Chapter: 18

State(s): Idaho

Recovery Unit Name: Southwest Idaho

Region 1
U. S. Fish and Wildlife Service
Portland, Oregon

DISCLAIMER

Recovery plans delineate reasonable actions that are believed necessary to recover and/or protect the species. Recovery plans are prepared by the U.S. Fish and Wildlife Service and, in this case, with the assistance of recovery unit teams, State and Tribal agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views or the official positions or indicate the approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. Recovery plans represent the official position of the U.S. Fish and Wildlife Service *only* after they have been signed by the Director or Regional Director as *approved*. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

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Four problem assessments prepared under the Idaho Bull Trout Conservation Plan by the Southwest Basin Native Fish Watershed Advisory Group contributed to this chapter. The four problem assessments include the Boise River (Steed *et al*. 1998), the Deadwood, Middle Fork and South Fork Payette Rivers (Jimenez and Zaroban 1998), the Gold Fork and Squaw creek watersheds (Steed 1999), and Weiser River (DuPont and Kennedy 2000). The U.S. Fish and Wildlife Service acknowledges the technical groups for the Southwest Basin Native Fish Watershed Advisory Group and numerous individuals who participated in various meetings and discussions in developing the problem assessments, and who are acknowledged in each assessment.

SOUTHWEST IDAHO

EXECUTIVE SUMMARY

SPECIES CURRENT STATUS

The U.S. Fish and Wildlife Service issued a final rule listing the Columbia River population of bull trout as a threatened species on June 10, 1998 (63 FR 31647). The Southwest Idaho Recovery Unit forms part of the range of the Columbia River population. The Southwest Idaho Recovery Unit includes the Boise River, Payette River, and Weiser River basins. Although there were likely no historic barriers to bull trout moving among the three basins via the Snake River, today bull trout occupy areas in the basins upstream unsuitable habitat and dams. The basins were included in a single recovery unit because they likely functioned as a unit historically, and they collectively encompass nine key watersheds identified in the Idaho Bull Trout Conservation Plan (Batt 1996). All nine key watersheds are administratively addressed by a single watershed advisory group, the Southwest Idaho Native Fish Advisory Group. However, each river basin is treated as a recovery subunit (Boise, Payette and Weiser subunits) for organization of this recovery unit chapter and because they are now functionally isolated from each other.

In the Boise River Recovery Subunit, bull trout are distributed in three core areas, all upstream of Lucky Peak Dam. The Arrowrock Core Area includes the Boise River watersheds upstream of Arrowrock Dam, including the North Fork Boise River, Middle Fork Boise River, and South Fork Boise River downstream of Anderson Ranch Dam. The Anderson Ranch Core Area includes the South Fork Boise River watershed upstream of Anderson Ranch Dam. The Lucky Peak Core Area includes Lucky Peak Reservoir and tributaries entering it, namely the Mores Creek watershed. Migratory and resident bull trout occur in both the Arrowrock and Anderson Ranch core areas. In the Lucky Peak Core Area, resident bull trout occur in the headwaters of Mores Creek and migratory bull trout occur in Lucky Peak Reservoir. It is not known whether all migratory bull trout in Lucky Peak Reservoir have been entrained from the Arrowrock Core Area, or that some fish may be produced in the Mores Creek watershed. A total of 31 local populations currently exist in the Boise River Recovery Subunit.

In the Payette River Recovery Subunit, bull trout are distributed in five core areas throughout the basin: (1) the North Fork Payette River Core Area includes the watershed upstream of Cascade Dam; (2) the Middle Fork Payette River Core Area includes the watersheds upstream from the confluence with the South Fork Payette River; (3) the upper South Fork Payette River Core Area includes watersheds upstream of Big Falls, including the Deadwood River drainage downstream of Deadwood Dam; (4) the Deadwood River Core Area

includes watersheds in the Deadwood River drainage upstream of Deadwood Dam; and (5) the Squaw Creek Core Area includes watersheds in Squaw Creek upstream from its confluence with the Payette River. Bull trout in these core areas are primarily resident fish, with relatively low numbers of migratory fish existing in some areas (*e.g.,* Middle Fork Payette River, South Fork Payette River, and Deadwood Reservoir). A total of 18 local populations currently exist in the Payette River Recovery Subunit.

The Weiser River Recovery Subunit consists of a single core area, which includes watersheds upstream of and including the Little Weiser River. Bull trout in the Weiser River Core Area are thought to consist only of resident fish. A total of five local populations currently exist in the Weiser River Recovery Subunit.

HABITAT REQUIREMENTS AND LIMITING FACTORS

A detailed discussion of bull trout biology and habitat requirements is provided in Chapter 1 of this recovery plan. The limiting factors discussed here are specific to the Willamette Recovery Unit Chapter. Habitat fragmentation and degradation are likely the most limiting factors for bull trout throughout the Southwest Idaho Recovery Unit. Although reservoirs formed by dams in some basins have allowed bull trout to express adfluvial life histories, dams, irrigation diversions, and road crossings have formed impassable barriers to fish movement within the basins, further fragmenting habitats and isolating bull trout. Land management activities that degrade aquatic and riparian habitats by altering stream flows and riparian vegetation, such as water diversions, past and current mining operations, timber harvest and road construction, and improper grazing practices, have negatively affected bull trout in several areas of the recovery unit. Bull trout are also subject to negative interactions with nonnative brook trout in some streams.

RECOVERY GOALS AND OBJECTIVES

The goal of the bull trout recovery plan is to **ensure the long-term persistence of self-sustaining, complex, interacting groups of bull trout distributed throughout the species' native range, so that the species can be delisted.** To achieve this goal the following objectives have been identified for bull trout in the Southwestern Idaho Recovery Unit:

- Maintain current distribution of bull trout and restore distribution in previously occupied areas within the Southwest Idaho Recovery Unit.

- Maintain stable or increasing trends in abundance of bull trout.

- Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies.

- Conserve genetic diversity and provide opportunity for genetic exchange.

RECOVERY CRITERIA

Recovery criteria for the Southwestern Idaho Recovery Unit are established to assess whether actions are resulting in the recovery of bull trout in the basin. The criteria developed for bull trout recovery address quantitative measurements of bull trout distribution and population characteristics on a recovery unit basis.

1. **Maintain current distribution of bull trout in the 54 local populations identified, and expand distribution by establishing bull trout local populations in areas identified as potential spawning and rearing habitat**. The number of existing local populations by recovery subunit and core area are: Boise River Recovery Subunit, 31 existing local populations; Payette River Recovery Subunit, 18 existing local populations; and 5 in Weiser River Recovery Subunit. Achieving criterion 1 entails maintaining existing local populations and encouraging the establishment of additional bull trout local populations in potential spawning and rearing habitat in all core areas of the recovery unit. Establishing at least one new local population each in the Lucky Peak, Middle Fork Payette River, North Fork Payette River, Squaw Creek, and Weiser River core areas is necessary to achieve criterion 1, if evaluations indicate that it is feasible in a specific core area.

2. **Estimated abundance of adult bull trout is at least 17,600 individuals in the Southwest Idaho Recovery Unit**. The recovered abundance of adult bull trout for the recovery unit was estimated based on professional judgement of the recovery unit team in consideration of surveyed fish densities, habitats, and potential fish production after threats have been addressed. The recovered abundance of adult bull trout by recovery subunit and core area are: Boise River Recovery Subunit, at least 10,100 bull trout; Payette River Recovery Subunit, at least 7,000 bull trout; and at least 500 in Weiser River Recovery Subunit.

3. **Adult bull trout exhibit stable or increasing trends in abundance in the Southwest Idaho Recovery Unit**.

4. **Specific barriers to bull trout migration in the Southwest Idaho Recovery Unit have been addressed**. Many barriers to bull trout migration exist within the recovery unit, and this recovery plan

recommends several tasks to identify, assess, and reduce barriers to bull trout passage. Although achieving criteria 1 through 3 is expected to depend on providing passage at barriers (including barriers due to physical obstructions, unsuitable habitat, and water quality) throughout all core areas in the recovery unit, the intent of criterion 4 is to note specific barriers to address or tasks that must be performed to achieve recovery (*i.e.,* evaluated and appropriately addressed if found to be feasible). Activities necessary to fulfill this criterion for each recovery subunit include: continuing to provide passage (*e.g.,* using the existing trap-and-haul program) of bull trout at Arrowrock Dam (task 1.4.2) and identifying, assessing, and remedying potential passage barriers in the Lucky Peak Core Area (task 1.2.4) in the Boise River Recovery Subunit; addressing passage at the Gold Fork River irrigation diversion (task 1.2.3) and identifying, assessing, and remedying potential passage barriers in the Squaw Creek and North Fork Payette River Core Areas (tasks 1.2.2, 1.2.3, and 1.2.4) in the Payette River Recovery Subunit; and identifying, assessing, and remedying potential passage barriers in the Weiser River core area (tasks 1.2.1 and 1.2.2). Tasks intended to assess the feasibility of providing passage should be conducted with coordinated review during implementation with the U.S. Fish and Wildlife Service.

ACTIONS NEEDED

Recovery for bull trout in the Southwest Idaho Recovery Unit will entail reducing threats to the long-term persistence of populations and their habitats, ensuring the security of multiple interacting groups of bull trout, and providing access to habitat conditions that allows for the expression of various life-history forms. Seven categories of actions needed are discussed in Chapter 1; tasks specific to this recovery unit are provided in this chapter.

ESTIMATED COST OF RECOVERY

The estimated cost of bull trout recovery in the Southwest Idaho Recovery Unit is $7 million spread over a 25-year period. This estimate does not include costs associated with some activities (*e.g.*, capital improvements for fish passage and protection) for which the feasibility and design options are the outcomes of recommended tasks in this chapter, nor does this estimate include costs for tasks that are normal agency responsibilities under existing authorities. Total costs include estimates of expenditures by local, Tribal, State, and Federal governments and by private business and individuals. Successful recovery of bull trout in the Southwest Idaho River Recovery Unit is contingent on removing barriers, improving habitat conditions, providing fish passage, and removal of nonnative species. These costs are attributed to bull trout conservation, but other aquatic species will also benefit.

ESTIMATED DATE OF RECOVERY

Time required to achieve recovery depends on bull trout status, factors affecting bull trout, implementation and effectiveness of recovery tasks, and responses to recovery tasks. A tremendous amount of work will be required to restore impaired habitat, reconnect habitat, and eliminate threats from nonnative species. Three to five bull trout generations (15 to 25 years), or possibly longer, may be necessary before identified threats to the species can be significantly reduced and bull trout can be considered eligible for delisting.

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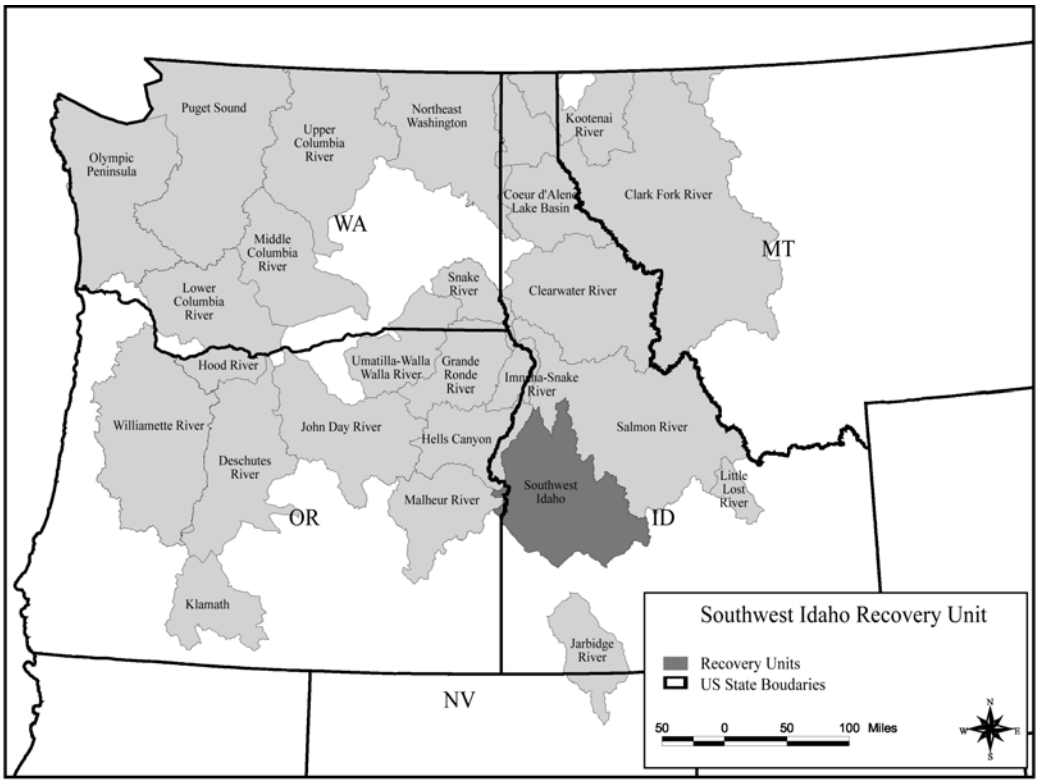
INTRODUCTION

Recovery Unit Designation

The Southwest Idaho Recovery Unit is one of 22 recovery units designated for bull trout in the Columbia River basin (Figure 1). This recovery unit includes the Boise, Payette, and Weiser rivers. Although there were likely no barriers to bull trout moving among the three river basins via the Snake River historically, today bull trout occupy areas in the basins upstream of dams and uninhabitable areas. The basins were included in a single recovery unit because they likely functioned as a unit historically, and they collectively encompass nine key watersheds identified in the Idaho Bull Trout Conservation Plan (Batt 1996). All nine key watersheds are administratively addressed by a single watershed advisory group, the Southwest Idaho Native Fish Advisory Group. However, each river basin is treated as a recovery subunit for organization of this recovery unit chapter and because they are now functionally isolated from each other.

Figure 1. Bull trout recovery units in the United States. The Southwest Idaho Recovery Unit is highlighted.



Geographic Description

The Boise River, Payette River, and Weiser rivers are tributaries to the Snake River, which are entirely within the State of Idaho. The river basins encompass about 2,323,826 hectares (5,742,174 acres) in southwestern Idaho. The Boise River basin contains the largest area (1,038,910 hectares [2,567,147 acres]), followed by the Payette River basin (855,393 hectares [2,113,676 acres]), and the Weiser River basin (429,523 hectares [1,061,351 acres]). The three basins flow south to southwest from mountains in central Idaho. Elevations of the basins range from over 3,048 meters (10,000 feet) in the Sawtooth Mountains to 802 meters (2,631 feet) near the confluence of the Weiser River with the Snake River.

The Southwest Idaho Recovery Unit includes the largest metropolitan area in Idaho, Boise, and the surrounding towns. However, the remainder of the recovery unit is largely rural. Most of the areas currently supporting bull trout in the recovery unit occur on Federal lands (*e.g.,* Boise National Forest, Payette National Forest, and Sawtooth National Forest). In the Boise River Recovery Subunit, over half of the entire area (59.3 percent) is administered by the U.S. Forest Service and Bureau of Land Management (Table 1). A similar percentage of the area in the Payette River Recovery Subunit (56.3 percent) is also managed by the two agencies (Table 2). In the Weiser River Recovery Subunit, about half of the entire area is under private ownership and 43.4 percent is managed by the U.S. Forest Service and Bureau of Land Management (Table 3). In the Boise River Recovery Subunit, headwaters of the Middle Fork Boise River and North Fork Boise River occur in designated wilderness areas. In the Payette River Recovery Subunit, headwaters of the South Fork Payette River and Middle Fork Payette River occur in designated wilderness areas. Forty roadless areas occur on U.S. Forest Service lands in the recovery unit (Stovall 2001).

The Southwest Idaho Recovery Unit has an upland continental climate. Infrequent, but intense, thunderstorms occur during summer and rainfall increases in the fall. November and December are usually the wettest months of the year. Average annual precipitation in the Boise River basin is 508 to 1,270 millimeters (20 to 50 inches) (Steed *et al.* 1998). Based on Snotel (snow telemetry) stations around the basin, the maximum snowfall would be over 1,016 millimeters (40 inches) snow water equivalents in the mountains, and the minimum would be under 381 millimeters (15 inches) in the western portion of the recovery unit.

Geology of the Southwest Idaho Recovery Unit consists primarily of basalt, Idaho batholith, and other granitic formations (Jimenez and Zaroban 1998; Steed *et al.* 1998; Steed 1999; DuPont and Kennedy 2000). Natural erosion rates

vary from easily erodible areas such as in the Boise River and Payette River Recovery Subunits to areas with low or moderate erosion rates such as in the Weiser River Recovery Subunit.

Table 1. Land ownership for the Boise River Recovery Subunit (modified from Stovall 2001).

	Area by 4th-field hydrologic unit code (hectare)[b]				
Ownership[a]	17050111 (N.-Mid. Fks)	17050112 (Boise-Mores)	17050113 (South Fork)	17050114 (Lower Boise)	Total[b]
Military	0.0 (0)	321.2 (0.2)	0.0 (0)	0.0 (0)	321.2 (<0.1)
Private	788.4 (0.4)	33,562.3 (20.9)	45,455.9 (13.5)	260,771.8 (75.7)	340,578.4 (32.8)
State lands	0.0 (0)	23,927.2 (14.9)	14,478.5 (4.3)	15,846.1 (4.6)	54,251.8 (5.2)
USFWS	0.0 (0)	0.0 (0)	0.0 (0)	344.5 (0.1)	344.5 (<0.1)
USFS	195,922.5 (99.4)	95,548.1 (59.5)	267,011.3 (79.3)	4,133.8 (1.2)	562,615.6 (54.2)
BLM	0.0 (0)	4,335.8 (2.7)	4,040.5 (1.2)	45,127.0 (13.1)	53,503.3 (5.1)
USBR	591.3 (0.3)	802.9 (0.5)	3,367.1 (1.0)	14,123.7 (4.1)	18,885.1 (1.8)
Water	0.0 (0)	1,927.0 (1.2)	2,693.7 (0.8)	3,789.3 (1.1)	8,410.0 (0.8)
Total	197,302.2	160,424.4	337,047.1	344,136.2	1,038,909.8

[a] USFWS–U.S. Fish and Wildlife Service, USFS–U.S. Forest Service, BLM–Bureau of Land Management, USBR–U.S. Bureau of Reclamation.
[b] Values in parentheses are percentages.

Hydrologically, peak stream flows typically occur during March through May as a result of snowmelt. Rain-on-snow events usually occur at elevations of 1,372 to 1,524 meters (4,500 to 5,000 feet) or lower. Vegetation within the Southwest Idaho Recovery Unit consist of lands dominated by Douglas fir (*Pseudotsuga menziesii*), subalpine fir (*Abies lasiocarpa*), and ponderosa pine (*Pinus ponderosa*), intermixed with grasses and shrubs; mountain slopes dominated by shrub lands with subalpine fir, Douglas fir, and ponderosa pine; and glaciated areas dominated by lodgepole pine (*P. contorta*) and subalpine fir.

Table 2. Land ownership for the Payette River Recovery Subunit (modified from Stovall 2001).

Ownership[a]	Area by 4th-field hydrologic unit code (hectare)[b]				Total[b]
	17050120 (South Fork)	17050121 (Middle Fork)	17050122 (Payette)	17050123 (North Fork)	
Military	0.0	0.0	0.0	0.0	0.0
	(0)	(0)	(0)	(0)	(0)
Private	3,158.6	6,128.1	186,920.9	91,651.5	287,859.2
	(1.5)	(7.0)	(58.2)	(38.8)	(33.7)
State lands	842.3	4,289.7	19,912.5	29,999.3	55,043.9
	(90.4)	(4.9)	(6.2)	(12.7)	(6.4)
USFWS	0.0	0.0	0.0	0.0	0.0
	(0)	(0)	(0)	(0)	(0)
USFS	197,728.5	71,261.4	45,285.0	97,793.1	412,068.0
	(93.9)	(81.4)	(14.1)	(41.4)	(48.2)
BLM	631.7	1,838.4	65,839.8	2,362.2	70,672.1
	(0.3)	(2.1)	(20.5)	(1.0)	(8.3)
USBR	6,738.4	4,027.1	1,284.7	236.2	12,286.3
	(3.2)	(4.6)	(0.4)	(0.1)	(1.4)
Water	1,684.6	0.0	1,605.8	14,172.9	17,463.4
	(0.8)	(0)	(0.5)	(6.0)	(2.0)
Total	210,784.1	87,544.7	320,848.8	236,215.3	855,392.8

[a] USFWS–U.S. Fish and Wildlife Service, USFS–U.S. Forest Service, BLM–Bureau of Land Management, USBR–U.S. Bureau of Reclamation.
[b] Values in parentheses are percentages.

