have inadequately protected salmonid habitat on BLM and national forest lands (Henjum et al. 1994; R. Schmitten, NMFS, *in litt.* 1995; Espinosa et al. 1997). While the severe resource damage from forest management that occurred in the 1950s through the 1970s

has ceased, the current LRMPs have not fully taken into account the habitat needs of salmonids and recovery of degraded habitats has not occurred as predicted. For example, most LRMPs were developed prior to listing the Snake River salmon stocks, and, consequently, the biological requirements of these fish are not fully considered under the parameters of the LRMPs. The NMFS noted that even though PACFISH provided some improvements in many standards and guidelines of the LRMPs, comprehensive, landscape-scale conservation strategies for salmonid survival and recovery are still lacking (Schmitten, NMFS, *in litt.* 1995). Espinosa et al. (1997) listed several reasons why the Clearwater National Forest Plan adopted in 1987 has failed to adequately protect salmonid habitats in forest watersheds. Reasons included for this failure were—projected timber harvests and levels of associated road construction too high to achieve fish habitat quality standards; inaccurate riparian habitat inventories; watershed recovery following disturbance was slower than expected; and inaccurate inventories of the timber resources.

Under the NFMA and the FLPMA, livestock grazing occurs on over 70 percent of federally-administered western rangeland, or about 108.5 million ha (268 million acres (ac)) of land in 16 western states (General Accounting Office (GAO) 1988). Ongoing livestock grazing on lands administered by the BLM and USFS continues to occur in watersheds occupied by bull trout (Henjum et al. 1994; McIntosh et al. 1994; USDA and USDI 1997). Technical solutions to improving riparian areas damaged by livestock grazing were available as early as 1988 (GAO 1988). However, the GAO (1988) noted that correcting damage from grazing was not readily solvable due to funding and political pressure to maintain the status quo grazing systems. Within the Interior Columbia River Basin, the BLM and USFS have had difficulty correcting practices that cause grazing damage to streams due to lack of funding, conflicting requirements of different laws, or budget allocations (USDA and USDI 1997). However, in some areas supporting federally listed fish or designated critical habitat, the BLM and the USFS have been able to improve livestock management in riparian areas, including habitat for shortnose sucker (*Chasmistes brevirostris*) and Lost River sucker (*Deltistes luxatus*) in the Klamath River basin, and the Lohontan cutthroat trout

(*Oncorhynchus clarki henshawii*) of the Great Basin.

Interior Columbia Basin Ecosystem Management Project

The USFS, BLM, EPA, NMFS, and Service are cooperating in development of the Interior Columbia Basin Ecosystem Management Project (ICBEMP), a large-scale land management plan for lands administered by these agencies in eastern Oregon and Washington, Idaho and western Montana. The alternatives described in the Draft Environmental Impact Statement (DEIS) do not specifically address bull trout conservation in "depressed" areas outside the range of steelhead and chinook salmon; the preferred alternative depends on subbasin review and ecosystem analysis at the watershed scale as the basis for decision-making within the Interior Columbia Basin (USDA and USDI 1997). The ICBEMP is in draft, and possible outcomes from implementing future bull trout conservation actions as part of an unapproved management alternative are not predictable. Funding and staffing to implement those components are also not secured.

Streamlined Consultation Procedures

On March 8, 1995, the USFS, Service, BLM, and NMFS, issued a memorandum directing the agencies to participate in "streamlined" consultation procedures. These procedures were initiated to address forest health and salvage projects (T. Dwyer, Service, *in litt.* 1995). By May 31, 1995, these procedures were extended indefinitely to include all consultation efforts (Dwyer, *in litt.* 1995). These procedures apply to Federal land management activities in Idaho, Oregon, Washington, Montana and California (California lands managed by BLM are subject to streamlined procedures only when forest ecosystem activities are involved). The purpose of the streamlined procedures is to improve the efficiency of the section 7 consultation process (C. Dunn, Service, *in litt.* 1997). Conservation and protection of bull trout habitat has been inconsistent due in part to the USFS and BLM discretionary option to review non-listed, candidate species or species of concern (R. Vizgirdas, Service, *in litt.* 1997; R. Strach, Service, *in litt.* 1997; P. Zenone, Service, *in litt.* 1997). In Idaho and eastern Oregon, Federal land management agencies have often not considered the effects of projects on bull trout through the streamlining process.

Endangered Species Act

In the Klamath River basin, the Service listed the shortnose sucker and Lost River sucker under the Act as endangered on August 26, 1987 (52 FR 32145), and proposed critical habitat for the species on December 1, 1994 (50 CFR 61744). Bull trout likely used portions of the proposed critical habitat in the past, including tributaries in the upper Klamath River, Crooked Creek, Sevenmile Creek, and Wood River. Although some of the earliest records of bull trout in the basin are from Fort Creek, a tributary of the Wood River (Dunsmoor and Bienz, *in litt.* 1997), bull trout do not presently occur within the habitat occupied by the two suckers. Therefore, conservation and recovery actions undertaken for the listed suckers will not directly benefit bull trout.

In the Columbia River basin, three species of salmon in the Snake River are listed—sockeye salmon (endangered), spring/summer chinook salmon (threatened) and fall chinook salmon (threatened). Critical habitat for all three salmon was designated, including the Columbia River migration corridor, and historically accessible streams in the Snake River basin upstream of Hell's Canyon Dam in Idaho, Oregon and Washington (58 FR 68543–68554). Downstream of Hell's Canyon and Dworshak Dam, the designation extends to reaches historically accessible to salmon, below historically impassible barriers (58 FR 68543–68554). The designation extends protection to bull trout habitat in areas where they co-occur with the salmon. However, in many areas bull trout tend to spawn and rear upstream of listed salmon habitats. For instance, Fall Creek, a tributary of the Salmon River, Idaho, has an impassible waterfall near its mouth, and habitat for the listed salmon ends at the impassible falls (58 FR 68543–68554), but bull trout spawn and rear above the falls. In this example, bull trout spawning and rearing habitat does not overlap with the listed salmon; thus, bull trout would not receive indirect protection under the Act.

On August 18, 1997, five evolutionarily significant units (ESUs) of steelhead were listed as threatened—three in California, one in Washington (Columbia River from the Yakima River to Grand Coulee Dam), and one in the Snake River basin in Oregon, Washington, and Idaho (62 FR 43937). Although protection for bull trout under the Act would be afforded where they co-occur with steelhead, measures to protect steelhead may be insufficient for bull trout due to differences in the life

history between the species and lack of complete habitat overlap.

Northwest Forest Plan

The Northwest Forest Plan (NWFP) addresses management of USFS and BLM lands within the range of the northern spotted owl, and implementation began in April 1994 (Tuchmann et al. 1996). The NWFP includes an aquatic conservation strategy, consisting of four inter-related elements. The first element is riparian reserves, which is the system of lands along streams allocated toward the conservation and restoration of aquatic and riparian dependent species. The second is key watersheds, which are watersheds with special values and appropriate management standards. The third element is watershed analysis, which is required to help land managers understand the processes that maintain habitats and to manage to preserve these processes. The fourth element is watershed restoration projects, which are funded to move watersheds toward recovery. For instance, in 1994 through 1996, 1675 watershed restoration projects (or groups of projects) were funded under the NWFP (Tuchmann et al. 1996). The conservation strategy generally addresses the maintenance of the four elements. Although the strategy does not specifically address bull trout needs, it contains objectives for riparian and stream conservation and maintenance that may facilitate conservation of bull trout habitat (W. Cole, Service, *in litt.* 1997). Additionally, the implementation of the NWFP is dependent on interagency collaboration to achieve resource conservation and a sampling of projects unaffected by the 1995 Salvage Rider (see below) indicates that bull trout are generally protected by the NWFP. However, the NWFP covers only a minor portion of bull trout habitat for the Columbia River population segment.

PACFISH and Infish

The USFS and BLM developed the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho and Portions of California, known as PACFISH. PACFISH is intended to be an ecosystem-based, aquatic habitat and riparian-area management strategy for Pacific salmon, steelhead, and sea-run cutthroat trout habitat on lands administered by the two agencies and outside the area subject to implementation of the NWFP (USDA and USDI 1995). PACFISH amended Regional Guides, forest plans and land use plans by applying management

measures for all ongoing and proposed or new projects that pose an unacceptable risk to anadromous fish involving the management of timber, roads, grazing, and other land uses. The Service is participating with NMFS, the USFS, and the BLM in reviewing action-agency PACFISH screening efforts for anadromous fish. Within the area of PACFISH where the habitats of salmon and bull trout overlap, the screening effort is to protect both anadromous fish and bull trout from major effects. However, efforts to include bull trout in the PACFISH review are not always successful (Vizgirdas, *in litt.* 1997; Strach, *in litt.* 1997; Zenone, *in litt.* 1997).

The Inland Native Fish Strategy (INfish) was developed by the USFS to provide an interim strategy for inland native fish in eastern Oregon and Washington, Idaho, western Montana and portions of Nevada (USDA and USDI 1995). It has not been determined whether INfish is an effective strategy for removing the threats for bull trout. In Idaho, the USFS does not place a priority on application of INfish and generally has determined that anadromous watersheds have a higher priority than bull trout watersheds (Vizgirdas, *in litt.* 1997; Strach *in litt.* 1997; Zenone, *in litt.* 1997).

Clean Water Act

Under sections 303 and 304 of the Clean Water Act (CWA), States or EPA set water quality standards, which combine designated beneficial uses and criteria established to protect those uses. Water bodies that are identified as failing water quality standards are designated by States under section 303(d) as water quality limited (MDHES 1994; EPA 1994; ODEQ 1996), and subject to development of management plans to restore water quality and protect designated uses. These management plans, or total maximum daily loads (TMDLs), address both point and non-point sources of pollutants within a watershed. Best Management Practices (BMPs) are used with TMDLs to address non-point sources of pollution, such as mining, forestry, and agriculture; however, regulatory authority to enforce the BMPs varies among the states. It is estimated that 10 percent of total length of streams within the ICBEMP assessment area, including the Klamath River and Columbia River basins, are listed as water quality limited. This may underestimate the true extent and distribution of streams with impaired water quality potentially affecting bull trout (USDA and USDI 1997). In the Klamath River basin, stream reaches designated as water

quality limited (i.e., cited on the 303(d) list of Oregon for various water quality standards (ODEQ 1996)) are estimated to apply to six of the seven bull trout subpopulations. In the Columbia River basin, water bodies designated as water quality limited by Oregon, Washington, Idaho, and Montana are estimated to apply to at least 64 of the 141 bull trout subpopulations.

Relative to water temperature, Oregon established a water quality criterion of 10° C (50° F) as a weekly average based on daily maximum temperatures in bull trout spawning and rearing waters (OAR 340–41–685 and OAR 340–41–026); however, water bodies where these criteria would apply have not been identified. In Washington, temperature criteria for waters vary among the different classifications that are assigned to each waterbody, and range from 16 to 22° C (60.8 to 71.6° F) (Chapter 173–201 WAC). Washington is reviewing these standards with the intent of creating more appropriate water quality standards; however, whether the criteria specifically are for bull trout is unknown. In Idaho, EPA disapproved the state's temperature criteria applications within the geographic range of bull trout (EPA 1997). The EPA determined that the criteria did not provide adequate protection for bull trout relative to two designated uses—cold water biota and salmonid spawning (maximum daily average of 13° C (55.5° F) and 9° C (48.2° F) for each respective use). In July 1997, EPA promulgated a temperature criterion of 10° C (50° F) during June through September in designated stream areas, as a weekly average based on daily maximum temperatures for spawning and rearing of bull trout (EPA 1997). To date, the State has not adopted EPA's promulgated criterion, but has adopted 12° C as a daily average during June–August for juvenile rearing and 9° C for September and October for spawning. Additionally, Idaho has established a geographical area where these criteria would apply. It is unknown whether EPA will approve the State's criteria and withdraw the promulgated rule. In Montana, the temperature criterion applied to waters with bull trout is 19° C (66° F); temperature can be raised 0.6° C (1° F) by discharges, but water temperature may not exceed 19.5° C (67° F) (Administrative Rules of Montana 1996).

In accordance with Section 319 of the CWA, States also develop programs to address non-point sources of pollution such as agriculture, forestry, and mining. The effectiveness of controlling water pollution from these activities has been mixed. The State of Washington

monitored the effectiveness in meeting water quality criteria for temperature in riparian areas on forest lands and concluded that regulations for stream shading were inadequate to meet criteria (Sullivan et al. 1990).

In summary, it is uncertain whether the CWA can provide sufficient protective measures for conservation of bull trout. Temperature regime is one of the most important factors affecting bull trout distribution (Adams and Bjornn 1997, Rieman and McIntyre 1995). Given the known temperature requirements of bull trout (Buchanan and Gregory 1997), criteria developed by the four States may not be conducive to either spawning, incubation, rearing, migration, or combinations of these life-history stages.

State Regulations and Conservation Planning Efforts

All four States within the range of the Klamath River and Columbia River population segments of bull trout have regulations affecting bull trout and their habitat. Idaho, Montana, and local or county organizations have recently developed or are developing conservation plans to maintain and restore bull trout, primarily through stream habitat protection.

In 1995, Idaho Governor Phil Batt initiated a conservation plan to restore bull trout populations in Idaho. The mission of the Governor's Plan, approved in July 1996, is to "... maintain and/or restore complex interacting groups of bull trout populations throughout their native range in Idaho" (Batt, *in litt.* 1997). A recent status report of implementation of the Plan stated that advisory groups, which will develop water quality and bull trout conservation measures, have formed only in some areas. Although the harvest of bull trout is closed throughout Idaho and State-sponsored survey and monitoring has increased (S. Mealey, IDFG, *in litt.* 1997), few on-the-ground recovery actions for bull trout have been implemented to date.

Other efforts include a 1994 conservation agreement (CA) between the Idaho Department of Transportation (IDOT) and the Service to protect bull trout (USDI and IDOT, *in litt.* 1994), and recent conservation activities by the IDFG that were funded by Section 6 of the Act. The IDOT finished only one passage restoration project under the CA, and recently declined to renew the CA (R. Howard, Service, pers. comm. 1997). Since 1994, IDFG has used Section 6 funds to begin several habitat restoration actions in northern and southwestern Idaho. Aside from enacting restrictive fishing regulations,

few protective or restoration projects have been completed that substantially reduce threats to bull trout throughout the Columbia River.