Fish Species. Within the Southwest Idaho Recovery Unit, anadromous fishes (*i.e.,* chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*O. mykiss*), and perhaps Pacific lamprey (*Lampetra tridentata*)) historically occurred in each of the three river basins; the Payette River basin contained the only sockeye salmon (*O. nerka*) in the upper Snake River basin (Stovall 2001). Construction of impassable dams, first within the basins and later downstream from the confluences of the three basins in the Snake River, eliminated natural runs of anadromous fishes from the recovery unit. The loss of these runs and associated nutrients derived from their carcasses is thought to have negatively affected resident fishes by reducing overall watershed productivity.

Table 3. Land ownership for the Weiser River Recovery Subunit (modified from Stovall 2001).

Ownership[a]	Area by hydrologic unit code 17050111 (hectare)[b] (Weiser)
Military	0.0 (0)
Private	215,836.5 (50.3)
State lands	25,367.2 (5.9)
USFWS	0.0 (0)
USFS	122,966.6 (28.6)
BLM	63,633.1 (14.8)
USBR	430.0 (0.1)
Water	1,289.9 (0.3)
Total	429,523.3

[a] USFWS–U.S. Fish and Wildlife Service, USFS–U.S. Forest Service, BLM–Bureau of Land Management, USBR–U.S. Bureau of Reclamation.
[b] Values in parentheses are percentages
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In the Boise River Recovery Subunit, bull trout found in headwater drainages tend to be associated with fish assemblages of low species richness (Steed *et al.* 1998). These assemblages generally consist of bull trout, rainbow-redband trout (*Oncorhynchus mykiss*), and sculpin (*Cottus bairdi, C. confusus*). In mainstem river and reservoir areas downstream, the fish assemblage is more diverse and includes native species such as mountain whitefish (*Prosopium williamsoni*), northern pikeminnow (*Ptychocheilus oregonensis*), redside shiner (*Richardsonius balteatus*), and several sucker (*Catostomus spp*.) and dace (*Rhinichthys spp*.) species. In addition to hatchery rainbow trout (*Oncorhynchus. mykiss*) and planted chinook salmon, six introduced species are present in the basin; westslope cutthroat trout (*O. clarki lewisi*), kokanee (*O. nerka*), brook trout (*Salvelinus fontinalis*), smallmouth bass (*Micropterus dolomieui*), yellow perch (*Perca flavescens*), and brown bullhead (*Ictalurus nebulosus*).

In the Payette River Recovery Subunit and Weiser River Recovery Subunit, extant native salmonids are bull trout, redband trout, and mountain whitefish (Steed 1999; DuPont and Kennedy 2000; Stovall 2001). Other salmonids, hatchery rainbow trout, cutthroat trout, brook trout, and brown trout (*Salmo trutta*) have been stocked, with stocking dating to the turn of the century. Stocking of rainbow trout, cutthroat trout, and brown trout occurs in some alpine lakes, such as in the Gold Fork River watershed. Other introduced species in the recovery subunits include such species as smallmouth bass, channel catfish (*Ictalurus punctatus*), and common carp (*Cyprinus carpio*).

DISTRIBUTION AND ABUNDANCE

Status of Bull Trout at the Time of Listing

In the final listing rule (63 FR 31647) the U.S. Fish and Wildlife Service identified two bull trout subpopulations in the Boise River basin (Arrowrock Reservoir and Anderson Ranch Reservoir), four in the Payette River basin (Black Canyon Reservoir, South Fork-Middle Fork Payette River, Deadwood Reservoir, and North Fork Payette River), and two in the Weiser River basin (Little Weiser River and East Fork Weiser River) (U.S. Fish and Wildlife Service (USFWS) 1998). Subpopulations were isolated by impassable dams and unsuitable habitat.

At the time of listing (June 1998), insufficient information was available to determine the status (depressed or strong) or trend (increasing, decreasing, stable) of the 8 subpopulations (USFWS 1998). The East Fork Weiser River and North Fork Payette River subpopulations were considered to be at risk of extirpation due to natural events. The U.S. Fish and Wildlife Service considered dams (2 subpopulations), forestry (5 subpopulations), grazing (4 subpopulations), water quality (5 subpopulations), and introduced species (5 subpopulations) to be threats to the 8 bull trout subpopulations in the Boise River, Payette River, and Weiser River basins (USFWS 1998). The magnitude of threats was considered high for 4 subpopulations and threats were considered imminent for 7 subpopulations. Although subpopulations were an appropriate unit upon which to base the 1998 listing decision, the recovery plan has revised the biological terminology to better reflect the current understanding of bull trout life history and conservation biology theory. Therefore, subpopulation terms will not be used in this chapter.

Current Distribution and Abundance

Federal and State resource agencies have documented the occurrence of bull trout throughout the Southwest Idaho Recovery Unit (*e.g.,* Rieman and McIntyre 1995; Corley 1997; Dunham and Rieman 1999; Salow 2001). Distribution of bull trout in the recovery unit comes primarily from presence-absence surveys and basin-wide surveys using electrofishing and snorkeling techniques. Comprehensive data on bull trout abundance through time in the recovery unit does not exist.

Boise River Recovery Subunit. In the Boise River Recovery Subunit, three large dams are impassable barriers to upstream fish movement: Anderson Ranch Dam on the South Fork Boise River, and Arrowrock Dam and Lucky Peak Dam on the mainstem Boise River. Fish in Anderson Ranch Reservoir have access to the South Fork Boise River upstream of the dam. Fish in Arrowrock Reservoir have access to the North Fork Boise River, Middle Fork Boise River, and lower South

Fork Boise River. The upstream portion of Lucky Peak Reservoir is adjacent to the base of Arrowrock Dam. The largest tributary to Lucky Peak Reservoir is Mores Creek, in which bull trout inhabit the headwaters (T. Burton, Boise National Forest, *in litt.* 2000; Boise National Forest, *in litt.* 2002). Upstream of Arrowrock Dam, bull trout have been found in 37 subwatersheds (*i.e.,* 6th-field HUCs) and not detected in 29 others with apparent suitable habitat for spawning and rearing (Steed *et al.* 1998).

Bull trout abundance has been estimated in both Arrowrock Reservoir and Anderson Ranch Reservoir. During 1996 through 1997, abundance of adult migratory bull trout (*i.e.,* fish greater than 300 millimeters (11.8 inches) total length) in Arrowrock Reservoir was estimated at 471 individuals (95 percent confidence intervals were 389 through 590) (Flatter 1998). Mean total length of bull trout was 405 millimeters (standard error was 4.2 millimeters) (15.9 inches, standard error 0.2 inches). The estimate of adult bull trout abundance in 1998 was 354 individuals (95 percent confidence intervals were 133 through 575) with a mean total length of 387 millimeters (standard error was 8.6 millimeters) (15.2 inches, standard error 0.3 inches) (R. Rieber, U.S. Bureau of Reclamation (USBR), pers. comm. 2001). During 1999 through 2000, abundance of adult migratory bull trout in Anderson Ranch Reservoir was estimated at 368 individuals (95 percent confidence intervals were 282 through 454) (Partridge 2000a). Range in total length of fish was 220 through 740 millimeters (8.7 through 29.1 inches).

The abundance of post-spawning adult bull trout that used the North Fork Boise River was estimated using numbers of bull trout marked at a weir in the North Fork Boise River during 1999 and recaptured at the weir in 2000 (Salow 2001). The estimate was 969 individuals (standard deviation was 228), and is biased because it does not account for such factors as varying mortality rates between years, recruitment of juveniles to spawners, straying, and individuals that may spawn in alternate years. Salow (2001) evaluated the effects of hypothetical spawner recruitment and tag loss rates on the abundance estimate and found that both factors, individually and combined, lower the estimate. For instance, post-spawning adult abundance was 385 individuals when a 60 percent immigration (*i.e.,* due to maturation of juvenile bull trout) rate was tested.

Payette River Recovery Subunit. In the Payette River Recovery Subunit, Deadwood Dam created Deadwood Reservoir and forms an impassible barrier to fish movement. Bull trout in the upper Deadwood River and Deadwood Reservoir are isolated from fish in the lower Deadwood River and the South Fork Payette River watersheds. Bull trout in the South Fork Payette River may be able to interact with fish in the Middle Fork Payette River, but a waterfall on the South Fork Payette River (Big Falls) may be a barrier to fish movement (Jimenez and Zaroban 1998). Bull trout inhabiting the North Fork Payette River drainage occur in Gold Fork

River, and are isolated upstream of Cascade Dam and Reservoir, and a diversion dam in the lower Gold Fork River (Steed 1999). Bull trout also occur in North Fork Lake Fork Creek in the North Fork Payette River drainage, but likely in very low abundance (R. Nelson, Payette National Forest, pers. comm.. 2002). Bull trout also occur in headwater reaches of a tributary to the Payette River at Black Canyon Reservoir, Squaw Creek. Bull trout in Squaw Creek are likely isolated from other bull trout in the Payette River basin by irrigation diversions and perhaps high water temperatures (Burton 1999c).

Upstream of Deadwood Dam, spawning and rearing habitat occurs in tributaries to the headwater portion of the upper Deadwood River, Deer Creek, and Trail Creek (Burton 1999b). Resident and migratory bull trout occur upstream of Deadwood Reservoir, however, the abundance of migratory fish is considered low based on observations of large fish in Trail Creek. The U.S. Forest Service estimates that about 1,160 bull trout reside in the drainage upstream of Deadwood Dam (Burton 1999b; Appendix A), and considers the bull trout population in the upper Deadwood River "weak" (*i.e.,* less than 1,500 individuals) and at high risk of extirpation. Low bull trout abundance appears to be related to loss of migratory individuals, isolation, past rotenone treatments, fragmented habitats, and high levels of sedimentation.

In the South Fork Payette River drainage, which includes the Deadwood River downstream of Deadwood Dam, bull trout spawning and rearing is known to occur in watersheds of the upper and middle South Fork Payette River, Canyon Creek, Clear Creek, Whitehawk Creek, and Scott Creek (Jimenez and Zaroban 1998). The U.S. Forest Service considers bull trout in Whitehawk-Scott creeks and Canyon Creek "strong" (*i.e.,* greater than 2,000 individuals with more than 500 adults) with an estimated 3,315 bull trout in Whitehawk and Scott creeks combined, and 2,653 bull trout in Canyon Creek (Burton and Erickson 1999a; Appendix A). Other groups of bull trout in the South Fork Payette River consist of fewer individuals (*i.e.,* 224 to almost 1,500; Appendix A). Most bull trout appear to be residents, but low numbers of migratory fish are also thought to exist (Jimenez and Zaroban 1998).

In the Middle Fork Payette River, bull trout spawning and rearing occurs in the upper portions of the watershed, including the Middle Fork Payette River, Bull Creek, and Sixteen to One Creek (Newberry 2002). Streams that presently do not support bull trout spawning and rearing but may, with restoration, occur elsewhere in the Middle Fork Payette River drainage, such as Lightning Creek and Silver Creek. The U.S. Forest Service estimated bull trout abundance of 2,932 in the upper Middle Fork Payette River and 2,550 in Bull and Sixteen to One creeks combined (Appendix A). Adult bull trout have been found in the lower reaches of the Middle

Fork Payette River suggesting that some migratory individuals exist (Burton 2000a). The distribution of bull trout in critical early life stages appears to be controlled by summer maximum temperatures. Bull trout abundance in Bull Creek appears to be related to brook trout competition, naturally high sediment levels within the roadless area, and few migratory fish.

Surveys conducted during 1991 through 1998 detected bull trout in the Gold Fork River drainage of the North Fork Payette River and in Squaw Creek, a tributary to Black Canyon Reservoir (Steed 1999). The U.S. Forest Service has estimated that about 1,600 bull trout occur in the Gold Fork River (Newberry 2000). Only one or two large fish greater than 305 millimeters (12 inches) have been observed, suggesting that a migratory component may be weak or may no longer exist (Steed 1999). Kennally and Rapid creeks, tributaries to Gold Fork River, contain apparently suitable but unoccupied habitats. The North Fork Kennally Creek and Rapid Creek are largely undisturbed, roadless areas. However, surveys have found high densities of brook trout within the streams. Low bull trout abundance in Gold Fork River appears to be related to brook trout competition, high levels of sediments within potential spawning and rearing habitat, increased drainage network density due to roads, and a migration barrier formed by an irrigation diversion (Burton 1998).

Bull trout have been observed upstream of Cascade Reservoir in the North Fork Payette River drainage (Steed 1999; Faurot 2001). In 1983, bull trout were collected by electrofishing in Fisher Creek and Sater Creek, a tributary to Fisher Creek. No bull trout were observed during snorkel surveys of Fisher Creek by the U.S. Forest Service in 1995, or during electrofishing surveys of Fisher Creek and other streams in the North Fork Payette River drainage by the Idaho Department of Fish and Game in 1998 and 1999. However, three bull trout were observed in North Fork Lake Fork drainage during the latter surveys (Faurot 2001).

In the Squaw Creek drainage, bull trout spawning and rearing occurs in upper Squaw Creek and in Third Fork Squaw Creek (Steed 1999). The U.S. Forest Service has estimated a total of 62 bull trout in Squaw Creek and 2,388 in Third Fork Squaw Creek (Burton 1999c). Bull trout have been observed in the lower reaches of Squaw Creek in recent times, suggesting that a migratory component exists. Low abundance of bull trout appears to be related to high road density and sediment, passage barriers, and brook trout.

Weiser River Recovery Subunit. In the Weiser River Recovery Subunit, bull trout have been found in the headwaters of the Little Weiser River (Anderson Creek, Sheep Creek, and the upper Little Weiser River), the Middle Fork Weiser River, the upper Weiser River (East Fork Weiser River and Dewey Creek) and the

Hornet Creek watershed (Hornet, North, Placer, and Olive creeks) (Adams 1994; DuPont and Kennedy 2000; J. DuPont, Idaho Department of Lands (IDL), *in litt.* 1998; DuPont, *in litt.* 2000). For the Middle Fork Weiser River, McGee *et al.* (2001) noted that a single adult bull trout was observed in 1994 by Hurley (1995) and that anglers have reported catching bull trout in the headwaters. Bull trout were also noted in other areas of the mainstem Middle Fork Weiser River during stream surveys in 1997 (E. Veach, U.S. Forest Service (USFS), *in litt.* 1998). Bull trout were not detected during intensive surveys throughout the Middle Fork Weiser River in 1999 (Williams and Veach 1999), suggesting that bull trout may be extirpated in the drainage (McGee *et al.* 2001).

Most adult bull trout are relatively small in the Weiser River drainage, 100 to 200 millimeters (3.9 to 8.0 inches), and are likely residents isolated most of the year by thermal barriers on the mainstem Weiser River (Adams 1994) or impassible barriers (*e.g.,* at road culverts and water diversions). Adams (1994) found bull trout up to 300 millimeters (11.8 inches) total length in the Little Weiser River drainage. To reach this size, bull trout may have migrated downstream to an area of greater forage production (DuPont and Kennedy 2000). In 1998, the Idaho Department of Lands located a previously unknown population of bull trout along reaches of State lands in Olive Creek, a tributary of Hornet Creek (DuPont, *in litt.* 1998). Fish in this creek were 100 to 180 millimeters (3.9 to 7.1 inches) total length. A culvert formed a fish passage barrier downstream of the bull trout in Olive Creek until it was removed and replaced with a bridge in 1997. Bull trout were also found in Hornet, North, and Placer creeks during additional surveys of State lands in the Hornet Creek watershed during 2000 (DuPont, *in litt.* 2000). No bull trout were over 216 millimeters (8.5 inches) total length. No bull trout were observed during surveys of Forest Service lands in the Hornet Creek watershed during 2000 (Williams 2001).

Adams (1994) estimated bull trout density for various habitat types in study reaches of three streams using daylight snorkel surveys. In Anderson and Sheep creeks, bull trout density was 5.7 and 5.6 fish per 100 square meters (1,076 square feet), respectively, for all habitat types in 1992. Expanding fish density to entire study reaches resulted in estimations of 1,433 bull trout in Anderson Creek and 1,251 in Sheep Creek. In Dewey Creek, bull trout density was 3.2 fish per 100 square meters (1,076 square feet) for pool habitats in 1993. The expanded estimate for the entire study reach was 166 bull trout. DuPont (*in litt.* 2000) estimated bull trout density in the Hornet Creek watershed using single-pass electrofishing surveys. Densities were 4 to 10 fish per 100 square meters (1,076 square feet). Expanding fish density to entire stream reaches suspected to support bull trout resulted in a total estimate of 2,000 to 4,000 individuals.

REASONS FOR DECLINE

Habitat fragmentation and degradation are likely the most limiting factors for bull trout throughout the Southwest Idaho Recovery Unit. Although reservoirs formed by dams in some basins have allowed bull trout to express adfluvial life histories, dams, irrigation diversions, and road crossings have formed impassable barriers to fish movement within the basins, further fragmenting habitats and isolating bull trout. Land management activities that degrade aquatic and riparian habitats by altering stream flows and riparian vegetation, such as water diversions, past and current mining operations, timber harvest and road construction, and improper grazing practices, have negatively affected bull trout in several areas of the recovery unit. Bull trout are also subject to negative interactions with nonnative brook trout in some streams. The following factors contributing to the decline of bull trout in the coterminous United States are discussed relative to bull trout in the Southwest Idaho Recovery Unit.

Dams

In the Boise River Recovery Subunit, three dams (Anderson Ranch, Arrowrock, and Lucky Peak dams) are fish passage barriers. Anderson Ranch and Arrowrock dams are operated by the U.S. Bureau of Reclamation; the U.S. Army Corps of Engineers operates Lucky Peak Dam. A fourth dam, Atlanta Dam, which is owned by the U.S. Forest Service and operated by a power company, was a passage barrier until a fish ladder was constructed and began operation in 1999. Habitats created in the reservoirs formed by Arrowrock Dam and Anderson Ranch Dam have allowed bull trout to express adfluvial life histories.

Anderson Ranch Dam, on the South Fork Boise River, blocks access of bull trout residing in the lower South Fork Boise River, North Fork Boise River, and Middle Fork Boise River to the upper portion of the South Fork Boise River basin. The dam is approximately 100 meters high (332 feet) tall and has no provisions for either upstream or downstream fish passage. Anecdotal information suggests entrainment of juvenile and adult bull trout may occur during spills prior to May 1, or when the pool is reduced to dead storage during September 30 through May 1 (Steed *et al.* 1998). However, of 48 bull trout collected upstream of Anderson Ranch Dam and implanted with radio tags during a study in 1998 and 1999, none were found downstream of the dam (Partridge 2000a). Operation of Anderson Ranch Dam has had a major alteration on stream flow downstream (Steed *et al.* 1998). During low water years (drought), flows are regulated at three levels, 48 cubic meters per second (1,700 cubic feet per second), 17 cubic meters per second (600 cubic feet per second), and 8 cubic meters per second (300 cubic feet per second).

Arrowrock and Lucky Peak dams have had adverse effects on bull trout inhabiting the lower South Fork, Middle Fork, and North Fork Boise River. The dams have no provisions for either upstream or downstream fish passage, and have eliminated access to lower portions of the Boise River basin by migratory fish. Based on bull trout that were radio tagged in Arrowrock Reservoir and later collected downstream in Lucky Peak Reservoir during 1998, Flatter (1999) found that a minimum of 16 percent of the tagged fish were entrained through Arrowrock Dam, which equates to 54 bull trout greater than 300 millimeters (11.8 inches) when extrapolated to include all bull trout estimated in Arrowrock Reservoir. Small bull trout (*i.e.,* less than 305 millimeters (12 inches)) were more likely to pass through Arrowrock Dam than larger individuals.