Beginning in 1992 and 1993, several interagency bull trout working groups were formed in Oregon (R. Rosen, ODFW, *in litt.* 1995). These working groups have been instrumental in gathering additional status information and developing preliminary conservation strategies for bull trout in their respective basins. These efforts are encouraging for bull trout conservation in the future, but the outcome has not yet been demonstrated.

In March 1997, Oregon also adopted the Oregon Coastal Salmon Restoration Initiative (OCSRI 1997) (Oregon Plan). The Oregon Plan is designed to "... restore salmon to a level at which they can once again be part of people's lives ..." in coastal Oregon. The Oregon Plan's initial focus is on areas within the range of Oregon coastal coho salmon, and does not overlap with presently occupied bull trout habitat. Oregon recently acknowledged support for developing future bull trout conservation measures by including bull trout in the Oregon Plan (J. Kitzhaber, Governor of Oregon, *in litt.* 1997), although no conservation measures specific to bull trout have been completed to date.

The Upper Klamath Basin Bull Trout Conservation Strategy (Light et al. 1996) was developed by the Klamath Basin Bull Trout Working Group in response to the limited and shrinking distribution and number of bull trout. The Working Group, formed in 1993, is composed of representatives from the Service, ODFW, Fremont and Winema National Forests, Crater Lake National Park, PacifiCorp, USBR, Sprague River Water Users Association, Klamath Basin Water Users Protective Association, U.S. Timberlands, and Klamath Tribes. The defined goals of this group as identified in the Conservation Strategy are—(1) secure existing bull trout populations and (2) restore populations to some of their former distribution (Light et al. 1996). Phase 1 has concentrated on addressing threats to bull trout from non-native salmonids, including eradication of brook trout and brown trout above barriers where isolated subpopulations of bull trout are found. Stream temperatures and sedimentation problems are being addressed concurrent with eradication of exotic species. Phase 2 will involve expanding the number of subpopulations by reestablishing bull trout in high quality headwater habitats, effectively increasing the size of the Klamath River metapopulation and making it more

resilient to natural disturbance, variation in breeding success, disease outbreaks, and other environmental factors (Light et al. 1996). Future objectives likely will include establishing natural movement corridors between adjacent headwater streams.

All habitats currently occupied by bull trout in the Klamath River basin are managed by Working Group members. From 1993 through 1996, conservation actions (phase 1) were implemented by the Working Group, including—watershed assessments; fish distribution, abundance, and spawning surveys; collection of stream temperature and sediment data to help identify limiting factors; brook trout eradication efforts in Long, Sun, and Threemile creeks; reduction or elimination of grazing along bull trout habitat owned by U.S. Timberlands; road system improvements, closures, and rehabilitation; and barrier management to prevent access of non-native fishes (Johnson *in litt.* 1997; Buchanan et al. 1997). Habitat improvement projects have also been implemented in areas historically occupied by bull trout, such as the 9,700 ha (24,000 ac) Nature Conservancy preserve at Sycan Marsh (P. Rexroat, The Nature Conservancy, *in litt.* 1997) and the Sun Pass State Forest on lower Sun Creek. These ongoing conservation efforts have been complicated by recent private land ownership changes and lack of an approved recovery plan that identifies specific conservation tasks and actions.

In addition to the Klamath Basin Bull Trout Working Group, a federally-authorized, interagency and entity group, the Upper Klamath Basin Working Group, was established in 1994. This group, composed of Federal, State, county, city, tribal, environmental, local business, agricultural-ranching, and local community members, works on a consensus-based approach to Klamath basin ecosystem issues. The group focuses on ecosystem restoration projects and has funded bull trout conservation efforts, a high group priority, such as riparian fencing and road maintenance and obliteration projects.

Other State regulations and policies affect bull trout and their habitat in Oregon. For instance, Oregon has a policy "to prevent the serious depletion of any indigenous species" (ORS 496.012). As such, the Oregon Department of Fish and Wildlife's Wildlife Diversity Plan (OAR 635-100) provides for a Sensitive Species List. The Sensitive Species List (OAR-635-100-040) is maintained by ODFW, and

is updated biennially. The Sensitive Species List is intended as a "watch list" of species potentially eligible for listing as endangered or threatened, and constitutes an early warning system for land managers and the public (ODFW 1996). There are no regulatory protections for species listed as sensitive, nor is the habitat on which they depend protected under OAR 635-100.

The Sensitive Species List has four categories—"critical" (species for which listing is appropriate or pending); "vulnerable" (species for which listing is not imminent and can be avoided via adequate protective measures); "peripheral or naturally rare" (occurring in Oregon at the edge of their range, in naturally low numbers due to limited in-state distribution); and "undetermined" status (species for which status is unclear). Bull trout is listed in the "critical" category (ODFW 1993).

The Washington Department of Fish and Wildlife released the final Environmental Impact Statement for the proposed Wild Salmonid Policy in September 1997 (WDFW 1997). Although the environmental impact statement (IS) focused on salmon and steelhead, referring to bull trout and other wild salmonids in an ancillary manner, it described problems and challenges facing the recovery of anadromous and resident salmonids throughout Washington. The IS presented five alternatives ranging from continuation of current management (i.e., policy generally based on maximum sustainable yield) to alternatives providing more protection for wild salmonids. Each alternative addressed harvest, hatcheries, and habitat relative to wild salmonids, and presented obstacles to recovery and possible actions to facilitate recovery. Regardless of the alternative ultimately selected by the Washington State Fish and Wildlife Commission as the Wild Salmonid Policy, implementation of the policy will suggest guidelines for actions taken by the WDFW and will not be binding on other State, tribal, and private entities. Because of uncertainties concerning implementation of the policy, the effect of the policy on bull trout conservation in Washington is unknown.

In Montana, Governor Marc Racicot appointed the Bull Trout Restoration Team in 1994 to produce a plan that maintains, protects, and increases bull trout populations. The team appointed a scientific group that has subsequently prepared eleven basin-specific status reports and two technical, peer-reviewed papers. A third technical

paper is presently undergoing peer review. A Montana Bull Trout Recovery Plan, including a recovery goal, is also nearing completion. Watershed groups are being established in some areas to lead local bull trout restoration efforts. As of October 1997, some localized habitat restoration projects, such as removal of fish passage barriers, screening irrigation diversions, riparian fencing, stream restoration projects, and habitat monitoring, had been completed or were underway (Graham and Clinch, *in litt.* 1997). Because of uncertainties concerning implementation of the restoration plan, the effect of the plan on future bull trout conservation in Montana is unknown.

Oregon, Washington, Idaho, and Montana each have adopted a Forest Practice Act (FPA) or other legislation consisting of rules and regulations addressing forest management on State, Federal, and private lands. In general, the legislation establishes best management practices (BMPs) to be implemented on forests, such as streamside management zones (Montana Department of State Lands 1994), activities allowed in riparian areas, restrictions on harvest adjacent to streams, and location of road construction. The application of BMPs is voluntary in some States. Although audits show that compliance with BMPs is high in Idaho (H. Malany, Idaho Forest Practice Act Advisory Committee Member, *in litt.* 1997) and Montana (Mathieus 1996), the Service is not aware of evaluations of various States' BMPs relative to the protection of bull trout habitat and processes affecting water quality, such as sediment delivery, water temperature, recruitment of woody debris, and bank stability. In Idaho, half of timber sales audited resulted in contributions of sediment to streams, largely from inadequately maintained roads (Zaroban et al. 1996). Even with high implementation rates, Idaho's forestry BMPs have been ineffective at maintaining beneficial uses, including cold water biota (McIntyre 1993). In Montana, McGreer (1994) noted that the Montana legislation may adequately provide for woody debris and bank stability, but it may be inadequate for temperature control and sedimentation. The MDNRC has discontinued timber harvest and grazing in areas directly adjacent to streams containing bull trout (P. Flowers, MDNRC, *in litt.* 1996). Based on current information, the Service is unable to conclude that State FPAs and related legislation are adequate to protect bull trout habitat.

E. Other natural or manmade factors affecting their continued existence.

Natural and manmade factors affecting the continued existence of bull trout include—previous introductions of non-native species that compete or hybridize with bull trout; fragmentation and isolation of bull trout subpopulations from habitat changes caused by human activities, and subpopulation extirpations due to naturally occurring events such as droughts and floods.

Introduced Non-native Species

Introductions of non-native species by the Federal government, State fish and game departments, and private parties, across the range of bull trout has resulted in declines in abundance, local extirpations, and hybridization of bull trout (Bond 1992; Howell and Buchanan 1992; Leary et al. 1993; Donald and Alger 1993; Pratt and Huston 1993; MBTSG 1995b,d, 1996g; Platts et al. 1995; Palmisano and Kaczynski, *in litt.* 1997). Non-native species may exacerbate stresses on bull trout from habitat degradation, fragmentation, and isolation (Rieman and McIntyre 1993). Introduced species, such as rainbow trout, may benefit large adult bull trout by providing supplemental forage (Faler and Bair 1991; Pratt 1992; ODFW, *in litt.* 1993). However, introductions of non-native game fish can be detrimental due to increased angling and subsequent incidental catch and illegal harvest of bull trout (Rode 1990; Bond 1992; WDW 1992; MBTSG 1995d).

Non-native fish also threaten bull trout in relatively secure and physically unaltered habitats, including roadless areas, wilderness, and national parks. For instance, brook trout occur in tributaries of the Middle Fork Salmon River within the Frank Church-River of No Return Wilderness, including Elk, Camas, Loon, and Big creeks (Thurrow 1985; S. Achord, National Marine Fisheries Service (NMFS), *in litt.* 1994) and Sun Creek in Crater Lake National Park (Light et al. 1996). Glacier National Park has self-sustaining populations of introduced non-native species, including lake trout, brook trout, rainbow trout, Yellowstone cutthroat trout, lake whitefish (*Coregonus clupeaformis*), and northern pike (MBTSG 1995d). Although stocking in Glacier National Park was terminated in 1971, only a few headwaters lakes contain exclusively native species, including bull trout. The introduction and expansion of lake trout into the relatively pristine habitats of Kintla Lake and Lake McDonald in Glacier National Park nearly extirpated the bull trout subpopulation from predation and competition (L. Marnell, NPS, *in litt.* 1995; MBTSG 1995d).

Introduced brook trout threaten bull trout through hybridization, competition, and possibly predation (Leary et al. 1993; Thomas 1992; WDW 1992; Clancy 1993; Rieman and McIntyre 1993; MBTSG 1996). Hybridization between brook trout and bull trout has been reported in Montana (MBTSG 1995a,b, 1996a,c,e; Hansen and DosSantos 1997), Oregon (Markle 1992; Ratliff and Howell 1992), Washington (WDFW 1997), and Idaho (Adams 1996; T. Burton, BNF, pers. comm. 1997). Hybridization results in offspring that are frequently sterile (Leary et al. 1993), but some hybrids show gonadal development (Dunsmoor and Bienz, *in litt.* 1997), raising concern of potential introgression. Hybrids may be significant competitors; Dunsmoor and Bienz (*in litt.* 1997) noted that hybrids are aggressive and larger than resident bull trout, suggesting that hybrids may have a competitive advantage. Brook trout mature faster and have a higher reproductive rate than bull trout. This difference may favor brook trout over bull trout when they occur together, often leading to replacement of bull trout with brook trout (Leary et al. 1993; Clancy 1993; MBTSG 1995b). The threat of hybridization and replacement is likely exacerbated where larger, more fecund migratory forms of bull trout have been eliminated (Rieman and McIntyre 1993). The magnitude of threats from non-native fishes is highest for subpopulations supporting only resident fish because resident bull trout typically are small in number and isolated where the effects of interspecific interactions are likely more intense.

Brook trout apparently adapt better to degraded habitats than bull trout (Clancy 1993; Rich 1996). Brook trout likely have higher survival-to-emergence than bull trout in areas with elevated sediment (MBTSG 1996h), and brook trout also tend to occur in streams with higher water temperatures (Adams 1994; MBTSG 1996h). Because elevated water temperatures and sediments are often indicative of degraded habitat, bull trout may be subject to stresses from both interactions with brook trout and degraded habitat (MBTSG 1996h). Watson and Hillman (1997) found an inverse relationship between bull trout occurrence and the presence of brook trout. Dunsmoor and Bienz (*in litt.* 1997) noted that brook trout have a high probability of displacing bull trout in the Klamath River basin due to degraded bull trout habitat.

Introduced brown trout are established in several areas within the range of bull trout and likely compete with bull trout (Ratliff and Howell 1992;

Platts et al. 1993; Pratt and Huston 1993). Brown trout tend to spawn in the same areas as bull trout, though later in the season, and may compete for spawning and rearing areas and superimpose redds on bull trout redds (Pratt & Huston 1993; Light et al. 1996; MBTSG 1996h). Additionally, brown trout are typically more aggressive than native trout, and can displace brook trout and other native trout species (Fausch and White 1981; Wang and White 1994). Bull trout and brown trout rear in similar areas and may compete for food and space. Elevated water temperatures may favor brown trout over bull trout in competitive interactions (MBTSG 1996h). Brown trout are thought to have been a secondary factor in the decline and eventual extirpation of bull trout in the McCloud River, California, after dam construction altered bull trout habitat (Rode 1990).

Non-native lake trout also negatively affect bull trout (Donald and Alger 1993; MBTSG 1996h). A study of 34 lakes in Montana, Alberta, and British Columbia found lake trout likely limit foraging opportunities and reduce the distribution and abundance of migratory bull trout in mountain lakes (Donald and Alger 1993). Illegal introductions of lake trout and other species have occurred in more than 50 northwest Montana waters in recent years (J. Vashro, MFWP, *in litt.* 1995). The potential for illegal introduction of lake trout into the Swan River basin and Hungry Horse Reservoir on the South Fork Flathead River, both in Montana, is considered a threat to bull trout (MBTSG 1995e, 1996a), potentially affecting up to six subpopulations. In Idaho, lake trout and habitat degradation were factors in the decline of bull trout from Priest Lake (Mauser et al. 1988; Pratt and Huston 1993). Juvenile lake trout are also using river habitats in Montana, possibly competing with bull trout (MBTSG 1996h). State plans to manage lake trout to reduce interactions with bull trout are unknown.