Without fish passage structures or a trap-and-haul program, bull trout that pass through Arrowrock Dam are restricted to Lucky Peak Reservoir and its tributaries. Bull trout inhabit the upper portion of Mores Creek (Burton, *in litt.* 2000; Boise National Forest, *in litt.* 2002), and extensive surveys for bull trout in tributaries of the Mores Creek watershed are planned. The relations and interactions between bull trout that pass through Arrowrock Dam and those inhabiting the upper portion of Mores Creek are presently unknown. However, preliminary genetic analyses of bull trout inhabiting the headwaters of Mores Creek and elsewhere in the Boise River basin indicate that Mores Creek fish possess levels of heterozygosity similar to other areas, and that there is little evidence of consistent spatial population structuring in the basin (M. Kellett, Boise National Forest (BNF), pers. comm. 2002).

Atlanta Dam is a 14-meter high (45 feet) hydropower facility located on the Middle Fork Boise River a short distance downstream of the town of Atlanta. It has completely blocked access to migratory bull trout since the early 1900s, preventing migratory fish from using the upper Middle Fork Boise River watershed (Steed *et al.* 1998). Upstream of Atlanta Dam, bull trout occur in the upper Yuba River. Passage at Atlanta Dam was recently restored when the Idaho Department of Fish and Game constructed a fish ladder that began operating in 1999.

In the Payette River Recovery Subunit, three major dams have been constructed for hydroelectric generation and irrigation water storage. These include: Deadwood Dam on the Deadwood River, Black Canyon Dam on the mainstem Payette River near the town of Emmett, and Cascade Dam on the North Fork Payette River near the town of Cascade. Other smaller dams have been constructed primarily for irrigation diversions.

Deadwood Dam was built in 1931, primarily for irrigation storage and to supplement late season flows in the Payette River for use at the Black Canyon Dam

hydroelectric facility (U.S. Bureau of Reclamation (USBR) 1998; Jimenez and Zaroban 1998). It is administered by the U.S. Bureau of Reclamation. Deadwood Dam is over 50 meters (165 feet) high, has no provisions for either upstream or downstream fish passage, and has isolated the bull trout population residing in the upper Deadwood River drainage. It is not known whether bull trout in Deadwood Reservoir pass downstream through the dam or over the spillway, and fish surveys conducted in summer 1998 found no bull trout in the Deadwood River immediately downstream of the dam (Jimemez and Zaroban 1998) or to the confluence with the South Fork Payette River. In September 1973, Deadwood Reservoir was completely evacuated for maintenance and repair work on the dam. This released large amounts of silt resulting in high turbidity and low dissolved oxygen levels for several days in the lower Deadwood River and South Fork Payette River (Jimemez and Zaroban 1998).

Flows within the lower Deadwood River are released from Deadwood Reservoir based on irrigation water needs (Jimenez and Zaroban 1998) and water to augment flows for salmon in the lower Snake River basin (USBR 2001). Historically, monthly mean flows ranged from 0.3 cubic meters per second (9.7 cubic feet per second) in fall and winter to 19.1 cubic meters per second (673 cubic feet per second) in spring and early summer (Jimenez and Zaroban 1998). Deadwood Dam is presently operated to maintain a winter flow of 1.4 cubic meters per second (50 cubic feet per second) and a minimum pool of about 62 million cubic meters (50,000 acre-feet), which is believed to be not likely to adversely affect bull trout inhabiting Deadwood Reservoir (USBR 2001). Downstream of Deadwood Dam, summer flows are cooler (*i.e.,* 7 to 10 degrees Celsius [45 to 50 degrees Fahrenheit]) than would naturally occur (USBR 2001) and may affect aquatic organisms (Jimenez and Zaroban 1998). However, summer flows and water temperatures may increase potential rearing habitat during the summer for juvenile bull trout, if present.

Cascade Dam was constructed on the North Fork Payette River primarily for irrigation water storage in 1948. The dam is about 30 meters (100 feet) high and has no provisions for either upstream or downstream fish passage. Gold Fork River is a tributary of Cascade Reservoir. Bull trout inhabiting Gold Fork River occur upstream of an irrigation diversion dam on the lower Gold Fork River. The diversion dam has no provisions for either upstream or downstream fish passage. Therefore, dams have isolated bull trout in the Gold Fork River and restricted access of bull trout from other areas to downstream of Cascade Dam.

Black Canyon Dam was constructed on the mainstem Payette River for irrigation water storage and hydroelectric generation in 1924. The dam is 56 meters (183 feet) high and has no provisions for either upstream or downstream fish

passage. Squaw Creek is a tributary of Black Canyon Reservoir. Although no major dams prevent bull trout inhabiting the upper portions of the Squaw Creek watershed from entering Black Canyon Reservoir, irrigation diversions form barriers to immigrating adults and divert emigrating juveniles into areas with lethal conditions.

In the Weiser River Recovery Subunit, there are numerous water diversions and at least 15 reservoirs in the Weiser River basin (DuPont and Kennedy 2000). Major reservoirs include the Hornet Creek Reservoirs, C. Ben Ross Reservoir, Mann Creek Reservoir, and Lost Valley Reservoir. Reservoirs and water diversions have likely had long-term changes in downstream water temperatures, flow regimes, and sediment distribution within the basin, which has likely produced unsuitable habitat for bull trout. Irrigation ditches and water diversions, such as the Galloway diversion, are common in the lower elevations, (typically less than 1,250 meters (4,100 feet) and have substantially influenced flows in the Weiser River basin. In some instances, streams downstream of water diversions are severely dewatered or dry, which influences riparian vegetation, stream temperatures, and sediment routing. Except for the Hornet Creek Reservoirs, C. Ben Ross Reservoir, and Lost Valley Reservoir, as well as some water diversions, most reservoirs and water diversions are located downstream of potential bull trout habitat.

Forest Management Practices

In the Boise River Recovery Subunit, fires, insects, and nearby timber markets have encouraged the application of numerous forestry practices (Steed *et al.* 1998). These practices include timber harvesting and reforestation, road construction, fire suppression, and other practices associated with forestry. These practices can negatively affect bull trout habitats by increasing sedimentation rates, stream bank and channel instability, and water temperatures; decreasing recruitment of woody debris, canopy shading, and habitat complexity; and altering the hydrologic regime. High sedimentation rates may reduce pool depth and cause channels to braid throughout bull trout habitats, and may reduce egg and larval survival in spawning and rearing habitat.

Roads exist throughout much of the public and private lands in the Boise River basin and have provided access for several activities, including logging and various recreational activities. Past road construction on timber lands of the Boise National Forest has negatively affected bull trout (Steed *et al.* 1998). The primary negative effects of road construction and timber harvest, combined, are increases in sedimentation, fish passage barriers, and habitat degradation (*e.g.,* reduced recruitment of woody debris, filling of pools, increased stream bank and channel instability, and decreased riparian canopy cover). For example, several habitat features important to bull trout (*e.g.,* fine sediment, large woody debris, large pools,

and channel conditions) were not adequately functioning for bull trout in some watersheds of the South Fork Boise River due to moderate and high road densities, passage barriers, and other management activities (Burton and Erikson 1998). Road densities throughout the Boise River basin range from 0 to 2.8 kilometers per square kilometer (0 to 4.5 miles per square mile) in watersheds overall, and 0 to 0.5 kilometer per square kilometer (0 to 1.9 miles per square mile) in riparian habitat areas (Appendix B in Steed *et al.* [1998]). There are over 6,600 culverts and road crossings at streams that may be fish passage barriers to adult or juvenile bull trout throughout the Boise River basin.

Forest management practices, such as fire suppression and timber harvest, are believed by many to have altered fire regime and vegetation composition in areas with certain vegetation types, increasing the intensity of fires and their potential effects on bull trout habitats (*e.g.,* Steed *et al.* 1998). Rieman *et al.* (1997) studied bull trout and redband trout responses to large, intense fires that burned three watersheds in the Boise National Forest. Although the fires were the most intense on record, there was a mix of areas that were unburned and severely burned after the fires. Fish were apparently eliminated in some stream reaches, whereas others contained relatively high densities of fish. Within a few years after the fires and after areas within the watersheds experienced debris flows, fish became reestablished in many reaches and densities increased. In some instances, fish densities were higher than those present before the fires in streams that were not burned (Rieman *et al.* 1997). These responses were attributed to spatial habitat diversity that supplied refuge areas for fish during the fires, the ability of bull trout and redband trout to move among stream reaches, and for bull trout, the presence of migratory fish within the system (Rieman and Clayton 1997; Rieman *et al.* 1997; Burton 2000b).

In the Payette River Recovery Subunit, about 90 percent of the upper Squaw Creek watershed is managed by the U.S. Forest Service, and silvicultural activities such as thinning and timber harvest are practiced (Steed 1999). To support these activities road maintenance and road construction have been conducted. Timber harvest in the Gold Fork River basin has been concentrated in the lower elevation areas of the watershed where timber values are highest and access is easier than at higher elevations. Although early settlers cleared and removed timber, initial entry of the watershed for commercial timber harvest began in the 1930's by the Boise-Payette Timber Company. To facilitate log removal, railroads were constructed along the main Gold Fork River and Kennally, Sloans and Flat creeks. By 1938, most of these basins had been harvested. Factors thought to have negatively affected bull trout in the watershed include timber harvest and associated high road densities, sedimentation, passage barriers, and changes in runoff (Burton 1999c). These

factors have also affected bull trout in other areas of the Payette River basin (*i.e.,* Deadwood River, Middle Fork Payette River, and South Fork Payette River).

In the Weiser River Recovery Subunit, timber harvest and associated road construction has occurred throughout most of the basin. The amount of these activities in some watersheds (*e.g.,* the upper East Fork Weiser River, Middle Fork Weiser River) has likely altered the hydrologic regime from what would occur in an undisturbed condition (McGee *et al.* 2001), resulting in habitat degradation due to such effects as increased stream bed and bank erosion. In the Little Weiser River drainage, large woody debris levels are low in some stream reaches (DuPont and Kennedy 2000). Visual inspections of streams in the watershed indicated that substantial amounts of coarse woody debris (0.9 to 10.7 meters (3.0 to 35.0 feet) in length, 76.2 to 304.8 millimeters (3.0 to 12.0 inches) in diameter) move rapidly through the system and the entire drainage would benefit from higher levels of large woody debris (DuPont and Kennedy 2000). Pool frequency is below U.S. Forest Service (1995) management objectives (*i.e.,* Inland Native Fish Strategy- INFISH) throughout the watershed. The average road density on National Forest lands with bull trout throughout the Weiser River basin is nearly 3.1 kilometers per square kilometer (5.0 miles per square mile) in riparian habitat conservation areas (Stovall 2001).

Livestock Grazing

In the Boise River Recovery Subunit, livestock graze on private, State, and Federal lands; monitoring of grazing forage and riparian habitats is limited (Steed *et al.* 1998). Livestock grazing has occurred in the South Fork Boise River drainage for more than 100 years at a variety of grazing intensities and has had negative effects on aquatic resources (*i.e.,* through reduced riparian vegetation, and increases in sedimentation, stream bank instability, water temperatures). In the last 20 years, sheep have grazed the majority of the area with only about 10 percent of the total area grazed by cattle. Federal cattle allotments are located on the southwestern portion of the drainage and sheep allotments generally on the remainder of the Federal lands. In 1999, the U.S. Fish and Wildlife Service established riparian vegetation standards for grazing allotments to protect bull trout in the Sawtooth National Forest (USFWS 2001a). Some standards have been exceeded and the Forest Service has taken measures to improve compliance (Kenney *et al.* 2001). On private lands, some cattle grazing occurs with relatively high use occurring in the Deer Creek and Grouse Creek watersheds (Steed *et al.* 1998). The effects of improper cattle grazing on riparian habitat are also apparent in the Fall Creek and Little Smokey Creek drainages. Overall, effects of sheep grazing have been moderate to light in the Boise River Recovery Subunit.

In the Payette River Recovery Subunit, there are eight grazing allotments on Federal lands upstream of Deadwood Dam (seven sheep and one cattle) (Jimenez and Zaroban 1998). None of the sheep allotments have been used during the last 15 years. The single cattle allotment is located in the Deer Creek watershed and is grazed on alternate years with light use (Jimenez and Zaroban 1998).

Extensive grazing occurs in the lower third of the Squaw Creek drainage and in the Gold Fork River drainage (Steed 1999). Private lands in the lower portions of Gold Fork River are managed for intensive cattle grazing, especially in the Laffin Well Creek, Kennally Creek, and Flat Creek watersheds. Cattle are also grazed throughout Boise Corporation lands, including an open range cattle allotment. A sheep allotment runs on portions of U.S. Forest Service lands in the Payette National Forest in the Rapid Creek, Camp Creek, and Paddy Creek basins and also in the Gold Fork Meadow area of the South Fork Gold Fork River. Effects of grazing from cattle and, to a lesser extent, sheep, are apparent in the Gold Fork River watershed, particularly in the Sloans Creek, Flat Creek, Kennally Creek, and Middle Gold Fork River drainages.

Timber harvest in the Gold Fork River drainage has created a network of roads and skid trails adjacent to stream channels, providing cattle access to riparian areas (Steed 1999). Cattle trampling has prevented revegetation of skid trails at road and stream crossings, and along alluvial channels. The combined effects of grazing and unvegetated skid trails have resulted in delivery of sediment directly to streams, as well as preventing the reestablishment of riparian vegetation along streambanks and skid trails.

In the Weiser River Recovery Subunit, cattle graze throughout the area. Cattle winter on private lands in the lower elevations and summer on U.S. Forest Service lands during May through October (DuPont and Kennedy 2000). Generally, the upland areas are lightly used and some riparian areas are inaccessible to cattle; however, many meadow areas and stream crossings have been heavily affected by cattle (DuPont and Kennedy 2000). Because most of the private, State, and Bureau of Land Management grazing allotments are at lower elevations, grazing primarily affects bull trout foraging, migrating, and overwintering habitat. However, grazing has degraded bull trout spawning and rearing habitat or reduced riparian vegetation in Olive Creek (DuPont and Kennedy 2000), but monitoring of grazing forage and riparian habitat in the Weiser River Recovery Subunit has generally been limited.

Agricultural Practices

In the Boise River Recovery Subunit, Arrowrock Reservoir, Anderson Ranch Reservoir, and Lucky Peak Reservoir store water used for irrigation of agricultural lands in the lower Boise River basin. These reservoirs are also currently being used for recreation, flood control, and habitat for aquatic species. Habitats created in the reservoirs formed by Arrowrock Dam and Anderson Ranch Dam have allow bull trout to express adfluvial life histories, which was not possible prior to construction of the dams. The reservoirs also provide habitat for introduced fishes that bull trout may prey upon. Overall effects of the dams on bull trout are addressed in the "Dams" section of this recovery plan, however, operation of the dams for agricultural purposes may be negatively affecting bull trout in the reservoirs by entrainment through the dams and reductions in habitat from reservoir drawdowns. In addition, losses of bull trout into irrigation diversions have been documented on Big Smokey and Willow creeks, both in the South Fork Boise River basin (D. Parrish, Idaho Department of Fish and Game (IDFG), pers. comm. 2000).

Crop production, primarily hay and grain, is limited to relatively small areas of private land in the South Fork Boise River drainage (Steed *et al.* 1998). Crop production can affect bull trout by modifying hydrologic regimes, accelerating sedimentation, and introducing agricultural chemicals. However, these effects of agricultural production have not been demonstrated to affect bull trout in the Boise River Recovery Subunit.

In the Payette River Recovery Subunit, the effects of three major dams constructed for hydroelectric generation and irrigation water storage on bull trout (*i.e.,* passage barriers) and bull trout habitat (*i.e.,* flow regime) were discussed under the "Dams" section of this recovery plan. These are Deadwood Dam on the Deadwood River, Black Canyon Dam on the mainstem Payette River near Emmett, and Cascade Dam on the North Fork Payette River near Cascade. Other smaller dams have been constructed primarily for irrigation diversions. Irrigation diversions in the Squaw Creek watershed are suspected to create unsuitable habitat conditions for bull trout (*e.g.,* stream reaches with simplified habitat complexity, elevated water temperatures, and reduced water depths) and may be passage barriers (Steed 1999). An irrigation diversion on the lower Gold Fork River is a fish passage barrier (Steed 1999), and other diversions forming passage barriers exist on streams in which bull trout have been observed in the past (*e.g.,* Lake Fork Creek, Fisher Creek) in the upper North Fork Payette River (Steed 1999; Faurot 2001).

In the Weiser River Recovery Subunit, much of the private lands along streams has been cleared for agricultural purposes and flood control (DuPont and Kennedy 2000). This has reduced or eliminated riparian vegetation, resulting in reduced stream bank stability, large woody debris recruitment, pool habitat, and overall habitat diversity; and likely elevated summer water temperatures and sediment delivery. In some areas, streams were excavated and channelized to reduce flooding of agricultural lands, which has reduced habitat complexity in such areas as the Weiser River from Council to Cambridge and on the Little Weiser River downstream of C. Ben Ross Reservoir. Numerous water diversions have created passage barriers, reduced water quality, and resulted in stream reaches that are often completely dry during peak irrigation periods (DuPont and Kennedy 2000).

About a quarter of the area in the Weiser River basin lies above 1,524 meters (5,000 feet) in elevation, which DuPont and Kennedy (2000) considered likely to have water temperatures conducive to bull trout spawning and rearing. Most agricultural activities occur on private lands at lower elevations (DuPont and Kennedy 2000). Therefore, the effects of agricultural practices on bull trout are largely responsible for the loss of migratory bull trout through degradation of foraging, migrating, and overwintering habitat.

Transportation Networks

In the Boise River Recovery Subunit, past road construction on timberlands of the Boise National Forest has negatively affected bull trout (Steed *et al.* 1998). Within the Boise River basin, road densities in 6th-field HUCs are 0 to 2.8 kilometers per square kilometer (0 to 4.5 miles per square mile), and watersheds with the highest road densities are areas where bull trout typically no longer exist. Some watersheds with high road densities include Beaver Creek in the North Fork Boise River drainage and Feather River in the South Fork Boise River drainage. Bull trout are relatively abundant in some roadless areas (*e.g.,* the headwaters of the Queens River and North Fork Boise River) compared to other areas within the Boise River basin (Steed *et al.* 1998).

In the Payette River Recovery Subunit, the effects of roads on aquatic habitats (*e.g.,* increased sedimentation, reductions in large pools, and migration barriers) are limiting factors to bull trout in the Deadwood River, Middle Fork Payette River, and South Fork Payette River basins (Jimenez and Zaroban 1998). Many of the primary access roads within the Middle Fork Payette River basin were built adjacent to the river or within tributary riparian areas. Roads are in poor condition in much of the basin and road densities vary according to management activity. In the South Fork Payette River basin, roads and stream crossings are the

most common factors influencing bull trout, with the lower South Fork Payette River and Clear Creek having the most degraded conditions.

Although the upper portions of the Squaw Creek watershed are roadless, the road network is primarily adjacent to streams in the lower portion of the drainage and occurs both adjacent to streams and on uplands in the mid-reaches of the drainage (Steed 1999). The Gold Fork River watershed contains a total of 943 kilometers (586 miles) of roads, with an overall mean density of 2.5 kilometer per square kilometer (4 miles per square mile). This includes 174, 311, and 459 kilometers of primary, secondary, and closed roads, respectively (108, 193, and 285 miles). Most primary and secondary roads are surfaced with native materials (*i.e.,* less than 10 percent have been surfaced with gravel). Gold Fork River contains high levels of fine sediment due to the geology of the drainage and road density in some areas.

The Weiser River Recovery Subunit contains over 4,106 kilometers (2,552 miles) of roads (DuPont and Kennedy 2000). Estimates of roads are likely low because some estimates apply only to public lands and may not include all roads. For example, inventories of the Little Weiser River and Middle Fork Weiser River drainages indicate that road estimates may be increased 56 to 70 percent to include nonsystem roads (McGee *et al.* 2001). Roads adjacent to streams in riparian areas are common throughout the Weiser River Recovery Subunit (DuPont and Kennedy 2000). The most common problems with roads on Forest Service lands were ditches on insloped roads, rutted surfaces, eroded banks at crossings, and insufficient drainage (McGee *et al.* 2001), which increases sediment delivery to streams particularly for roads used during wet weather. Mean road density is 2.6 kilometers per square kilometer (4.2 miles per square mile) on Forest Service lands in the Middle Fork Weiser River drainage, and 2.4 kilometers per square kilometer (3.7 miles per square mile) in the Little Weiser River drainage. Overall, the average road density on Forest Service lands throughout the Weiser River basin is nearly 3.1 kilometers per square kilometer (5.0 miles per square mile) in riparian habitat conservation areas (Stovall 2001). Roads cross streams at numerous locations in the basin, and many crossings use culverts that may be complete or partial barriers to fish passage (DuPont and Kennedy 2000).