Non-native northern pike (*Esox lucius*), bass (*Micropterus spp.*), and opossum shrimp (*Mysis relicta*) are also thought to negatively affect bull trout. Northern pike were illegally introduced into Swan Lake in the 1970s (MFWP 1997), and predation on juvenile bull trout has been documented (S. Rumsey, MFWP, pers. comm. *in* MBTSG 1996a). Management of Swan Lake emphasizes protection of native salmonids, particularly bull trout, and control of northern pike to minimize effects on native species (MFWP 1997). Northern pike were also illegally introduced into

Salmon, Inez, Seeley, and Alva lakes in the Clearwater River basin, a tributary to the Blackfoot River, Montana (MFWP 1997). Northern pike numbers have increased in Salmon Lake and Lake Inez, having a negative effect on bull trout (Berg, pers. comm. 1997). Northern pike in Seeley Lake and Lake Alva are also expected to increase in numbers (Berg, pers. comm. 1997).

Introduced bass may negatively affect bull trout where the species co-occur (MFWP 1997). In the Clark Fork River, Montana, Noxon Rapids Reservoir supports fisheries for both smallmouth bass (*Micropterus dolomieu*) and largemouth bass. Both are high priority species in current management of Noxon Rapids Reservoir unless more suitable bull trout habitat is created as a result of dam relicensing. The fishery management objective for Cabinet Gorge Reservoir, downstream of Noxon Rapids Reservoir, is to enhance bull trout while managing the existing bass fishery (MFWP 1997).

Opossum shrimp, a crustacean native to the Canadian Shield area, was widely introduced in the 1970s as supplemental forage for kokanee and other salmonids in several lakes and reservoirs across the northwest (Nesler and Bergerson 1991). The introduction of opossum shrimp in Flathead Lake changed the lake's trophic dynamics, and is widely believed to have been partially responsible for the expanding the lake trout population, resulting in increased competition and predation on bull trout (T. Weaver, MFWP, *in litt.* 1993). Thus, opossum shrimp have had an indirect, negative effect on bull trout. Conversely, in Swan Lake, Montana, opossum shrimp and kokanee have become established and increased the availability of forage for bull trout, contributing to the significant increase in bull trout numbers in the Swan River basin (MBTSG 1996a). Thus, the effects of introduced species on bull trout involve complex interactions that are dependent on several factors.

Klamath River Population Segment

Bull trout have been displaced by brook trout in portions of the Klamath River basin (Light et al. 1996), and hybrids of the two species have been verified in several of the streams (Ratliff and Howell 1992). Either brook trout, brown trout, or both species occur with bull trout in six of seven subpopulations. Where brook trout or brown trout co-occur with bull trout, the distribution of bull trout has contracted and that of introduced salmonids expanded (e.g., Brownsworth, Leonard, and Long creeks) (Buchanan et al. 1997). Only four subpopulations exist in the

absence of brook trout, and these are the most abundant (Ratliff and Howell 1992; Ziller 1992). In 1992, chemical eradication of brook trout was initiated in Sun Creek (Buktenica 1997). The chemical treatment apparently killed a number of bull trout due to the difficulty of removing fish prior to treatment (Buktenica 1997). Other eradication programs relying on chemical treatments would likely have similar effects on bull trout. Ongoing management actions in Threemile and Long creeks focus on brook trout eradication via selective electrofishing, snorkel-spearing, trapping, and chemical treatments with the objective of expanding bull trout range. Brook trout have declined in Threemile Creek, but there has been no measurable change in brook trout numbers in Long Creek (Dunsmoor and Bienz, *in litt.* 1997).

Columbia River Population Segment

Within the upper Columbia River basin in Montana, brook trout are found in approximately 65 percent of the stream reaches where bull trout occur (J. Hutten, MFWP, *in litt.* 1993). Brook trout are found in all major basins in Montana that support bull trout except the South Fork of the Flathead River. Brook trout and bull trout hybridization was first documented in the early 1980s in South Fork Lolo Creek in the Bitterroot River basin, Montana (Clancy 1993; MBTSG 1996h). Bull trout have largely been replaced by brook trout.

Introduced brook, brown, and rainbow trout are present in the Bitterroot drainage in Montana (Clancy 1996). The presence of non-native fish may have been a factor causing the fragmentation of bull trout range in the Bitterroot drainage by restricting migratory movements by bull trout (Rich 1996). Brook trout appeared to be replacing bull trout in some streams in the Bitterroot. Bull trout-brook trout hybrids have been documented in at least nine tributaries (MBTSG 1995b). Rich (1996) found a strong negative correlation between the presence of bull trout and brook trout in tributaries of the Bitterroot River.

The MBTSG concluded that introduced species, particularly in the lower Clark Fork River pose a high threat to bull trout (MBTSG 1996b). Non-native fishes have been introduced throughout the Clark Fork River system and brook trout are found throughout. Bull trout-brook trout hybrids exist in the Middle and upper Clark Fork systems (MBTSG 1995a; Hansen and DosSantos 1997).

In Idaho, bull trout densities in Mica Creek, Spokane River basin, during 1972

ranged from 0.03 to 0.23 fish/100 m² (0.003 to 0.023 fish/100 ft²) (Mausser et al. 1972 in Platts et al. 1993). Extensive electrofishing surveys in Mica Creek during 1993 did not find bull trout, but brook trout were numerous at one transect (Martin 1994). Brook trout are present or accessible to most of the Clearwater River basin in Idaho, with hybridization and competition the primary threat to bull trout (A. Espinosa, Clearwater National Forest, pers. comm. 1993; D. Johnson, Nez Perce Tribe, pers. comm. 1995). For example, Meadow Creek, a tributary to the North Fork Clearwater River, contained numerous bull trout in 1987 and 1988, but, currently, high numbers of brook trout occur and bull trout numbers have been sharply reduced (Johnson, pers. comm., 1995).

Negative effects of interactions with introduced non-native species may be the most pervasive threat to bull trout throughout the Columbia River basin. Of the 141 subpopulations of bull trout in the Columbia River population segment, approximately 62 percent were threatened by competition, predation, or displacement by non-native species. Often one or more non-native species have been introduced into bull trout habitats; interactions with bull trout are likely exacerbated by factors such as habitat conditions, water temperature, and isolation. The MBTSG concluded that non-native species pose a limitation to bull trout restoration (MBTSG 1995a-e, 1996a-f). The MBTSG is reviewing recommendations for removing or suppressing non-native fishes to benefit bull trout, but success of such an effort on a large scale is questionable (MBTSG 1996h).

Isolation and Habitat Fragmentation

Bull trout are widely distributed over a large geographic area, and exhibit a patchy distribution due, in part, to specific habitat requirements (Rieman and McIntyre 1993). However, the effects of human activities over the past 100 years have resulted in reductions in the overall distribution of bull trout. In general, habitat fragmentation results in reduction in available habitat and increased isolation from conspecifics (Saunders et al. 1991). In studies of extinction in fragmented landscapes, Burkey (1989) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in each local population (i.e., subpopulations) and their probability of extirpation is directly related to the degree of isolation and fragmentation. Without sufficient immigration, overall growth for subpopulations may be low and the overall probability of

extirpation for subpopulations is high (Burkey 1989, 1995). Moreover, habitat fragmentation that isolates subpopulations may increase a species' susceptibility to both demographic and naturally occurring events (Rieman and McIntyre 1993).

Metapopulation concepts of conservation biology theory are applicable to the bull trout (Reiman and McIntyre 1993). A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994). Subpopulations may be extirpated, but can be reestablished by individuals from other subpopulations. Metapopulations are thought to provide a mechanism for spreading risk because the simultaneous loss of all subpopulations is unlikely. Migratory corridors can also allow individuals access to unoccupied but suitable habitats, foraging areas, and refuges from perturbations (Saunders et al. 1990). Relative to bull trout, maintenance of migratory corridors is essential to provide connectivity among subpopulations thought to be sources and sinks, and enables the reestablishment of extirpated subpopulations. Where migratory bull trout are not present, disjunct subpopulations cannot be replenished when a disturbance makes local habitats unsuitable (Rieman and McIntyre 1993; USDA and USDI 1997). Moreover, limited downstream movement was observed for resident bull trout in the Bitterroot River basin (Nelson 1996) suggesting low probability that extirpated bull trout would be reestablished by resident fish residing nearby. Of the 141 subpopulations in the Columbia River population segment, approximately 79 percent are unlikely to be reestablished if extirpated; and 50 percent are at risk of extirpation from naturally occurring events.

Passage barriers, degraded habitat, absence of migratory fish, and intensified stream perturbations, such as forest fires, floods, and droughts, reduce the ability of isolated bull trout subpopulations to persist following disturbances to streams (Rieman and McIntyre 1993; USDA and USDI 1997). Bull trout evolved with habitat perturbations to streams that were likely factors in shaping bull trout life history (Rieman and McIntyre 1993). Historically, areas suitable for bull trout spawning were likely distributed in a disjunct pattern (Fraley and Shepard 1989; Rieman and McIntyre 1995; USDA and USDI 1997) maintained by natural perturbations. Although the amount and distribution of spawning areas vary through time, sufficient spawning areas

were accessible to bull trout to maintain the species (Rieman and McIntyre 1995; USDA and USDI 1997). Migratory bull trout tend to show fidelity to spawning streams, but they have been documented to spawn in different tributaries from one year to the next, including tributaries not previously known to have recent spawning (Ratliff et al. 1996). Thus, migratory bull trout have the ability to reestablish an area where extirpated previously as long as suitable migratory corridors exist (Rieman and McIntyre 1993).

Today, bull trout exhibiting migratory life histories have declined or are absent in many river systems (Bond, 1992; Schill 1992; Ziller 1992; Pratt and Huston 1993; Rieman and McIntyre 1993; Newton and Pribyl 1994; MBTSG 1995a,b; 1996b,c,e; USDA and USDI 1997). Passage barriers (e.g., dams and diversions) and other habitat alterations prevent bull trout migration from following historical patterns. Additionally, suitable spawning areas are more fragmented across the landscape than historically (USDA and USDI 1997). With fewer and more compressed spawning and rearing areas available, bull trout increasingly persist as small, isolated resident populations instead of few, large connected subpopulations (Bond, 1992; Schill 1992; Thomas 1992; Ziller 1992; Rieman and McIntyre 1993, 1995; Rich 1996; Newton and Pribyl 1994; MBTSG 1995a,b; 1996b,c,d,e; USDA and USDI 1997).

As discussed in Factor A, evidence suggests that landscape disturbances, such as floods and fires, have increased in frequency and magnitude of effects within the range of bull trout (Henjum et al. 1994; USDA and USDI 1997). Where recolonization is prevented by passage barriers and suitable habitat, bull trout subpopulations may be extirpated by perturbations (USDA and USDI 1997). Also, isolated subpopulations are typically small, and more likely to be extirpated by local events than larger populations (Rieman and McIntyre 1995). Small populations may be at risk of impaired genetic fitness, as in Gold Creek, Washington (Craig and Wissmar 1993).

An example of the effects of naturally occurring events, such as fire, on bull trout habitat is the Entiat River basin of central Washington. "Historical and current influences have been significant and include: localized compaction from sheep grazing and trailing; fire exclusion; timber salvage/road building from the early 1970's to present; and recreation. A portion of this (transitional or bull trout) zone has recently been impacted by a large, moderate high

intensity fire" (Wenatchee National Forest, *in litt.* 1996). This transitional or bull trout zone in the mainstem Entiat River has had a 30 to 60 percent loss of pools since initially surveyed by the U.S. Bureau of Fisheries during 1935 through 1937 (Wenatchee National Forest, *in litt.* 1996). Both bull trout densities and recruitment are depressed in the mainstem Entiat in response to habitat degradation.

Conversely, most bull trout recruitment in the Entiat River basin is now occurring in the transitional zone in the Mad River. Pool frequencies have increased dramatically, 85 percent in one reach surveyed, 1,000 percent in the other, since the 1935 through 1937 surveys (Wenatchee National Forest, *in litt.* 1996). A large fire occurred in the Mad River basin in 1888, and the basin had splash dams and log drives early in this century. It has taken 60 years for the habitat to recover.

Floods or high flows have also been altered by land management (USDA and USDI 1997). Roads and clear cutting forested areas tend to magnify the effects of floods, leading to higher flows, erosion and bedload that scour channels (Furniss et al. 1991; McIntosh et al. 1994; USDA and USDI 1997), and degrade bull trout habitat (Henjum et al. 1994). Erosion from road landslides increases bedload to high stream flows over bedload levels without roads (Furniss et al. 1991). Increased bedload increases the scouring effect of the high water, increasing channel instability, leading to a loss of habitat diversity, especially pools (Henjum et al. 1994; McIntosh et al. 1994). Bull trout eggs and fry in the gravels during the scouring likely survive at lower rates (Henjum et al. 1994). For instance, hundreds of landslides associated with roads on the Clearwater National Forest and Panhandle National Forests (R. Patten and J. Pengkover, Panhandle National Forests, *in litt.* 1996) resulted from high water in 1995, and the effects of flooding on isolated bull trout populations is unknown. Habitat degradation has reduced the number and size of bull trout spawning areas (USDA and USDI 1997).

The Service has carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to bull trout in the Klamath River and Columbia River distinct population segments of bull trout in developing this final rule. Based on this evaluation the preferred action is to list the Klamath River and the Columbia River population segments of bull trout as threatened.

Klamath River Population Segment

Bull trout are currently limited to seven geographically isolated subpopulations that occupy only a fraction of the historical habitat. The species distribution and numbers have declined due to habitat degradation, isolation, loss of migratory corridors, poor water quality, and the introduction of non-native species. Six of seven bull trout subpopulations are small in number, and unlikely to persist over the next 100 years unless conservation and other corrective actions are taken. Remaining Klamath River bull trout subpopulations are threatened by the effects of past, present and future land and water management practices. Most subpopulations also face more than one threat.

Despite the bull trout's current status, the Service is encouraged that recent conservation and recovery actions are being initiated at Federal, State and local levels to begin to reverse the long-term declining trend for bull trout in the Klamath River basin. Progress has already been made toward improving habitat conditions for bull trout. Although the Service proposed the Klamath River population segment as endangered based on the 1994 administrative record, new information indicates that interagency conservation programs are being implemented and have begun to reduce threats to bull trout. Included are efforts of the Klamath Basin Working Group to eradicate brook trout in Long, Sun and Threemile Creeks, reduce livestock grazing along bull trout streams, and monitor watershed conditions and bull trout status. Moreover, bull trout conservation in the Klamath Basin has benefitted from habitat restoration activities of the Upper Klamath Basin Working Group which began in 1994. Habitat improvements derived from these two programs have just begun to be realized. Thus the final determination is to list the Klamath River population of bull trout as threatened because it is no longer in danger of extinction in the foreseeable future and threats have been reduced.