Mining

In the Boise River Recovery Subunit, mining has historically affected substantial areas of the Boise River basin (Steed *et al.* 1998). Dredge mining (commercial bucket) was conducted in several reaches of all the three forks of the Boise River (south, middle, and north), as well as the Mores Creek watershed. Much of the flood plain in mined reaches was turned, leaving cobble piles and

dredge pools. Although bucket dredge mining has not been performed in decades, piles of dredge tailings and pools are still apparent in some areas.

Lode and other forms of placer mining have also been conducted in the Boise River basin, which included processing materials from both river terraces and active stream channels (Steed *et al.* 1998). Most historic placer mining occurred in the upper South Fork Boise River and Middle Fork Boise River, such as near the Atlanta and Featherville-Rocky Bar areas, and Idaho City (Mores Creek drainage). Less extensive mining activity was conducted in the North Fork Boise River and some of its tributaries. Mining has affected large portions of foraging, migrating, and overwintering habitat. It is uncertain whether potentially toxic chemicals used in these types of mining have affected bull trout and other native fishes.

The Atlanta mining district was a major producer of gold; large dredge piles and tailings are still evident (Steed *et al.* 1998). Materials mined were largely quartz with arsenopyrite (iron-arsenic-sulfide) and gold. Other old mines in the Boise River basin include an antimony mine near Swanholm Peak, and small gold and silver mines in Black Warrior Creek, Little Queens River, and other watersheds. The gold-bearing quartz veins at Rocky Bar are upstream of Anderson Ranch Dam, and large placer deposits are evident near Featherville. Commercial mining is still viable in these areas, with the Atlanta deposits the most likely to be reactivated.

Recreational mining using suction dredges occurs in the Boise River basin. Because suction dredges pass gravel from the streambed over a sluice before depositing material back into the stream, their operation may damage bull trout redds and spawning habitat (Steed *et al.* 1998). Dredge operators are regulated by permits and regulations issued by Idaho Department of Water Resources. There are 34 dredge and 10 nondredge mining claims, permits, or abandoned claims in the Boise River basin (Steed *et al.* 1998). Some areas within the Boise River basin have restrictions on recreational mining to reduce negative effects on bull trout..

In the Payette River Recovery Subunit, placer and tunnel mining were conducted historically in the Deadwood River drainage (Jimenez and Zaroban 1998). It is uncertain whether drainage from the Deadwood Mine is adversely affecting water quality of the Deadwood River. The only active mine operating in the Deadwood River drainage is a relatively small mine in the Wilson Creek watershed (Mary Jane Mine). There are no known precious metal mining activities in the Middle Fork Payette River (Jimenez and Zaroban 1998). Past and current aggregate mining occurs in the lower Middle Fork Payette River. In the Gold Fork River drainage, gold discoveries in the late 1800's led to prospecting near McCall (Steed 1999). Several large pits in the Paddy Flat area appear to be the result of

hydraulic mining. Although extensive drilling to test for monazite deposits occurred in the Gold Fork basin, there is no evidence that dredge mining for monazite has occurred.

In the Weiser River Recovery Subunit, effects of mining are not thought to be a factor affecting bull trout.

Residential Development and Urbanization

Residential development has not taken place throughout much of the the Boise River Recovery Subunit. There are several small communities, such as Atlanta, Featherville, Pine, and Rocky Bar, of which Featherville and the surrounding area is undergoing the most rapid growth (Steed *et al.* 1998). Development in Featherville is largely due to recreation. The majority of private land in the Boise River Recovery Subunit upstream of Arrowrock Dam occurs in the lower (92 percent) and upper (7 percent) portions of the South Fork Boise River.

Although negative effects of residential development on bull trout in the Boise River Recovery Subunit have not been documented, expected effects would be related to development on the flood plain (Steed *et al.* 1998). Residential development typically includes stream channelization and levee construction, which can negatively alter hydraulic characteristics and simplify aquatic habitats. Additional effects include loss of riparian vegetation, road construction and passage barriers, flow alteration, contaminants from household chemicals and seepage from septic systems. Although residential development has not likely been a factor in the decline of bull trout in the Boise River Recovery Subunit, residential development in bull trout habitats increases the likelihood of adverse effects on bull trout.

In the Payette River Recovery Subunit, residential development is not known to have negatively affected bull trout.

In the Weiser River Recovery Subunit, the basin is sparsely populated in the headwaters compared to the lower portions where farm communities occur (DuPont and Kennedy 2000). The two major towns within the basin are Council and Cambridge. General effects of residential development were previously discussed for the Boise River Recovery Subunit. It is thought that these effects may have negatively influenced potential foraging, migrating, and overwintering habitat for bull trout in the Weiser River basin.

Fisheries Management

In the Boise River Recovery Subunit, brook trout have been documented in the three forks of the Boise River basin (Steed *et al.* 1998) and in Mores Creek. In the North Fork Boise River drainage, brook trout have been observed in Meadow Creek, French Creek, lower Crooked River, Beaver Creek, Edna Creek, Pikes Fork Creek, upper Crooked River, lower Bear River, and Bear Creek. Brook trout distribution presently appears to be limited to a relatively small area of the drainage, with most observations in the Crooked River watershed. Hybridization with bull trout has been documented in such areas as lower Crooked River, Bear Creek, and lower Bear River. Brook trout have been documented from the extreme upper portion of the Middle Fork Boise River drainage, such as in Long Gulch and upper Smith Creek. In the South Fork Boise River drainage, brook trout occur in lower and middle Fall Creek, Salt Creek, and Paradise Creek, and they likely occur in other areas. Brook trout in the upper Middle Fork Boise River and South Fork Boise River are thought to have originated from fish introduced in alpine lakes and stocked streams by State and Federal resource agencies and private individuals during the 1940's and 1950's. Hybrids between brook trout and bull trout have been observed in the two drainages.

Hatchery-reared rainbow trout have been and continue to be stocked in the Boise River basin by the Idaho Department of Fish and Game. Transmission of whirling disease from stocked fish to bull trout does not appear to be a factor because bull trout appear to be less susceptible than other salmonids, and the Idaho Department of Fish and Game does not maintain or plant fish that test positive for whirling disease. Numerous nonnative species have been introduced into Anderson Ranch Reservoir and Arrowrock Reservoirs. Species such as kokanee may be used by bull trout as a substitute prey base in place of the anadromous fish that once existed in the basin. Other nonnative species, such as smallmouth bass, may prey on juvenile bull trout. Recreational fisheries for stocked and introduced fish may also expose bull trout to unintended angler mortality.

In the Payette River Recovery Subunit, brook trout are locally abundant in some areas. They have been observed in the upper Middle Fork Payette River (*e.g.,* Bull Creek) (Jimenez and Zaroban 1998) and are present in the Squaw Creek drainage and portions of the North Fork Payette River drainage, such as tributaries to Gold Fork River and Lake Fork Creek (Steed 1999). Brook trout have not been documented in the Deadwood River drainage or in bull trout spawning and rearing habitat in the South Fork Payette River basin (Jimenez and Zaroban 1998). Lake trout have been introduced into Payette Lake (Walker 1998), which may have negatively influenced bull trout in the upper North Fork Payette River.

Numerous nonnative salmonids have been stocked in Deadwood Reservoir, including kokanee, cutthroat trout, rainbow trout, rainbow trout-cutthroat trout hybrids, fall chinook salmon, and Atlantic salmon (*Salmo salar*) (Jimenez and Zaroban 1998). Although stocking species (*e.g.,* chinook salmon and Atlantic salmon) likely to prey on juvenile bull trout has not occurred since 1998, they may have negatively affected bull trout earlier.

Past management activities for the maintenance of Deadwood Dam and to benefit the kokanee fishery in Deadwood Reservoir may have negatively affected bull trout. During August through September 1973, the U.S. Bureau of Reclamation completely evacuated Deadwood Reservoir for repair and maintenance of the dam (Jimenez and Zaroban 1998). During this time, the Idaho Department of Fish and Game treated the reservoir with rotenone and operated Fintrol drip stations in upstream tributaries to eliminate kokanee spawning. The chemical treatment apparently extended downstream of the dam killing several nontarget fishes, including bull trout (Jimenez and Zaroban 1998). In September 1992, the Idaho Department of Fish and Game also applied rotenone to tributaries in the Deadwood drainage (*i.e.,* Trail Creek, Beaver Creek, and South Fork Beaver Creek) to suppress kokanee spawning. Although pre-treatment fish surveys were not conducted, about 40 juvenile bull trout were killed in Beaver Creek (Jimenez and Zaroban 1998). The number of bull trout affected by the treatment was likely underestimated.

The Idaho Department of Fish and Game constructed a migration barrier on the Deadwood River upstream of the reservoir in 1978 to limit access of kokanee to spawning areas (Jimenez and Zaroban 1998). The barrier may have restricted bull trout movement. The barrier was removed in 1980 and replaced with a removable velocity barrier in 1981, which was breached in 1999. A weir is operated at the site to collect kokanee eggs for the Idaho Department of Fish and Game hatchery system on an as-needed basis typically during mid-August through late September, which may be after bull trout have moved upstream to spawn.

In the Weiser River Recovery Subunit, brook trout were widely stocked in the early 1900's and they are established in several areas throughout the Weiser River basin (DuPont and Kennedy 2000). Although a comprehensive survey for brook trout has not been conducted for the basin, brook trout are known to co-occur with bull trout in the upper Little Weiser River, Dewey Creek, and East Fork Weiser River. Hybrids between bull trout and brook trout have been observed in the Little Weiser River and Dewey Creek (Adams 1994). Bull trout are residing at lower elevations in streams lacking brook trout (Sheep, Anderson, and Olive creeks) compared to streams with both species, suggesting that brook trout are influencing the distribution of bull trout (DuPont and Kennedy 2000).

Rainbow trout have been stocked at the Evergreen Campground, Barr Jacobs' Bridge, Ashley Bridge, and at a few other locations throughout the Weiser River basin (DuPont and Kennedy 2000). Rainbow trout distribution overlaps with that of bull trout in the basin. Although rainbow trout are native to the basin, it is uncertain whether the stocked rainbow trout life histories and habitat needs differ from those of the native fish, potentially resulting in competition with bull trout (DuPont and Kennedy 2000). Incidental harvest of bull trout by anglers fishing for rainbow trout may be ocurring.

Isolation and Habitat Fragmentation

In the Boise River Recovery Subunit, dams and some culverts at road crossings are barriers to bull trout movement. Culverts may present unsuitable water velocities in which a fish or certain sizes of fish are unable to swim. Culvertswith perched outlets (*i.e.,* located above the stream channel) may be inaccessible to fish (Steed *et al.* 1998). Depending on the conditions at specific culverts, they may function as partial barriers both seasonally and selectively for fish of certain sizes. Dams and culverts may also cause fish to concentrate downstream where they are vulnerable to predators and anglers. These barriers may not only affect bull trout, but also their potential prey species such as rainbow trout.

The U.S. Forest Service has conducted an inventory of culverts in some watersheds within the Boise River basin (Steed *et al.* 1998). Because of the high numbers of culverts in some areas, such as in the extreme example of the 500 to 600 culverts in the Beaver Creek, Edna Creek, and Pikes Fork watersheds, it is likely that numerous undocumented barriers exist in other areas of the Boise River Recovery Subunit. Culverts thought to be fish barriers have been documented in the Beaver Creek and Owl Creek watersheds in the North Fork Boise River drainage; Swanholm Creek, Cottonwood Creek, and Roaring River watersheds in the Middle Fork Boise River and lower South Fork Boise River drainages; and Fall River, Feather River, Little Smokey Creek, and Trinity Creek watersheds in the upper South Fork Boise River drainage. The overall effects of barriers have likely been a reduction in habitat available to migratory bull trout and reduced interaction of individuals from various portions of the basin (*e.g.,* reproduction and genetic exchange).

In the South Fork Boise River drainage, Idaho Department of Fish and Game conducted a survey of culverts at 105 road crossings and identified 26 that could be potential barriers to fish passage (Partridge *et al.* 2000). Seven of the associated creeks and rivers were considered of sufficient size to support bull trout: Big Water, Fall, Little Water, Steel, Trinity, and Whiskey Jack creeks, and the

Feather River. The culverts on the Feather River (upstream of Featherville) had been previously noted as passage barriers to bull trout (Parrish 1999). However, three migratory bull trout tagged in Anderson Ranch Reservoir were located upstream of the culverts in 1999. In the fall of 1999, three drop structures were built below the culverts to facilitate bull trout passage (Partridge 2000b). An angle-iron structure was also built in one culvert to improve conditions for passage. Overall, passage barriers for bull trout may be particularly detrimental in the upper South Fork Boise River drainage where Anderson Ranch Dam prevents access by fish from the remainder of the basin and has substantially reduced the area of habitat available to fish isolated upstream of the dam. However, Anderson Ranch Reservoir has provided habitat allowing bull trout to express adfluvial life histories.

In the Payette River Recovery Subunit, there are four or five groups (*i.e.,* core populations, see Chapter 1) of bull trout that are essentially isolated due to the effects of various factors. Bull trout are isolated in the upper Deadwood River and Gold Fork River by an impassible (*i.e.,* in the upstream direction) dam and an irrigation diversion, respectively. Additional barriers to fish movement likely exist in the watersheds upstream of these structures due primarily to culverts at road crossings (Jimenez and Zaroban 1998; Steed 1999). Barriers (*e.g.,* irrigation diversions and road crossings) primarily in foraging, migrating, and overwintering habitat, have isolated bull trout in the upper reaches of Squaw Creek. The degree of connectivity between bull trout in the Middle Fork Payette River and the South Fork Payette River is uncertain. Moreover, potential foraging, migrating, and overwintering habitat in the lower Middle Fork Payette River may not be conducive to bull trout due to unsuitable temperature and habitat complexity (*e.g.,* lack of large pools, large woody debris, and appropriate channel form, and excessive sedimentation). Big Falls is a potential natural barrier to fish movement under some flow conditions in the South Fork Payette River; however, adult chinook salmon released in the Payette River have moved above the falls. Because bull trout in each of the groups within the basin are generally in low abundance with few or no migratory fish, the groups are highly isolated.

In the Weiser River Recovery Subunit, several types of barriers to migrating adult and juvenile bull trout exist, such as dams, culverts, water diversions, severely degraded habitat (*e.g.,* subsurface flow and unsuitable water temperature), and natural waterfalls (Dupont and Kennedy 2000). For example, 17 fish passage barriers have been identified associated with 143 kilometers (89 miles) of roads within the Little Weiser River watershed (McGee *et al.* 2001). Similarly, road culverts were identified as passage barriers in the Hornet Creek watershed, which included one each in North Creek and Placer Creek, two in South Fork Olive Creek, and one at the mouth of Grouse Creek (DuPont, *in litt.* 1998, 2000). Bull trout movement in the mainstem Weiser River is inhibited or prevented by excessively

warm water temperatures, human-caused physical and thermal barriers, and dewatered streams (McGee *et al.* 2001).

Construction and operation of reservoirs and water diversions have degraded habitats, which further contributes to bull trout isolation and habitat fragmentation in the Weiser River basin. Typical effects have been long-term changes in downstream water temperatures, flow regime, dewatering, and sediment dynamics in the basin (DuPont and Kennedy 2000). Major reservoirs upstream of either existing or potential bull trout habitats include Hornet Creek Reservoirs, C. Ben Ross Reservoir, and Lost Valley Reservoir. Major water diversions blocking bull trout passage are in the Little Weiser River, West Fork Weiser River, East Fork Weiser River, upper Weiser River, and Hornet Creek watersheds. In the lower portion of the Weiser River basin the Galloway diversion prevents bull trout in the Weiser River from potentially interacting with bull trout from Snake River tributaries in Oregon.

Poor water quality associated with habitat degradation has likely contributed to isolation and habitat fragmentation of bull trout in the three recovery subunits. Under the Federal Clean Water Act, States or the U.S. Environmental Protection Agency designate water bodies that are failing to meet water quality standards (*i.e.,* not achieving their beneficial use) as water quality limited under section 303(d) and are required to develop management plans. The 303(d) lists are published biennually. In 1998, a total of 62 water bodies appeared on Idaho's 303(d) list for the three river basins making up the Southwest Idaho Recovery Unit (*i.e.,* 26, 24, and 12 in the Boise River, Payette River, and Weiser River basins, respectively (Stovall 2001); Appendix B). The most common pollutant for the three basins is excess sediment. Although water quality limited stream segments occur throughout the basins, some reaches coincide with the current distribution of bull trout and have likely contributed to their decline.

ONGOING RECOVERY UNIT CONSERVATION MEASURES

Several activities have been implemented and are ongoing that will improve bull trout distribution, abundance, and their habitats in the Southwest Idaho Recovery Unit. These activities include studies that have and will generate information improving our understanding of bull trout needs, their status, and efficacy of recovery activities.

For proposed Federal activities occurring in the three recovery subunits, the Boise National Forest and Payette National Forest are consulting with the U.S. Fish and Wildlife Service pursuant to section 7 of the Endangered Species Act. During consultations, potential effects of proposed activities on bull trout and their habitats are evaluated, and the activities may be modified to reduce or eliminate negative effects on bull trout. Federal activities often include conservation measures beneficial to bull trout, such as reducing sediment delivery to streams by closing or altering forest roads and grazing practices, providing fish passage by replacing improperly constructed culverts, and conducting fish and habitat surveys (*e.g.,* Faurot 2001; Kenney *et al.* 2001. McGee *et al.* 2001). The current management direction of the two National Forests is guided by objectives contained in INFISH (USFS 1995).

Fish passage barriers have been and continue to be evaluated and addressed in various areas of the recovery unit. In the South Fork Boise River drainage for example, structures were installed in culverts to improve conditions for fish passage in the Feather River (Partridge 2000b), and culverts have been replaced to improve fish passage in other streams in the drainage (*e.g.,* Trinity, Green, Spanish, Johnson Fork, and Whiskey Jack creeks). Culverts have been replaced elsewhere in the other recovery subunits (*e.g.,* Olive Creek in the Weiser River Recovery Subunit). In the Middle Fork Boise River, a fish ladder was constructed at Atlanta Dam to provide bull trout passage. The U.S. Forest Service estimated there are approximately 233 kilometers (145 miles) of bull trout spawning and rearing habitat in the Middle Fork Boise River drainage downstream of Atlanta Dam and approximately 90 kilometers (56 miles) of unoccupied spawning and rearing habitat upstream of Atlanta Dam (Steed *et al.* 1998). Therefore, the fish ladder at Atlanta Dam has increased access for migratory bull trout to 39 percent more spawning and rearing habitat than previously available.

In the Boise River Recovery Subunit, cooperative studies are underway among the U.S. Bureau of Reclamation, Idaho Department of Fish and Game, Boise National Forest, and the U.S. Forest Service Rocky Mountain Research Station to investigate bull trout distribution, movement, and life history. For example, bull

trout movement, abundance, and life history information has been collected in the North Fork Boise River and South Fork Boise River using such methods as weirs and a rotary screw trap. In Arrowrock, Lucky Peak, and Anderson Ranch reservoirs, bull trout abundance was estimated using traps and gill nets, and bull trout movements were estimated using radio telemetry. In tributaries, bull trout distribution and densities were estimated using snorkel and electrofishing surveys; habitat surveys were also conducted, including water temperature monitoring. Various methods to collect bull trout that pass from Arrowrock Reservoir to Lucky Peak Reservoir are being investigated so that fish may be released back into Arrowrock Reservoir. Several of these studies are associated with biological opinions on the operation of U.S. Bureau of Reclamation facilities and the replacement of valves at Arrowrock Dam, which may negatively affect bull trout in the reservoir (USFWS 1999, 2001b). Additional ongoing work includes trap-and-haul of bull trout, genetic investigations, assessments of fish movement and habitats using archival tags and juvenile telemetry, evaluation of conservation pools in reservoirs (*i.e.,* minimum water levels), and the formation of an advisory group to assist in directing and coordinating studies.