Columbia River Population Segment

Bull trout in the Columbia River basin, despite their relatively widespread distribution, have declined in both their overall range and numbers. Numerous extirpations of local subpopulations have been reported, with bull trout eliminated from areas ranging in size from relatively small tributaries of currently occupied, though fragmented habitat, to large river systems comprising a substantial

portion of the species' previous range. Bull trout in the Columbia River population segment are currently limited to 141 isolated subpopulations, which indicates habitat fragmentation and geographic isolation. Many remaining bull trout occur as isolated subpopulations in headwater lakes or tributaries with migratory life histories lost or restricted. Few bull trout subpopulations are considered "strong" in terms of relative abundance and subpopulation stability. These remaining important strongholds tend to be found in large areas of contiguous habitats in the Snake River basin of central Idaho Mountains, upper Clark Fork and Flathead rivers in Montana, and the Blue Mountains in Washington and Oregon. The decline of bull trout is due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices and the introduction of non-native species. Most bull trout subpopulations are affected by one or more threats.

Recent activities to address threats and reverse the long-term decline of bull trout are being initiated at Federal, State and local levels (e.g., restrictive angling regulations, adoption of various land management rules, and development of conservation strategies and plans). While these efforts are important to the long term conservation and recovery of bull trout, threats continue and subpopulation improvement throughout the Columbia River has yet to be demonstrated. Because bull trout in the Columbia River basin are still a wide-ranging species, with some "strongholds" in relatively protected areas, the Columbia River population segment is not in immediate danger of extinction. Therefore the Service's final determination is to list the Columbia River population segment of bull trout as threatened.

Critical Habitat

Critical habitat is defined in section 3 of the Act as—(i) the specific area within the geographical area occupied by a species, at the time it is listed in accordance with the Act, on which are found those biological features (I) essential to the conservation of the species and (II) that may require special management considerations or protection and; (ii) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. "Conservation" means the use of all methods and procedures needed to bring the species to the point at

which listing under the Act is no longer necessary.

Section 4(a)(3) of the Act, as amended, and implementing regulations (50 CFR 424.12) require that, to the maximum extent prudent and determinable, the Secretary designate critical habitat at the time the species is determined to be endangered or threatened. Service regulations (50 CFR 424.12(a)) state that critical habitat is not determinable if information sufficient to perform required analysis of impacts of the designation is lacking or if the biological needs of the species are not sufficiently well known to permit identification of an area as critical habitat. Section 4(b)(2) of the Act requires the Service to consider economic and other relevant impacts of designating a particular area as critical habitat on the basis of the best scientific data available. The Secretary may exclude any area from critical habitat if he determines that the benefits of such exclusion outweigh the conservation benefits, unless to do such would result in the extinction of the species.

The Service finds that the designation of critical habitat is not determinable for these distinct population segments based on the best available information. When a "not determinable" finding is made, the Service must, within 2 years of the publication date of the original proposed rule, designate critical habitat, unless the designation is found to be not prudent. The Service reached a "not determinable" critical habitat finding for the proposed rule based on the 1994 administrative record. In the proposed rule the Service specifically requested comments on this issue. While the Service received a number of comments advocating critical habitat designation, none of these comments provided information that added to the Service's ability to determine critical habitat. Additionally, no new information regarding specific physical and biological features essential for bull trout in the Klamath River and Columbia River bull trout population segments was obtained during the open comment period including the five public hearings. The biological needs of bull trout in the two population segments are not sufficiently well known to permit identification of areas as critical habitat. Insufficient information is available on the number of individuals or spawning reaches required to support viable subpopulations throughout the distinct population segment. In addition, the extent of habitat required and specific management measures needed for recovery of these fish have not been identified. This information is

considered essential for determining critical habitat for these population segments. Therefore, the Service finds that designation of critical habitat for the Klamath River and the Columbia River population segments is not determinable at this time. Protection of bull trout habitat will be addressed through the recovery process and through section 7 consultations to determine whether Federal actions are likely to jeopardize the continued existence of the species.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Endangered Species Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain activities. Recognition through listing encourages and results in conservation actions by Federal, State, and private agencies, groups, and individuals. The Act provides for possible land acquisition and cooperation with the states and requires that recovery actions be carried out for all listed species. The protection required of Federal agencies and the prohibitions against taking and harm are discussed, in part, below.

Section 7(a) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if any is being designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR Part 402. Section 7(a)(2) requires Federal agencies to insure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Service.

The Klamath River and Columbia River bull trout population segments occur on lands administered by the USFS and BLM; various State-owned properties in Oregon, Washington, Idaho and Montana; and private lands. Federal agency actions that may require consultation as described in the preceding paragraph include Army Corps of Engineers (Corps) involvement in projects such as the construction of roads and bridges, and the permitting of wetland filling and dredging projects subject to section 404 of the Clean Water Act (33 U.S.C. 1344); Federal Energy Regulatory Commission licensed

hydropower projects authorized under the Federal Power Act; USFS and BLM timber and grazing management activities; EPA authorized discharges under the National Pollutant Discharge System of the Clean Water Act; and U.S. Housing and Urban Development projects.

On January 27, 1998, an interagency memorandum between the USFS, BLM and the Service outlined a process for bull trout section 7 conferencing/consultation in recognition of the possibility of an impending listing. The process considers both programmatic actions (e.g., land management plans) and site-specific actions (e.g., timber sales and livestock grazing allotments) and incorporates conferencing/consultation at the watershed level. The process uses a matrix to determine the environmental baseline and the effects of projects on the environmental baseline of bull trout. The goal of this strategy is to complete conferences for all ongoing actions and proposed actions by the effective date of listing through a system of batching and aggregating of projects to the watershed level. A programmatic LRMP/RMP biological assessment would be used to assess ongoing projects for up to 9 months post-listing that result from implementation of Forest Plans/Resource Management Plans as amended in INFISH, PACFISH and the Northwest Forest Plan. The Service would determine in a programmatic biological opinion whether these issues would jeopardize the continued existence of bull trout, and would authorize incidental take. Part of the project description and evaluation process would stipulate that an ongoing project would be completed by May 10, 1999. For projects that are proposed after the initial 9 month post-listing period, the watershed approach, using the bull trout matrix incorporating local watershed biological data, would be project-specific applied in the section 7 process.

The Act and its implementing regulations found at 50 CFR 17.21 and 17.31 set forth a series of general trade prohibitions and exceptions that apply to all threatened wildlife. These prohibitions, in part, make it illegal for any person subject to the jurisdiction of the United States to take (includes harass, harm, pursue, hunt, shoot, wound, kill, trap, or collect; or attempt any of these), import or export, ship in interstate commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. It is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been

taken illegally. Certain exceptions apply to agents of the Service and State conservation agencies.

Permits, authorized under section 10(a)(1) of the Act, may be issued to carry out otherwise prohibited activities involving endangered and threatened wildlife under certain circumstances. Regulations governing permits are at 50 CFR 17.22, 17.23 and 17.32. Such permits are available for scientific purposes, to enhance the propagation or survival of the species, and/or for incidental take in connection with otherwise lawful activities. For threatened species, permits are also available for zoological exhibition, educational purposes, or special purposes consistent with the purpose of the Act. Private landowners seeking permits under section 10 of the Act for incidental take are a means of protecting bull trout habitat through the voluntary development of habitat conservation plans. Information collections associated with these permits are approved under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.*, and assigned Office of Management and Budget clearance number 1018-0094. For additional information concerning these permits and associated requirements, see 50 CFR 17.32.

It is the policy of the Service published in the **Federal Register** on July 1, 1994, (59 FR 34272) to identify to the maximum extent practicable at the time a species is listed those activities that would or would not constitute a violation of section 9 of the Act. The intent of this policy is to increase public awareness of the effect of this listing on proposed and ongoing activities within the species' range. The Service believes the following actions would not be likely to result in a violation of section 9, provided the activities are carried out in accordance with any existing regulations and permit requirements—

(1) Actions that may affect bull trout in the Klamath and Columbia River basins and are authorized, funded or carried out by a Federal agency when the action is conducted in accordance with an incidental take statement issued by the Service pursuant to section 7 of the Act;

(2) Possession of Columbia River basin bull trout caught legally in accordance with authorized State fishing regulations (see Special Rule section);

(3) State, local and other activities that have been approved by the Service through development of Conservation Plans and special rules under section 4(d) and section 6(c)(1) of the Act.

With respect to both the Klamath River and Columbia River bull trout population segments, the following actions likely would be considered a violation of section 9—

(1) Take of bull trout without a permit, which includes harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting, or attempting any of these actions, except in accordance with applicable State fish and wildlife conservation laws and regulations within the Columbia River bull trout population segment;

(2) To possess, sell, deliver, carry, transport, or ship illegally taken bull trout;

(3) Unauthorized interstate and foreign commerce (commerce across State and international boundaries) and import/export of bull trout (as discussed in the prohibition discussion earlier in this section);

(4) Introduction of non-native fish species that compete or hybridize with, or prey on bull trout;

(5) Destruction or alteration of bull trout habitat by dredging, channelization, diversion, in-stream vehicle operation or rock removal, or other activities that result in the destruction or significant degradation of cover, channel stability, substrate composition, temperature, and migratory corridors used by the species for foraging, cover, migration, and spawning;

(6) Discharges or dumping of toxic chemicals, silt, or other pollutants into waters supporting bull trout that result in death or injury of the species; and

(7) Destruction or alteration of riparian or lakeshore habitat and adjoining uplands of waters supporting bull trout by timber harvest, grazing, mining, hydropower development, or other developmental activities that result in destruction or significant degradation of cover, channel stability, substrate composition, temperature, and migratory corridors used by the species for foraging, cover, migration, and spawning.

Other activities not identified above will be reviewed on a case-by-case basis to determine if a violation of section 9 of the Act may be likely to result from such activity. The Service does not consider these lists to be exhaustive and provides them as information to the public.

Questions regarding whether specific activities may constitute a violation of section 9 should be directed to the Supervisor of the Service's Snake River Basin Office (see **ADDRESSES** section). Requests for copies of the regulations concerning listed species and inquiries

regarding prohibitions and permits may be addressed to the U.S. Fish and Wildlife Service, Endangered Species Permits, 911 NE 11th Avenue, Portland, Oregon 97232-4181 (telephone 503 231-6241; facsimile 503 231-6243).

Special Rule

Section 4(d) of the Act provides authority for the Service to promulgate special rules for threatened species that would relax the prohibition against taking. The Service finds that statewide angling regulations have become more restrictive in an attempt to protect bull trout throughout Idaho, Montana, Nevada, Oregon, and Washington and are adequate to protect the species from excessive taking. The Service intends to continue to work with the States and Tribes in developing management plans and agreements with the objective of recovery and eventual delisting of the Klamath River and Columbia River distinct population segments. This special rule allows for take of bull trout within the Klamath River and Columbia River distinct population segments when it is in accordance with applicable State and Native American Tribal fish and wildlife conservation laws and regulations, as constituted in all respects relevant to protection of bull trout. The Service believes that this special rule will allow for more efficient management of the species, thereby facilitating its conservation.

National Environmental Policy Act

The Service has determined that an Environmental Assessment, as defined under the authority of the National Environmental Policy Act of 1969, need not be prepared in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act, as amended. A notice outlining the Service's reasons for this determination was published in the **Federal Register** on October 25, 1983 (48 FR 49244).

Required Determinations

This rule does not contain any new collections of information other than those already approved under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.*, and assigned Office of Management and Budget clearance number 1018-0094. For additional information concerning permit and associated requirements for threatened species, see 50 CFR 17.32.

References Cited

A complete list of all references cited herein is available upon request from the Snake River Basin Office (see **Addresses** section).

Author(s)

The primary authors of this final rule are: John Bowerman, Klamath Basin Fish and Wildlife Office, Klamath Falls, OR; Timothy Cummings, Columbia River Fisheries Office, Vancouver, WA; Stephen Duke, Snake River Basin Office, Boise, ID; Michael Faler, Idaho Fisheries Resource Office, Ahsahka, ID; Robert Hallock, Upper Columbia River Basin Office, Spokane, WA; Samuel Lohr, Snake River Basin Office, Boise, Idaho; Lori Nordstrom, Helena Field Office, Helena, MT; and Ron Rhew, Oregon State Office, Portland, OR.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Regulation Promulgation**PART 17—[AMENDED]**

Accordingly, the Service amends part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below—

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 16 U.S.C. 1531–1544; 16 U.S.C. 4201–4245; Pub. L. 99–625, 100 Stat. 3500, unless otherwise noted.

2. Amend § 17.11(h) by adding the following, in alphabetical order under FISHES, to the List of Endangered and Threatened Wildlife to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
*	*	*	*	*	*		*
FISHES							
*	*	*	*	*	*		*
Trout, bull	<i>Salvelinus confluentus</i> .	U.S.A. (Pacific NW), Canada (NW Territories).	Klamath R. (U.S.A.-OR)	T	637	NA	17.44 (v)
Do.....	do.....	do	Columbia R. (U.S.A.—ID, MT, OR, WA) mainstem and its tributaries, excluding Jarbidge R., NV, and east of Continental Divide, MT.)	T	637	NA	Do.
*	*	*	*	*	*		*

3. Amend § 17.44 by adding paragraph (v) to read as follows:

§ 17.44 Special rules—fishes.

* * * * *

(v) Bull trout (*Salvelinus confluentus*), Columbia River and Klamath River population segments.

(1) Prohibitions. Except as noted in paragraph (v)(2) of this section, all prohibitions of 50 CFR 17.31 and exemptions of 50 CFR 17.32 shall apply to the bull trout Columbia River and Klamath River population segments within the contiguous United States.

(2) Exceptions. No person shall take this species, except in accordance with applicable State and Native American Tribal fish and wildlife conservation laws and regulations, as constituted in all respects relevant to protection of bull trout in effect on June 10, 1998.

(3) Any violation of applicable State and Native American Tribal fish and wildlife conservation laws or regulations with respect to the taking of this species is also a violation of the Endangered Species Act.

(4) No person shall possess, sell, deliver, carry, transport, ship, import, or export, any means whatsoever, any such

species taken in violation of this section or in violation of applicable State and Native American Tribal fish and game laws and regulations.

(5) It is unlawful for any person to attempt to commit, solicit another to commit, or cause to be committed, any offense defined in paragraphs (v) (2) through (4) of this section.

Dated: June 1, 1998.

Jamie Rappaport Clark,

Director, Fish and Wildlife Service.

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