The Idaho Department of Fish and Game has also implemented ongoing conservation measures to benefit bull trout. Bull trout harvest has been prohibited Statewide since 1994. Fish use of the ladder at Atlanta Dam will be monitored during August through 2005. The agency has also conducted a brook trout suppression study in a tributary of the North Fork Boise River during 1998 through 2000. In addition, the agency has conducted creel surveys in conjunction with educational efforts to investigate anglers' ability to correctly identify fishes with the goal of improving angler knowledge of fishes and fishing regulations. The intensive program of using signs to inform anglers has been successful in reducing bull trout harvest in the Boise River basin and should be expanded.

Under sections 303 and 304 of the Federal Clean Water Act, states or the U.S. Environmental Protection Agency set water quality standards, which combine designated beneficial uses and criteria established to protect uses. States or the Environmental Protection Agency designate water bodies that are failing water quality standards as water quality limited under section 303(d) and are required to develop management plans. Management plans include total Maximum Daily Loads with implementation plans that define site-specific actions and timelines for meeting water quality goals. A total of 62 water bodies, which is about 1,448 kilometers (900 miles) of rivers and streams, in the three recovery subunits was designed as water quality limited in the 1998 303(d) list for Idaho (Stovall 2001). These water bodies include some stream segments that are currently occupied by bull trout or contain habitat that could be used by bull trout. Total maximum daily loads have been approved by the Environmental Protection Agency for Cascade

Reservoir, lower Boise River, Middle Fork Payette River, and lower Payette River, and Idaho Department of Environment Quality expects to complete plans for other areas in the recovery unit by 2005 and 2006 (Stovall 2001). Ongoing implementation of completed management plans will improve bull trout habitats.

The Natural Resources Conservation Service and the Farm Services Agency administer several programs that provide technical and/or financial assistance, to private landowners to address natural resource issues. Resource management systems are developed with landowners to address soil, water, air, plant, and animal resource concerns. Programs available to private landowners include the Conservation Reserve Program, Environmental Quality Incentives Program, Wetland Reserve Program, and Wildlife Habitat Incentives Program. Resource management systems developed with landowners identify practices that will reduce soil erosion and sediment delivery to streams, restore riparian and wetland functions and values, reduce water consumption on irrigated agricultural lands, and reduce nutrient and pesticide pollution in water bodies. Typical practices implemented include, riparian forest buffers, fencing, use exclusion, irrigation water management, nutrient and pesticide management, prescribed grazing and livestock watering facilities away from streams.

STRATEGY FOR RECOVERY

A core area represents the closest approximation of a biologically functioning unit. The combination of core habitat (*i.e.*, habitat that could supply all the necessary elements for the long-term security of bull trout including both spawning and rearing as well as foraging, migrating, and overwintering) and a core population (*i.e.*, bull trout inhabiting a core habitat) constitutes the basic core area upon which to gauge recovery within a recovery unit. Within a core area, many local populations may exist.

Bull trout are currently distributed among three recovery subunits in the Southwest Idaho Recovery Unit, with individuals occurring in Boise River, Payette River, and Weiser River basins (Figure 2). In the Boise River Recovery Subunit, bull trout occur in three core areas in the basin upstream of Lucky Peak Dam (Table 4; Figure 2). The Arrowrock Core Area includes the Boise River watersheds upstream of Arrowrock Dam, including the North Fork Boise River, Middle Fork Boise River, and South Fork Boise River downstream of Anderson Ranch Dam (Figure 3). The Anderson Ranch Core Area includes the South Fork Boise River watershed upstream of Anderson Ranch Dam (Figure 4). The Lucky Peak Core Area includes Lucky Peak Reservoir and tributaries entering it, namely the Mores Creek watershed (Figure 5). Migratory and resident bull trout occur in both the Arrowrock and Anderson Ranch core areas. In the Lucky Peak Core Area, resident bull trout occur in the headwaters of Mores Creek and migratory bull trout occur in Lucky Peak Reservoir. It is not known whether all migratory bull trout in Lucky Peak Reservoir have been entrained from the Arrowrock Core Area, or whether some fish may be produced in the Mores Creek watershed. Within the Mores Creek drainage, it is uncertain whether the Grimes Creek watershed contains potential spawning and rearing habitat because it has not been intensively surveyed specifically for bull trout. Investigating the presence of bull trout and the suitability of the watershed for bull trout spawning and rearing is a research need.

In the Payette River Recovery Subunit, bull trout occur in five core areas throughout the basin (Table 4; Figure 6): 1) the upper South Fork Payette River core area includes watersheds upstream of Big Falls, including the Deadwood River drainage downstream of Deadwood Dam (Figure 7); 2) the Deadwood River Core Area includes watersheds in the Deadwood River drainage upstream of Deadwood Dam (Figure 8); 3) the Middle Fork Payette River Core Area includes the watersheds upstream from the confluence with the South Fork Payette River (Figure 9); 4) the North Fork Payette River Core Area includes the watershed upstream of Cascade Dam (Figure 10); and 5) the Squaw Creek Core Area includes watersheds in Squaw Creek upstream from its confluence with the Payette River

(Figure 11). Bull trout in these core areas are primarily resident fish, with relatively low numbers of migratory fish.

In the Weiser River Recovery Subunit, bull trout occur in a single core area (Table 4; Figure 12), which includes watersheds upstream of and including the Little Weiser River watershed. The current distribution of bull trout in the recovery unit includes the Little Weiser River, East Fork Weiser River, and the Hornet Creek drainages (Figure 13). Bull trout in the Weiser River Core Area are thought to consist only of resident fish.

Table 4. Recovery subunits, core areas, local populations, and currently unoccupied potential spawning and rearing habitat in the Southwest Idaho Recovery Unit, Idaho.

Recovery subunit	Core area	Local populations	Potential spawning and rearing habitat[1]
Boise River	Arrowrock	1. Upper Crooked River 2. Bear River (including Bear Creek) 3. Lodgepole Creek 4. Upper North Fork Boise River (McLeod and McPhearson creeks) 5. Big Silver Creek 6. Ballentyne Creek 7. Johnson Creek 8. Roaring River 9. Buck Creek 10. Blackwarrior Creek 11. Steel Creek 12. Queens River (including Little Queens River) 13. Yuba River 14. Sheep Creek 15. Rattlesnake Creek	upper Smith Creek, Cottonwood Creek, Logging Creek, Haga Creek, Meadow Creek, French Creek, Lost Man Creek, Swanholm Creek, Hot Creek, Bald Mountain Creek, Eagle Creek, Joe Daley Creek, Leggitt Creek, upper Middle Fork Boise River, Pikes Creek, Beaver Creek, Edna Creek, Big Owl Creek, Wren Creek, Trapper Creek, Trail Creek, Taylor Creek
Boise River	Anderson Ranch	1. Dog Creek 2. Willow Creek 3. Elk Creek 4. Big Water Gulch 5. Beaver Creek 6. Boardman Creek 7. Salt Creek 8. Skeleton Creek 9. Bear Creek 10. Ross Fork Creek 11. Johnson Creek 12. Emma Creek 13. Big Smokey Creek (including West Fork Big Smokey Creek) 14. Little Smokey Creek 15. Smokey Dome Canyon	Basalt Creek, Backhorse Creek, Redrock Creek, Carrie Creek, Grindstone Creek, Warwick Creek, Big Peak Creek, North Fork Big Smokey Creek, Skunk Creek, Feather River, Trinity Creek, Grouse Creek, Deer Creek, Fall Creek, North Fork Lime Creek, Middle Fork Lime Creek, South Fork Lime Creek, Hunter Creek, Maxfield Creek
Boise River	Lucky Peak	1. Mores Creek	Grimes Creek[2]

Table 4. Recovery subunits, core areas, local populations, and currently unoccupied potential spawning and rearing habitat in the Southwest Idaho Recovery Unit, Idaho.

Recovery subunit	Core area	Local populations	Potential spawning and rearing habitat[1]
Payette River	Upper South Fork Payette River	1. Scott Creek 2. Whitehawk Creek 3. Clear Creek 4. Eightmile Creek 5. Wapiti Creek 6. Canyon Creek 7. Upper South Fork Payette River 8. Tenmile Creek 9. Chapman Creek	Warm Springs Creek, Fivemile Creek, Rock Creek
Payette River	Deadwood River	1. Trail Creek 2. Beaver Creek 3. Wildbuck Creek 4. Upper Deadwood River 5. Deer Creek	South Fork Beaver Creek, Habit Creek, Basin Creek, Goat Creek, Bitter Creek, East Fork Deadwood River, Stratton Creek
Payette River	Middle Fork Payette River	1. Upper Middle Fork Payette River (drainage upstream of and including Bull Creek and Sixteen-to-One Creek)	Silver Creek, Lightning Creek, Sixmile Creek, West Fork Creek, Wet Foot Creek
Payette River	North Fork Payette River	1. Gold Fork River	Kennally Creek, Lake Fork, North Fork Lake Fork, South Fork Lake Fork, Fisher Creek, upper North Fork Payette River
Payette River	Squaw Creek	1. Squaw Creek 2. Third Fork Squaw Creek	Second Fork Squaw Creek, Sagehen Creek, Pine Creek
Weiser River	Weiser River	1. Upper Hornet Creek 2. East Fork Weiser River 3. Upper Little Weiser River 4. Anderson Creek 5. Sheep Creek	Pine Creek, Rush Creek, Goodrich Creek, Johnson Creek, West Fork Weiser River, Lost Creek, upper Weiser River

[1] Potential spawning and rearing habitat are areas that are presently unoccupied or where the status of bull trout is unknown, but that may be able to provide spawning and rearing habitat for bull trout. Listed streams are based on discussions with the recovery unit team, bull trout observations, and adjunct habitat (*i.e.,* areas not presently supporting bull trout spawning and rearing, but most likely to support spawning and rearing if restored) identified in bull trout problem assessments (Jimenez and Zaroban 1998; Steed *et al.* 1998; Steed 1999; DuPont and Kennedy 2000).

[2] It is uncertain whether the Grimes Creek watershed contains potential spawning and rearing habitat. Investigating the presence of bull trout and the suitability of the watershed for bull trout spawning and rearing is a research need.

Figure 2. Boise River Recovery Subunit showing the locations of the Arrowrock, Anderson Ranch, and Lucky Peak core areas (see Table 4).

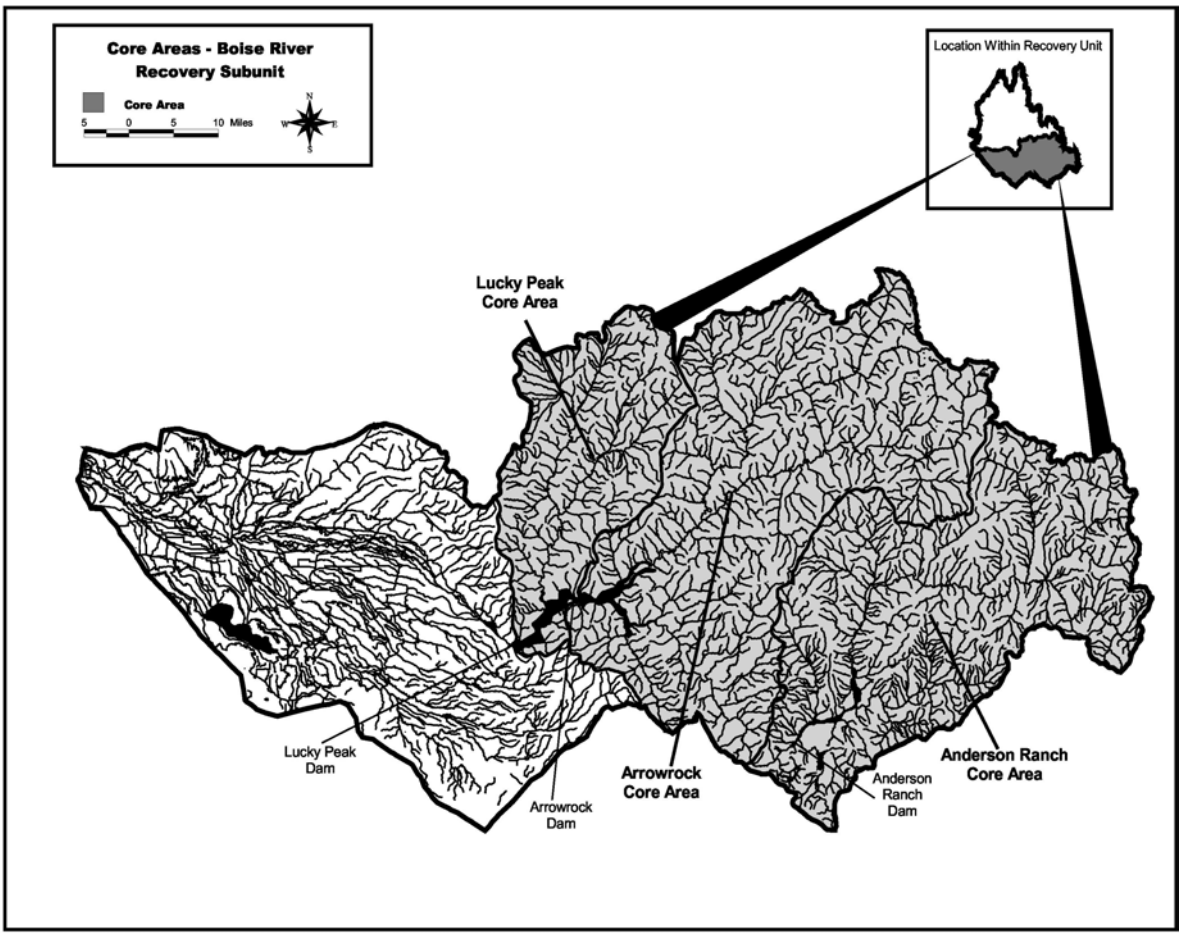


Figure 3. Arrowrock Core Area (Boise River Recovery Subunit) showing the locations of local populations and areas with potential spawning and rearing habitat (see Table 4).

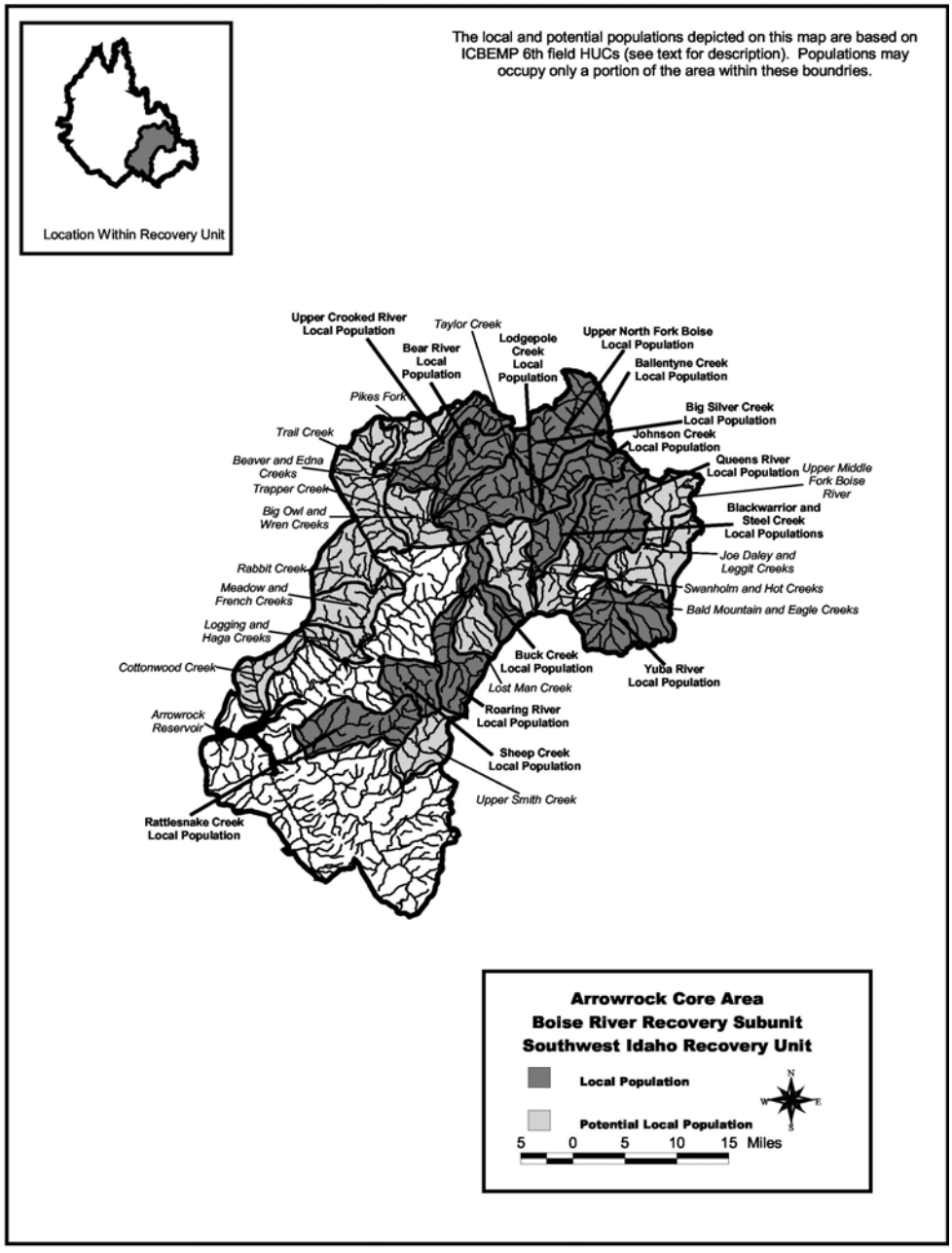


Figure 4. Anderson Ranch Core Area (Boise River Recovery Subunit) showing the locations of local populations and areas with potential spawning and rearing habitat (see Table 4).

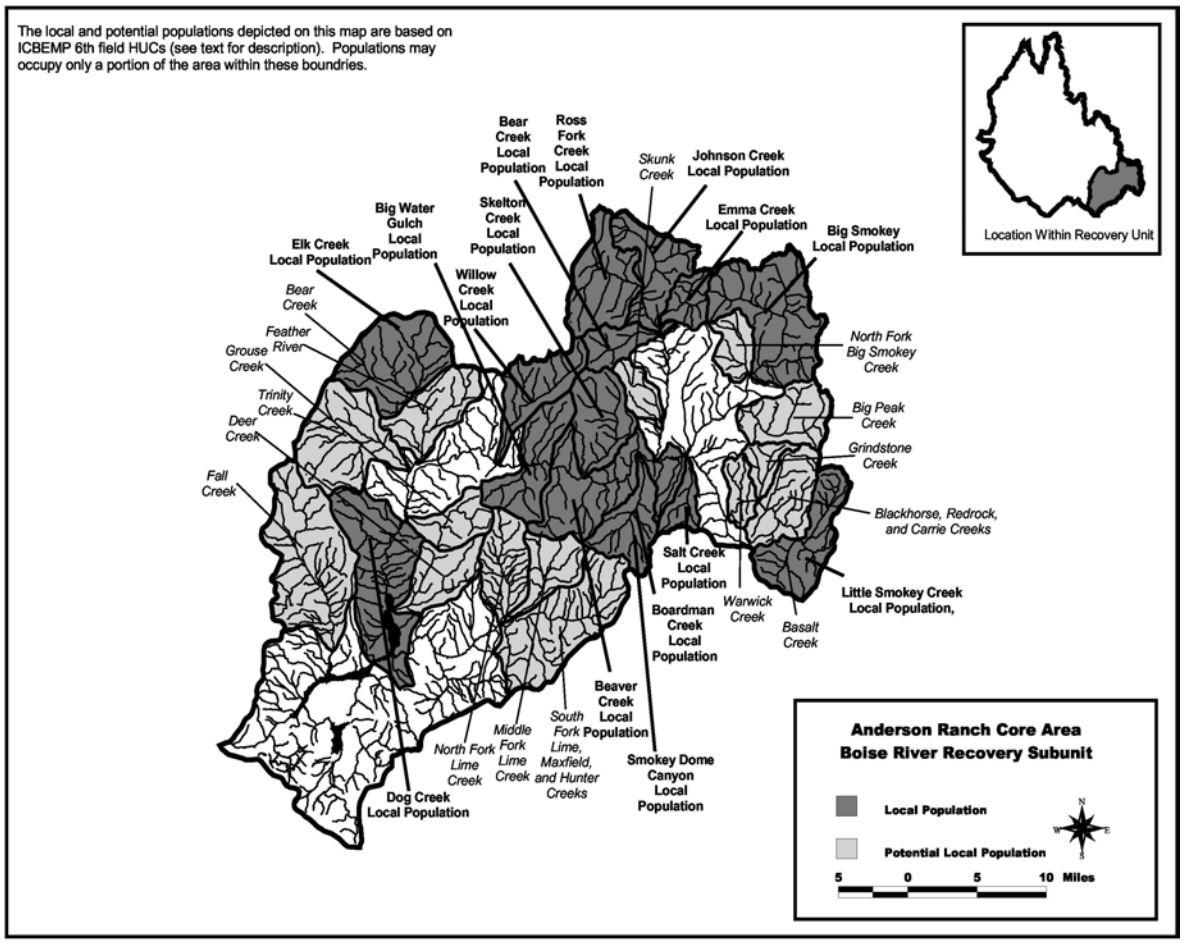


Figure 5. Lucky Peak Core Area (Boise River Recovery Subunit) showing the location of the local population (see Table 4).

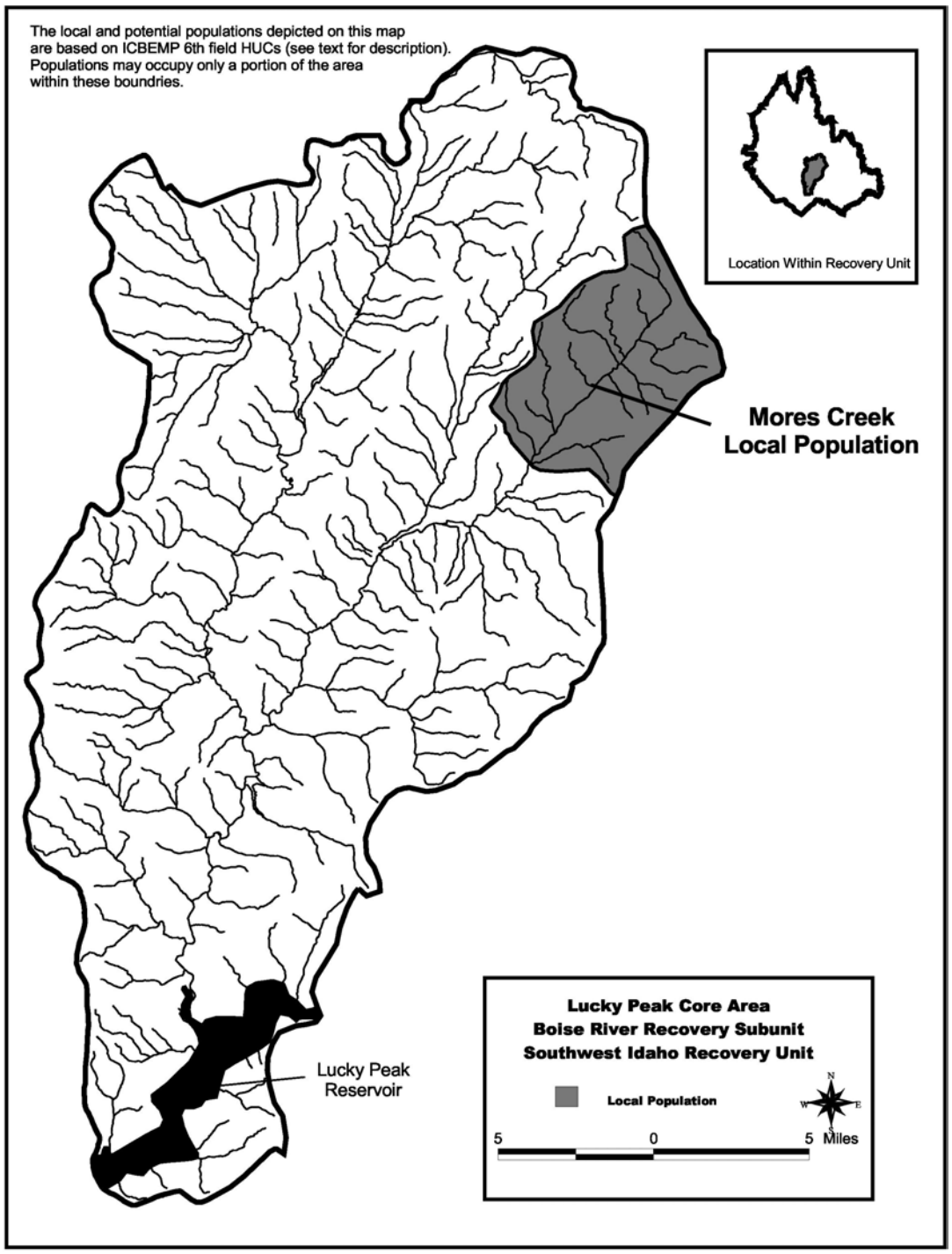


Figure 6. Payette River Recovery Subunit showing the locations of the upper South Fork Payette River, Deadwood River, Middle Fork Payette River, North Fork Payette River, and Squaw Creek core areas (see Table 6).

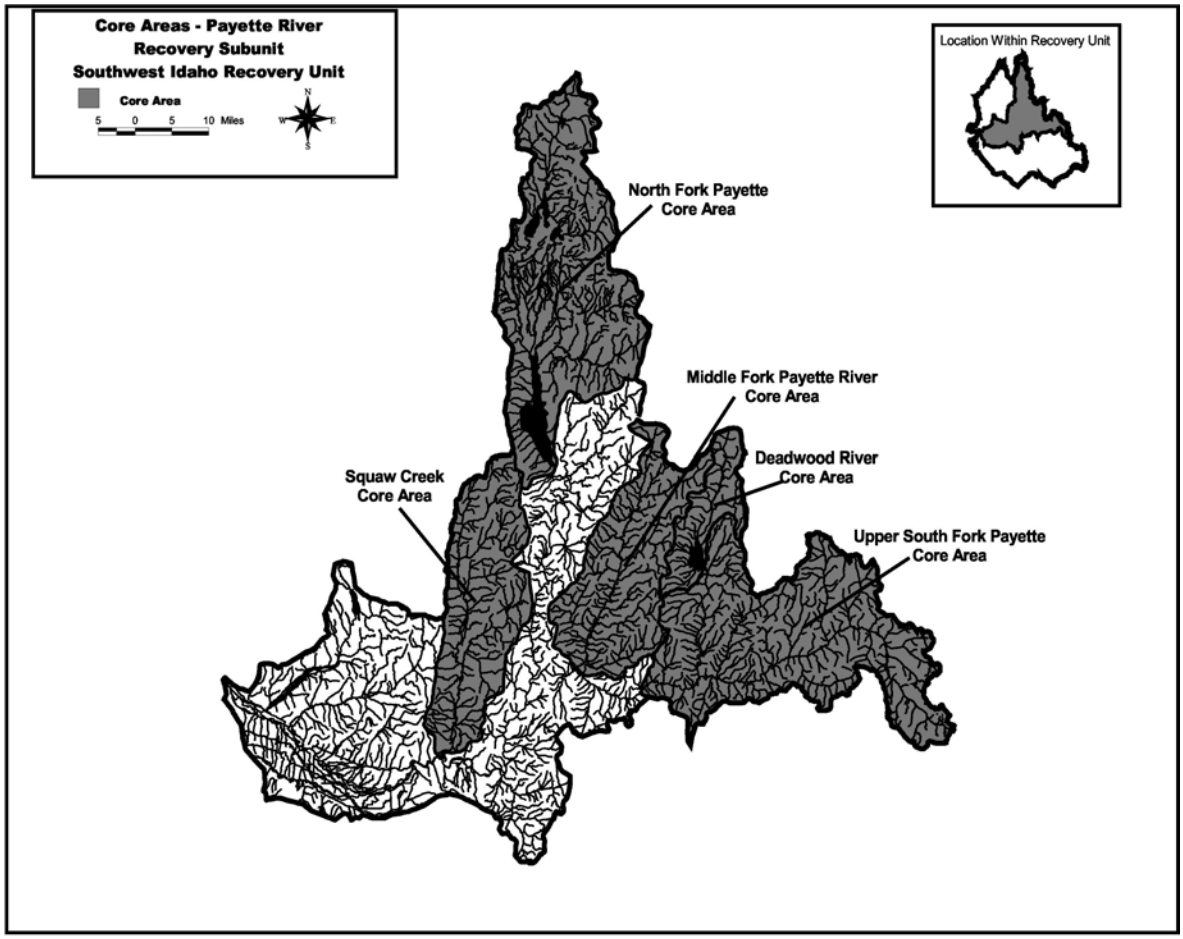


Figure 7. Upper South Fork Payette River Core Area (Payette River Recovery Subunit) showing the locations of local populations and areas with potential spawning and rearing habitat (see Table 4).

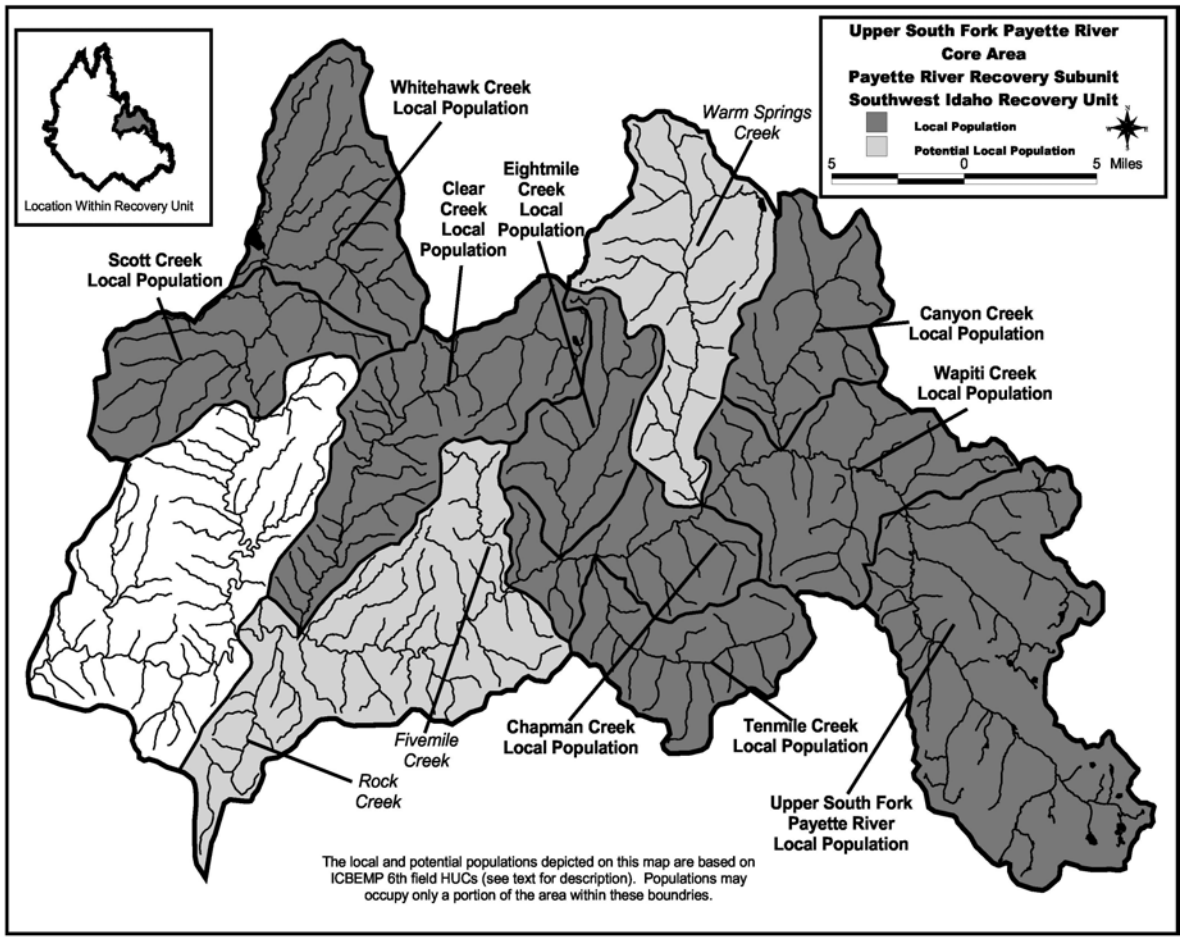


Figure 8. Deadwood River Core Area (Payette River Recovery Subunit) showing the locations of local populations and areas with potential spawning and rearing habitat (see Table 4).

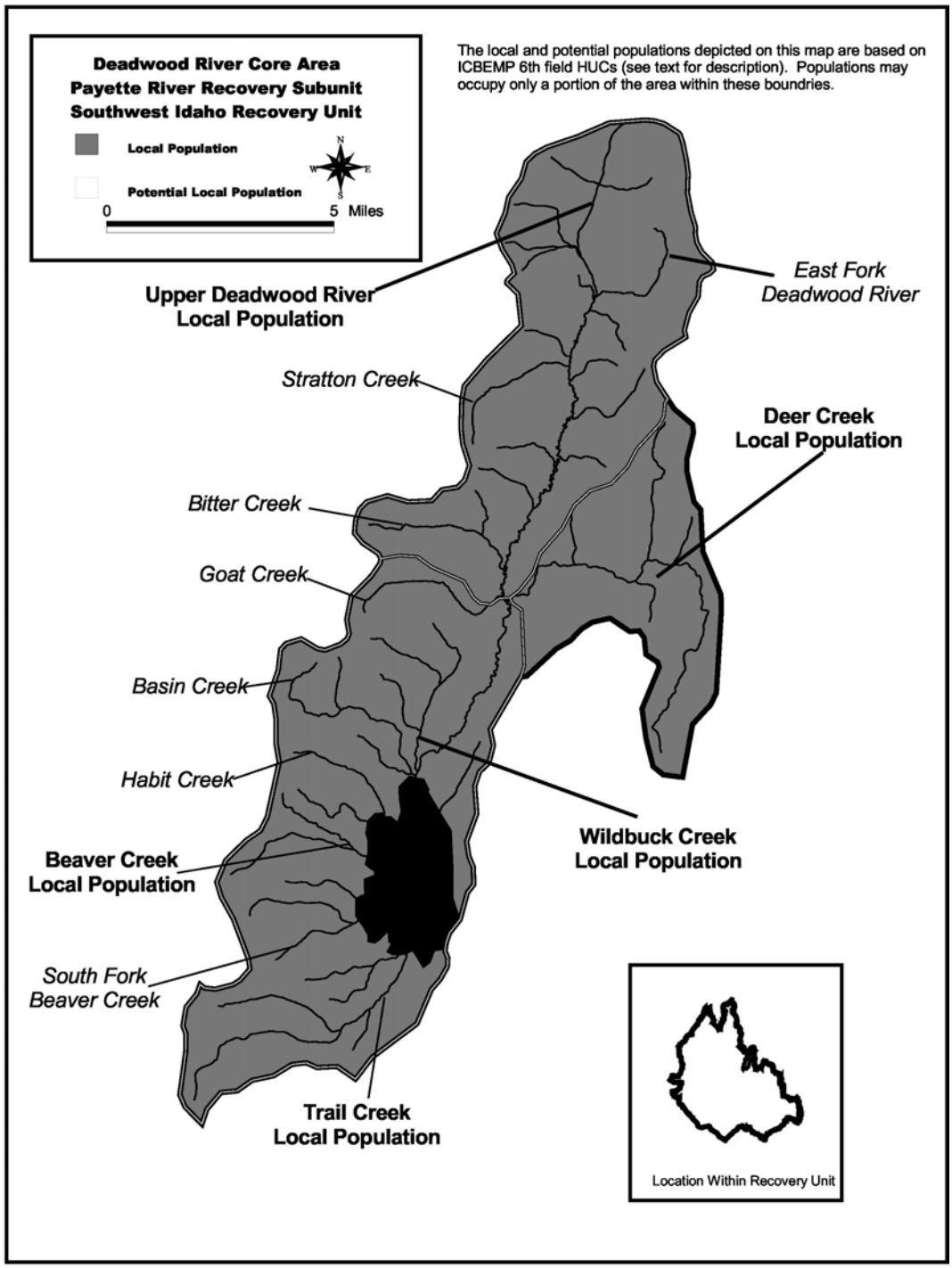


Figure 9. Middle Fork Payette River Core Area (Payette River Recovery Subunit) showing the locations of local populations and areas with potential spawning and rearing habitat (see Table 4).

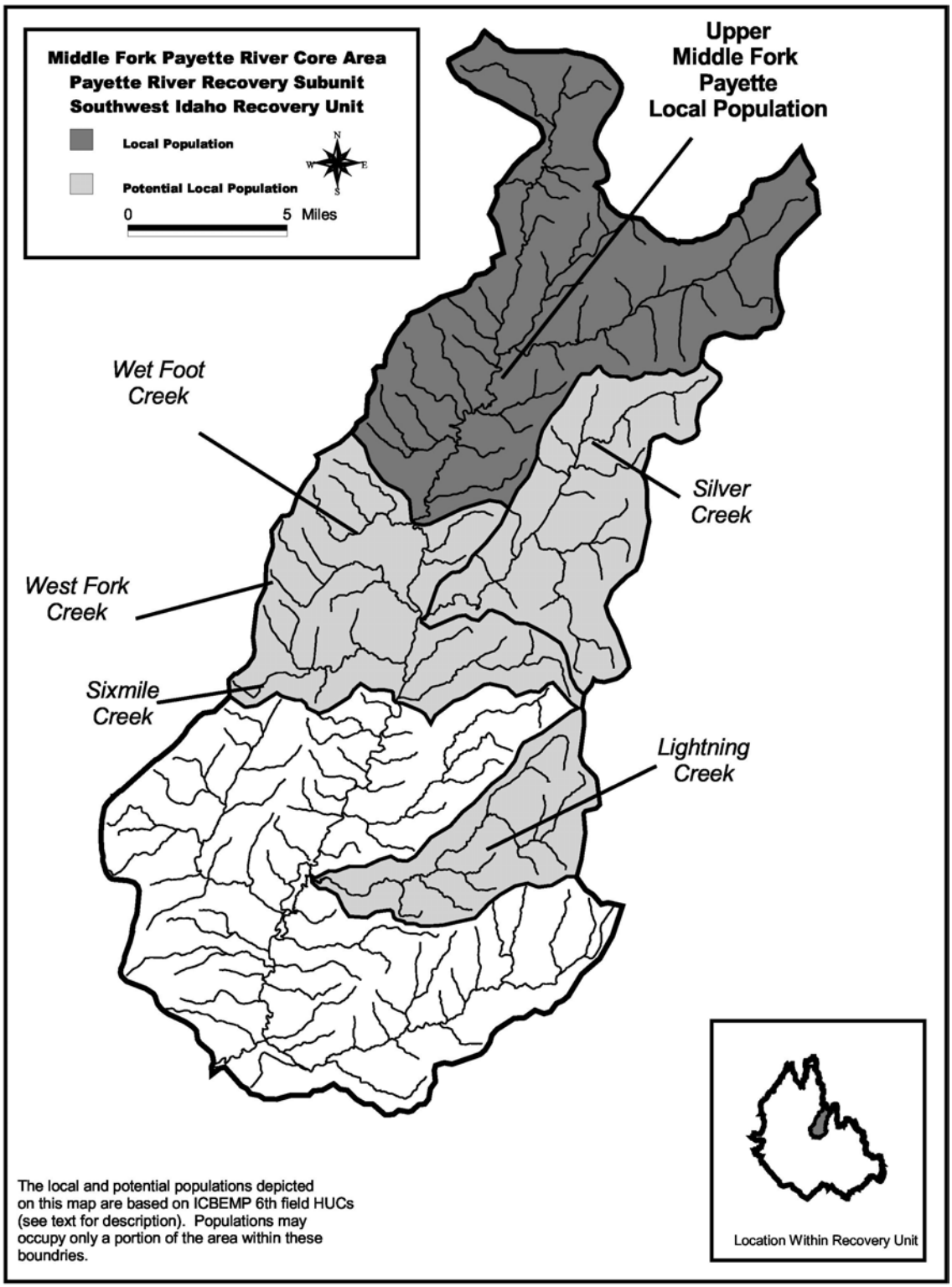


Figure 10. North Fork Payette River Core Area (Payette River Recovery Subunit) showing the locations of local populations and areas with potential spawning and rearing habitat (see Table 4).

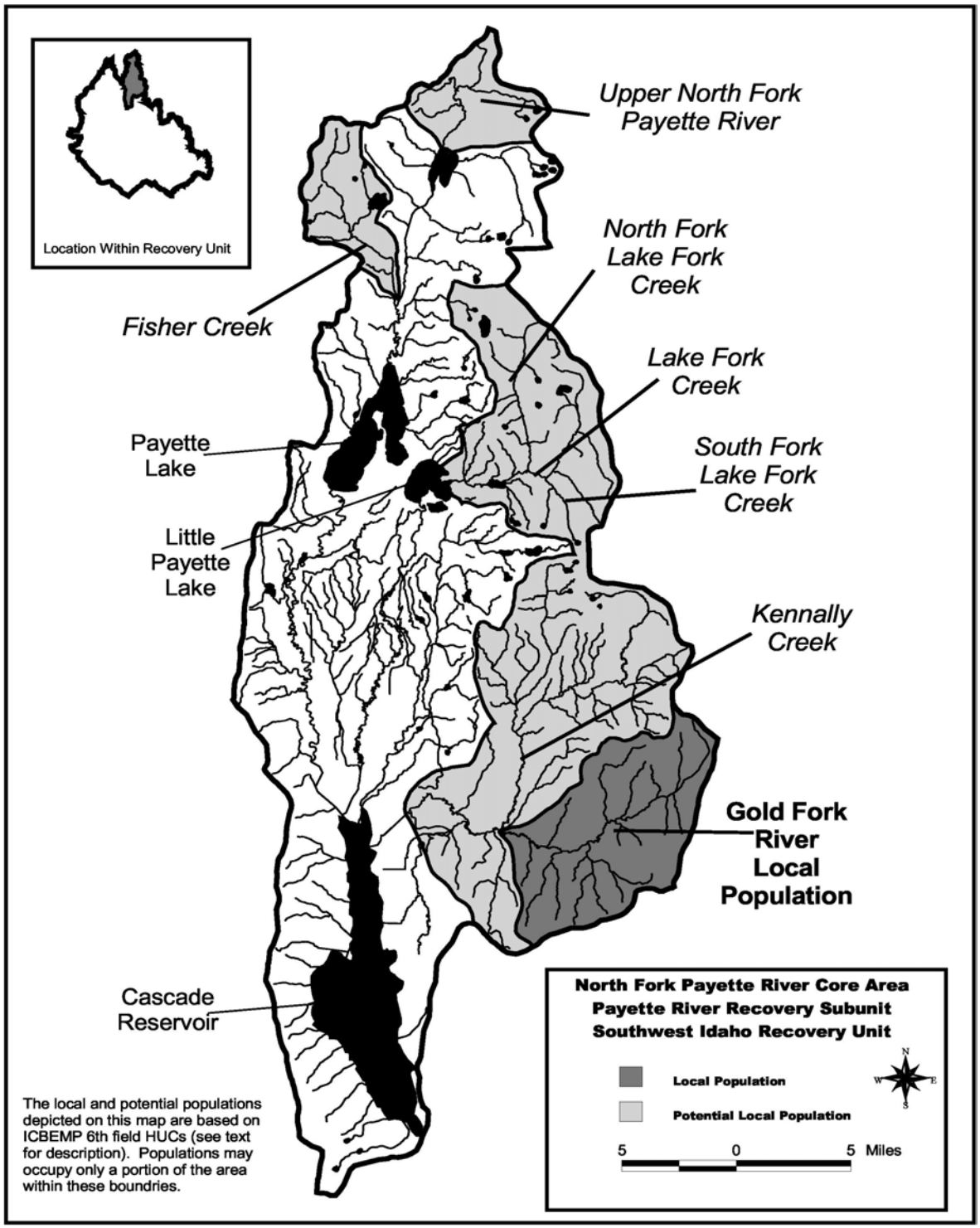


Figure 11. Squaw Creek Core Area (Payette River Recovery Subunit) showing the locations of local populations and areas with potential spawning and rearing habitat (see Table 4).

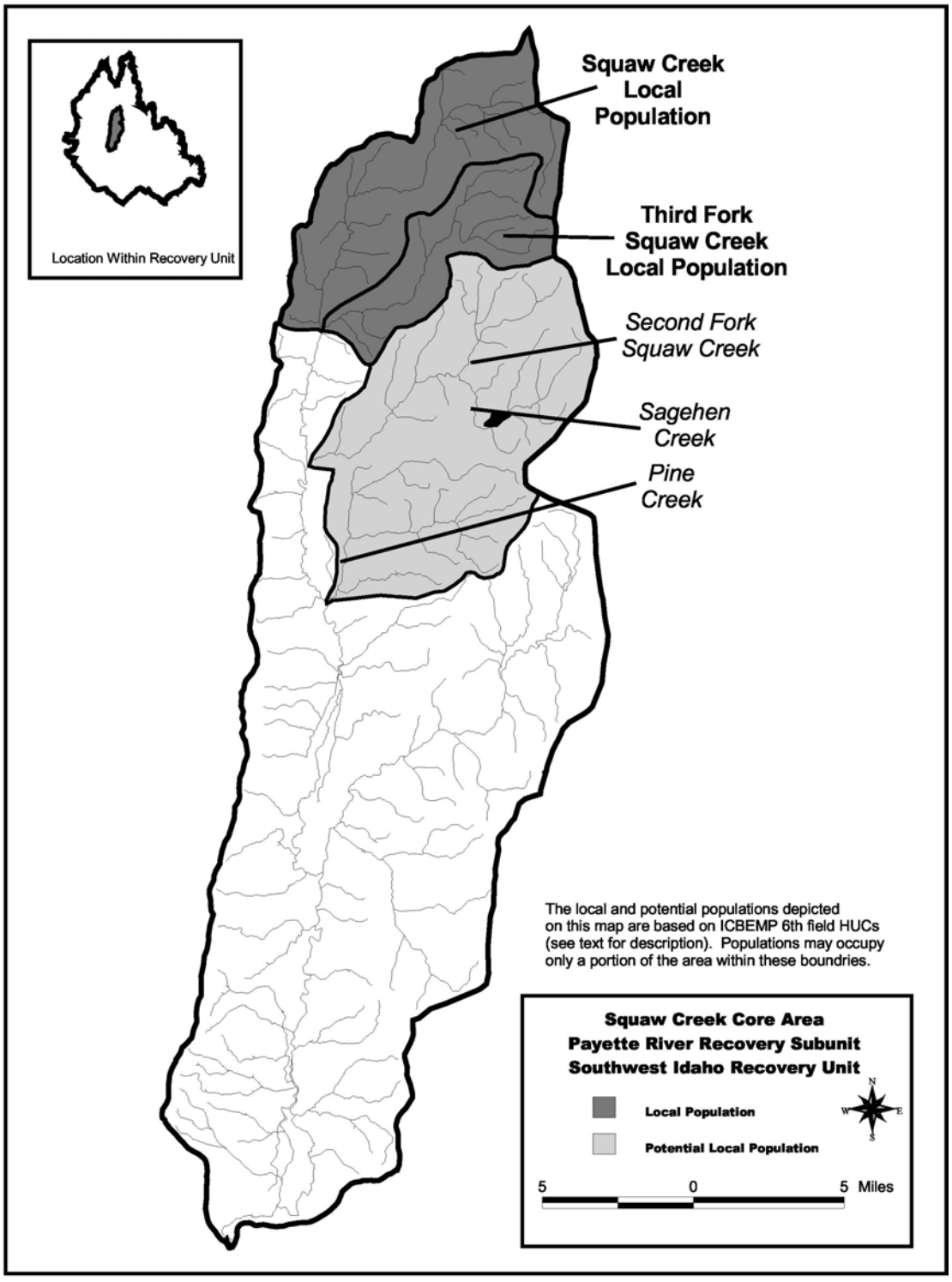


Figure 12. Weiser River Recovery Subunit showing the location of the Weiser River Core Area (see Table 4).

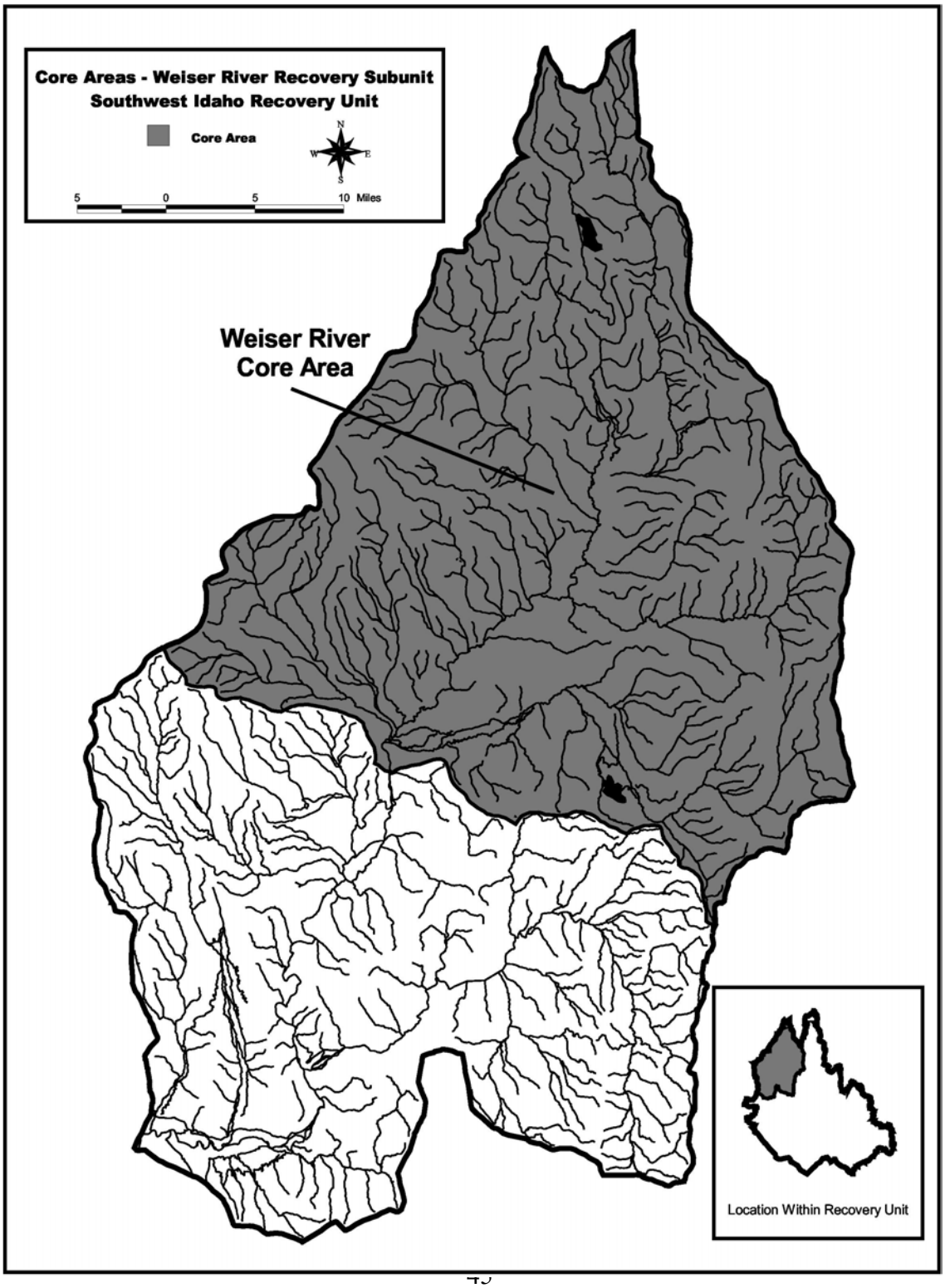
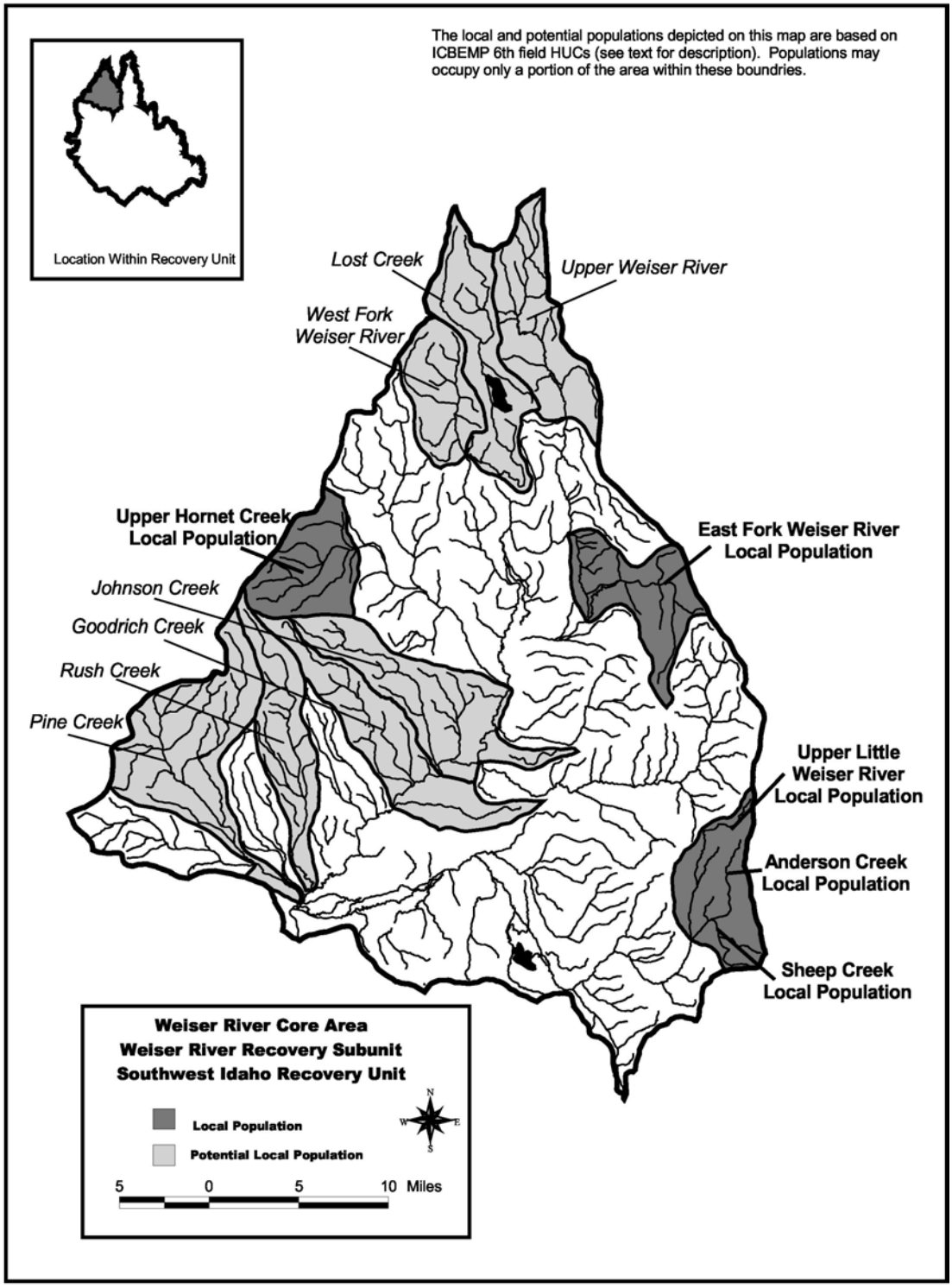


Figure 13. Weiser River Creek Core Area (Weiser River Recovery Subunit) showing the locations of local populations and areas with potential spawning and rearing habitat (see Table 4).



Recovery Goals and Objectives

The goal of the bull trout recovery plan is to **ensure the long-term persistence of self-sustaining, complex, interacting groups of bull trout distributed throughout the species' native range, so that the species can be delisted.** To achieve this goal the following objectives have been identified for bull trout in the Southwestern Idaho Recovery Unit:

- Maintain current distribution of bull trout and restore distribution in previously occupied areas within the Southwest Idaho Recovery Unit.
- Maintain stable or increasing trends in abundance of bull trout.
- Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies.
- Conserve genetic diversity and provide opportunity for genetic exchange.

Rieman and McIntyre (1993) and Rieman and Allendorf (2001) evaluated the bull trout population numbers and habitat thresholds necessary for long-term viability of the species. They identified four elements, and the characteristics of those elements, to consider when evaluating the viability of bull trout populations. These four elements are 1) number of local populations; 2) adult abundance (defined as the number of spawning fish present in a core area in a given year); 3) productivity, or the reproductive rate of the population (as measured by population trend and variability); and 4) connectivity (as represented by the migratory life history form and functional habitat). For each element, the Southwest Idaho Recovery Unit Team classified bull trout into relative risk categories based on the best available data and the professional judgment of the team.

The Southwest Idaho Recovery Unit Team also evaluated each element under a potential recovered condition to produce recovery criteria. Evaluation of these elements under a recovered condition assumed that actions identified within this chapter had been implemented. Recovery criteria for the Southwest Idaho Recovery Unit reflect 1) the stated objectives for the recovery unit, 2) evaluation of each population element in both current and recovered conditions, and 3) consideration of current and recovered habitat characteristics within the recovery unit. Recovery criteria will probably be revised in the future as more detailed information on bull trout population dynamics becomes available. Given the limited information on bull trout, both the level of adult abundance and the number of local populations needed to lessen the risk of extinction should be viewed as a best estimate.

This approach to developing recovery criteria acknowledges that the status of populations in some core areas may remain short of ideals described by conservation biology theory. Some core areas may be limited by natural attributes or by patch size and may always remain at a relatively high risk of extinction. Because of limited data within the Southwest Idaho Recovery Unit, the Recovery Unit Team relied heavily on the professional judgment of its members.

Local Populations. Metapopulation theory is important to consider in bull trout recovery. A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994) (see Chapter 1). Multiple local populations distributed and interconnected throughout a watershed provide a mechanism for spreading risk from stochastic events. In part, distribution of local populations in such a manner is an indicator of a functioning core area. Based in part on guidance from Rieman and McIntyre (1993), bull trout core areas with fewer than 5 local populations are at increased risk, core areas with between 5 and 10 local populations are at intermediate risk, and core areas with more than 10 interconnected local populations are at diminished risk.

For the Arrowrock Core Area, there are currently 15 known local populations; for the Anderson Ranch Core Area, there are 13 known local populations. Based on the above guidance, bull trout in the these two core areas are at a diminished risk. For the Upper South Fork Payette River Core Area, there are currently nine known local populations; for the Deadwood River Core Area, there are five known local populations. Based on the above guidance, bull trout in the these two core areas are at an intermediate risk category. For the South Fork Payette River Core Area, Squaw Creek Core Area, and Weiser Core Area there are currently two known local populations in each core area; for the North Fork Payette River Core Area and Lucky Peak Core Area there is currently one known local population in each core area. Based on the above guidance, bull trout in the these five core areas are at an increased risk category.

Adult Abundance. The recovered abundance levels in the Southwest Idaho Recovery Unit were determined by considering theoretical estimates of effective population size, historical census information, and the professional judgment of recovery team members. In general, effective population size is a theoretical concept that allows us to predict potential future losses of genetic variation within a population due to small population sizes and genetic drift (see Chapter 1). For the purpose of recovery planning, effective population size is the number of adult bull trout that successfully spawn annually. Based on standardized theoretical equations (Crow and Kimura 1970), guidelines have been established for maintaining minimum effective population sizes for conservation purposes. Effective population sizes of greater than 50 adults are necessary to prevent inbreeding depression and a potential decrease in

viability or reproductive fitness of a population (Franklin 1980). To minimize the loss of genetic variation due to genetic drift and to maintain constant genetic variance within a population, an effective population size of at least 500 is recommended (Franklin 1980; Soule 1980; Lande 1988). Effective population sizes required to maintain long-term genetic variation that can serve as a reservoir for future adaptations in response to natural selection and changing environmental conditions are discussed in Chapter 1 of the recovery plan.

For bull trout, Rieman and Allendorf (2001) estimated that a minimum number of 50 to 100 spawners per year is needed to minimize potential inbreeding effects within local populations. In addition, a population size of between 500 and 1,000 adults in a core area is needed to minimize the deleterious effects of genetic variation from drift.

For the purposes of bull trout recovery planning, abundance levels were conservatively evaluated at the local population and core area levels. Local populations containing fewer than 100 spawning adults per year were classified as at risk from inbreeding depression. Bull trout core areas containing fewer than 1,000 spawning adults per year were classified as at risk from genetic drift.

Productivity. A stable or increasing population is a key criterion for recovery under the requirements of the Endangered Species Act. Measures of the trend of a population (the tendency to increase, decrease, or remain stable) include population growth rate or productivity. Estimates of population growth rate (*i.e.*, productivity over the entire life cycle) that indicate a population is consistently failing to replace itself also indicate an increased risk of extinction. Therefore, the reproductive rate should indicate that the population is replacing itself, or growing.

Since estimates of the total population size are rarely available, the productivity or population growth rate is usually estimated from temporal trends in indices of abundance at a particular life stage. For example, redd counts are often used as an index of a spawning adult population. The direction and magnitude of a trend in the index can be used as a surrogate for the growth rate of the entire population. For instance, a downward trend in an abundance indicator may signal the need for increased protection, regardless of the actual size of the population. A population that is below recovered abundance levels, but that is moving toward recovery, would be expected to exhibit an increasing trend in the indicator.

The population growth rate is an indicator of probability of extinction. This probability cannot be measured directly, but it can be estimated as the consequence of the population growth rate and the variability in that rate. For a population to be considered viable, its natural productivity should be sufficient for the population to

replace itself from generation to generation. Evaluations of population status will also have to take into account uncertainty in estimates of population growth rate or productivity. For a population to contribute to recovery, its growth rate must indicate that the population is stable or increasing for a period of time. Based on the depressed, likely declining population trend and loss of range within the basin, or the lack of adequate population trend data, bull trout in all core areas within the Southwest Idaho Recovery Unit are currently at increased risk.

Connectivity. The presence of the migratory life history form within the Southwestern Idaho Recovery Unit was used as an indicator of the functional connectivity of the recovery unit and both core areas. If the migratory life form was absent, or if the migratory form is present but local populations lack connectivity, the core area was considered to be at increased risk. If the migratory life form persists in at least some local populations, with partial ability to connect with other local populations, the core area was judged to be at intermediate risk. Finally, if the migratory life form was present in all or nearly all local populations, and had the ability to connect with other local populations, the core area was considered to be at diminished risk.

Migratory bull are present in all or nearly all local populations with the ability to connect with other local populations in the Arrowrock, Anderson, and Middle Fork Payette river core areas and therefore are considered at diminishing risk. Migratory bull trout may persist in some local populations in the Upper South Fork Payette River, Deadwood River, Squaw Creek, and Weiser River core areas and therefore are considered at an intermediate risk. Migratory forms in the North Fork Payette River and Lucky Peak core areas are believed to be absent or extremely limited in their respective single local populations and therefore are considered at increasing risk.

Recovery Criteria

Recovery criteria for the Southwest Idaho Recovery Unit are summarized in Table 5 and include:

1. **Maintain current distribution of bull trout in the 54 local populations identified, and expand distribution by establishing bull trout local populations in areas identified as potential spawning and rearing habitat**. The number of existing local populations by recovery subunit and core area are: Boise River Recovery Subunit, 31 existing local populations (15 in Arrowrock Core Area, 17 in Anderson Ranch Core Area, and 1 in Lucky Peak Core Area); Payette River Recovery Subunit, 18 existing local populations (9 in upper South Fork Payette River Core Area, 5 in Deadwood River Core Area, 1 in Middle Fork Payette River Core Area, 1 in North Fork Payette River Core Area, 2 in

Squaw Creek Core Area); and 5 in Weiser River Recovery Subunit (this recovery subunit constitutes a single core area). Table 4 presents specific local populations and areas identified as having potential spawning and rearing habitat (*i.e.,* presently unoccupied areas that may be able to support local populations). Achieving criterion 1 entails: (1) maintaining existing local populations; (2) encouraging the establishment of additional bull trout local populations in potential spawning and rearing habitat in all core areas of the recovery unit (*e.g.,* by implementing recovery tasks to provide accesses to the areas and restoring habitat), which will contribute to achieving criteria 2 and 3; and (3) implementing activities (*i.e.,* task 5.5.3 in the Boise River Recovery Subunit, task 5.5.4 in the Payette River Recovery Subunit, and task 5.5.2 in the Weiser River Recovery Subunit) intended to evaluate the feasibility of establishing additional bull trout local populations in potential spawning and rearing habitat and then implementing activities to establish new local populations where feasible. Establishing at least one new local population each in the Lucky Peak, Middle Fork Payette River, North Fork Payette River, Squaw Creek, and Weiser River core areas is necessary to achieve criterion 1, if evaluations indicate that it is feasible in a specific core area. Tasks intended to assess the feasibility of establishing additional local populations should be conducted with coordinated review during implementation with the U.S. Fish and Wildlife Service.

2. **Estimated abundance of adult bull trout is at least 17,600 individuals in the Southwest Idaho Recovery Unit**. The recovered abundance of adult bull trout for the recovery unit was estimated based on professional judgement of the recovery unit team in consideration of surveyed fish densities, habitats, and potential fish production after threats have been addressed. (Estimates of current abundance and potential abundance of bull trout in the future include considerable uncertainty, for which measures of uncertainty are not presently available and are likely to vary among specific areas [e.g., population-specific definitions of mature bull trout, variability in sample efficiency, and appropriateness of extrapolating sample sites to larger areas.]) The recovered abundance of adult bull trout by recovery subunit and core area are: Boise River Recovery Subunit, at least 10,100 bull trout (at least 5,000 in Arrowrock Core Area, 5,000 in Anderson Ranch Core Area, 100 in Lucky Peak Core Area); Payette River Recovery Subunit, at least 7,000 bull trout (at least 5,000 in upper South Fork Payette River Core Area, 500 to 5,000 in Deadwood River Core Area, 500 to 5,000 in Middle Fork Payette River Core Area, 500 to 5,000 in North Fork Payette River Core Area, 500 to 5,000 in Squaw Creek Core Area); and at least 500 in Weiser River Recovery Subunit (500 to 5,000 in the single core area).

3. **Adult bull trout exhibit stable or increasing trends in abundance in the Southwest Idaho Recovery Unit.** The intent of this criterion is that adult bull trout in core areas presently below their recovered abundance exhibit increasing trends, whereas bull trout in core areas that may be at their recovered abundance exhibit stable trends.

4. **Specific barriers to bull trout migration in the Southwest Idaho Recovery Unit have been addressed.** Many barriers to bull trout migration exist within the recovery unit, and this recovery plan recommends several tasks to identify, assess, and reduce barriers to bull trout passage. Although achieving criteria 1 through 3 is expected to depend on providing passage at barriers (including barriers due to physical obstructions, unsuitable habitat, and water quality) throughout all core areas in the recovery unit, the intent of criterion 4 is to note specific barriers to address or tasks that must be performed to achieve recovery (*i.e.,* evaluated and appropriately addressed if found to be feasible). Activities necessary to fulfill this criterion for each recovery subunit include: continuing to provide passage (*e.g.,* using the existing trap-and-haul program) of bull trout at Arrowrock Dam (task 1.4.2) and identifying, assessing, and remedying potential passage barriers in the Lucky Peak Core Area (task 1.2.4) in the Boise River Recovery Subunit; addressing passage at the Gold Fork River irrigation diversion (task 1.2.3) and identifying, assessing, and remedying potential passage barriers in the Squaw Creek and North Fork Payette River core areas (tasks 1.2.2, 1.2.3, and 1.2.4) in the Payette River Recovery Subunit; and identifying, assessing, and remedying potential passage barriers in the Weiser River Core Area (tasks 1.2.1 and 1.2.2). Tasks intended to assess the feasibility of providing passage should be conducted with coordinated review during implementation with the U.S. Fish and Wildlife Service.

Recovery criteria for the Southwestern Idaho Recovery Unit were established to assess whether recovery actions have resulted in the recovery of bull trout. The Southwestern Idaho Recovery Unit Team expects that the recovery process will be dynamic and require refinements as more information becomes available over time. While removal of bull trout as a species under the Endangered Species Act (*i.e.*, delisting) can only occur for the entity that was listed (Columbia River Distinct Population Segment), the criteria listed above will be used to determine when the Southwestern Idaho Recovery Unit Recovery Unit is fully contributing to recovery of the population segment.

Table 5. Summary of values for recovery criteria in the Southwest Idaho Recovery Unit

Recovery subunit	Number of core areas	Minimum number of local populations	Adult abundance	Trend in abundance	Minimum number of barriers addressed[a]
Boise River	3	31	>10,100	stable or increasing	2
Payette River	5	18	>7,000	stable or increasing	3
Weiser River	1	5	>500	stable or increasing	2
Total	9	54	>17,600	stable or increasing	7

[a] Some values are the number of tasks that should be implemented; see preceding text for criterion 4.

ACTIONS NEEDED

Recovery Measures Narrative

In this chapter and all other chapters of the bull trout recovery plan, the recovery measures narrative consists of a hierarchical listing of actions that follows a standard template. The first-tier entries are identical in all chapters and represent general recovery tasks under which specific (*e.g.*, third-tier) tasks appear when appropriate. Second-tier entries also represent general recovery tasks under which specific tasks appear. Second-tier tasks that do not include specific third-tier actions are usually programmatic activities that are applicable across the species' range; they appear in *italic type*. These tasks may or may not have third-tier tasks associated with them; see Chapter 1 for more explanation. Some second-tier tasks may not be sufficiently developed to apply to the recovery unit at this time; they appear in *a shaded italic type (as seen here)*. These tasks are included to preserve consistency in numbering tasks among recovery unit chapters and intended to assist in generating information during the comment period for the draft recovery plan, a period when additional tasks may be developed. Third-tier entries are tasks specific to the Southwest Idaho Recovery Unit. They appear in the implementation schedule that follows this section and are identified by three numerals separated by periods.

The Southwestern Idaho Recovery Unit Chapter should be updated or revised as recovery tasks are accomplished, environmental conditions change, or monitoring results or other new information becomes available. Revisions to the Southwestern Idaho Recovery Unit Chapter will likely focus on priority streams or stream segments within core areas where restoration activities occurred, and habitat or bull trout populations have shown a positive response. The Southwestern Idaho Recovery Unit Team should meet annually to review annual monitoring reports and summaries, and make recommendations to the U.S. Fish and Wildlife Service.

Boise River Recovery Subunit

1 Protect, restore, and maintain suitable habitat conditions for bull trout.

1.1 Maintain or improve water quality in bull trout core areas or potential core habitat.

1.1.1 Reduce sediment production from roads. Activities such as restricting road use during wet weather, improving road surfaces, removing unnecessary roads, and relocating roads out of sensitive riparian areas should be used to reduce sediment

delivery to streams. Efforts should initially focus on areas where sediments are delivered to bull trout spawning and rearing habitat and watersheds with high levels of fine sediments and road densities in riparian areas greater than or equal to 0.62 kilometer per square kilometer (1 mile per square mile). Examples of streams with these characteristics include the Beaver Creek, Edna Creek, Pikes Fork Creek, upper Trinity Creek, and streams within the Feather River drainage.

1.1.2 Evaluate and improve drainage from existing roads. Water draining from roads should be directed to slope infiltration areas and not streams to reduce sediment delivery (*e.g.,* by effective cross-drain spacing and drain dip locations). Examples of areas to initially focus efforts include the Crooked River, Beaver Creek, Edna Creek, Pikes Fork, and Fall Creek watersheds. All other watersheds in the Boise River Recovery Subunit should be evaluated and road improvements made, where necessary.

1.1.3 Assess the risk of negative effects of historic mine tailings on bull trout, and implement actions to eliminate or reduce them, if necessary. Some portions of core areas were subjected to extensive mining activities in the past. The effects of resulting mine tailings on bull trout in the recovery subunit is not known.

1.2 Identify barriers or sites of entrainment for bull trout and implement tasks to provide passage and eliminate entrainment.

1.2.1 Inventory culverts to identify those inhibiting fish passage, and develop a program with schedules for their replacement or modification to improve fish passage. There are over 6,000 road crossings in the Boise River Recovery Subunit. Many crossings consist of culverts that may be barriers to fish movement. Culverts acting as barriers need to be identified and remedied (*e.g.,* by using concrete box or bottomless arched culverts, bridges, or other means). The Feather River, Trinity Creek and Beaver Creek watersheds should be inventoried first, followed by the Deer Creek, Dog Creek, Nichols Creek, Big Owl Creek, Wren Creek, Trapper Creek, Trail Creek, Swanholm Creek, Hot Creek, Cottonwood Creek, and Roaring River watersheds. Improvements to culverts should be implemented according to the program's schedules. The program should prioritize culverts

within areas so that agencies can include them in their management plans to expedite corrections.

1.2.2 Evaluate bull trout use of the fish ladder at Atlanta Dam. The fish ladder at Atlanta Dam provides migratory bull trout access to about 90 kilometers (56 miles) of previously unoccupied spawning and rearing habitat (an increase of 39 percent than previously available). Bull trout were observed using the ladder after it was initially opened, however the extent that bull trout use the ladder and it has connected areas upstream and downstream of Atlanta Dam is not known. Trends in bull trout use of the ladder through time should be recorded to generate demographic information useful for evaluating biological responses.

1.2.3 Install screens on the irrigation diversions in Big Smokey and Willow creeks of the Anderson Ranch Core Area. Screens are needed to prevent fish from entering the ditches at these diversions.

1.2.4. Evaluate possible barriers to fish passage in the Mores Creek watershed and improve passage where necessary. In the Lucky Peak core area, bull trout inhabit the headwaters of Mores Creek and Lucky Peak Reservoir. Connectivity between the headwaters and reservoir is uncertain. The watershed should be surveyed for potential barriers, and approaches to providing passage developed and implemented where appropriate.

1.3 Identify impaired stream channel and riparian areas and implement tasks to restore their functions.

1.3.1 Evaluate and address suction dredge mining impacts in bull trout spawning and rearing habitat. Appropriate restrictions in location (*i.e.,* spawning and rearing habitat) and timing of suction dredge activities should avoid potential negative effects to bull trout and bull trout habitat.

1.3.2 Identify areas where livestock grazing has negatively affected riparian and aquatic habitats, and implement actions to restore and improve stream and riparian habitats. For areas where grazing has affected bull trout habitat, restoration activities

should reduce sediment production, increase stream bank and stream channel stability, and contribute to the integrity of riparian vegetation. Potential actions that encourage passive restoration include fencing and modifying livestock dispersal, timing of use, and herding.

1.4 Operate dams to minimize negative effects on bull trout in reservoirs and downstream.

1.4.1 Establish conservation pools in Anderson Ranch Reservoir and Arrowrock Reservoir as per U.S. Fish and Wildlife Service (1999). Bull trout use the two reservoirs as foraging, migrating, and overwintering habitat. The reservoirs are also periodically drawn down to low levels. Conservation pools should be established to avoid potential negative effects on bull trout and their prey. Reasonable and prudent measures for establishing conservation pools are provided in U.S. Fish and Wildlife Service (1999).

1.4.2 Identify and implement operational actions and facilities necessary to prevent or reduce fish passage through dams. Make operational and structural modifications to Arrowrock Dam to prevent bull trout from passing downstream to Lucky Peak Reservoir. Evaluate the potential for bull trout to pass through Anderson Ranch Dam and implement preventative actions, if necessary. Reasonable and prudent measures for dam operations and the valve replacement project at Arrowrock Dam are provided in U.S. Fish and Wildlife Service (1999, 2001b). Because the valve replacement project has the potential to affect a major core population within the recovery subunit, it should be implemented to minimize effects on bull trout and their prey.

1.5 Identify upland conditions negatively affecting bull trout habitats and implement tasks to restore appropriate functions.

2 Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.

2.1 Develop, implement, and enforce public and private fish stocking policies to reduce stocking of nonnative fishes that affect bull trout.

2.2 Evaluate enforcement policies for preventing illegal transport and introduction of nonnative fishes.

2.3 Provide educational material to the public about ecosystem concerns of illegal introductions of nonnative fishes.

2.4 Evaluate biological, economic, and social effects of control of nonnative fishes.

2.4.1 Evaluate various methods to reduce the abundance of brook trout. Throughout the range of bull trout, various projects to reduce brook trout abundance have typically had mixed results and were conducted in areas where both species occur. A variety of methods should be developed and evaluated that can be used to eradicate or substantially reduce brook trout abundance in habitats where they coexist with bull trout or where their removal would facilitate establishment of a new bull trout local population. For instance, aggressive methods can be investigated in streams where bull trout do not occur with brook trout and can encompass relatively large areas (*e.g.,* entire drainages or portions of drainages of moderate size). The biological, economic, and social feasibility of methods to reduce brook trout should be evaluated, especially in areas presently unoccupied by bull trout that are necessary for bull trout recovery (*e.g.,* potential spawning and rearing habitat).

2.5 Implement control of nonnative fishes where found to be feasible and appropriate.

2.5.1 Reduce competition with brook trout where they overlap with bull trout, especially in spawning and rearing habitat. From successful methods expected to be developed per task 2.4.1 (*e.g.,* physical or chemical eradication or suppression of brook trout, or habitat modifications), select appropriate methods to apply in specific streams. Efforts should initially focus on the Crooked River, Pikes Fork, Salt Creek, and Bear River watersheds.

2.6 Develop tasks to reduce negative effects of nonnative taxa on bull trout.

3 Establish fisheries management goals and objectives compatible with bull trout recovery, and implement practices to achieve goals.

3.1 Develop and implement State and Tribal native fish management plans integrating adaptive research.

3.2 Evaluate and prevent overharvest and incidental angling mortality of bull trout.

3.2.1 Continue and expand public education programs for fish identification, angling regulations, reasons for protective regulations on bull trout, and fish handling practices. Surveys have indicated that anglers' inability to correctly identify salmonids is common. Improving anglers' ability to correctly identify fishes, awareness of regulations, and fish handling will reduce incidental harvest and hooking mortality of bull trout. Educational techniques that can be used in programs include signs at popular fishing access areas, and flyers and brochures at license vendors and resource agency offices. Examples of additional locations for signs in the Arrowrock Core Area include Swanholm and Phifer creeks.

3.2.2 Continue enforcement of current fishing regulations and increase patrols. Enforcement actions should focus on areas with the greatest risk to bull trout such as popular fishing areas at Anderson Ranch and Arrowrock reservoirs and areas used seasonally by bull trout when they may be particularly vulnerable to capture (*e.g.,* spawning and staging areas, overwintering areas).

3.3 Evaluate potential effects of introduced fishes and associated sport fisheries on bull trout recovery and implement tasks to minimize negative effects on bull trout.

3.4 Evaluate effects of existing and proposed sport fishing regulations on bull trout.

3.4.1 Investigate compliance with fishing regulations and opportunities to benefit bull trout. In conjunction with tasks 3.2.1 and 3.2.2, evaluate methods to improve anglers' knowledge of fishing regulations and issues affecting bull trout. Use information generated by this task to improve regulations and angler education.

4 Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.

4.1 Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery and management plans.

4.1.1 Collect samples for genetic analysis to contribute to establishing a program to understand the genetic baseline and monitor genetic changes throughout the range of bull trout (see Chapter 1 narrative).

4.1.2 Describe and monitor genetic and phenotypic characteristics of bull trout in core areas, and incorporate information into management strategies. The interaction of bull trout genetic composition with particular environments results in phenotypic diversity and perhaps local adaptation. Such information for particular groups of bull trout and their habitats should be generated and incorporated into management strategies to improve their effectiveness.

4.2 Maintain existing opportunities for gene flow among bull trout populations.

4.2.1 Prevent the establishment of barriers that may inhibit the movement of bull trout within the Boise River Recovery Subunit. Proposed activities that might result in structural barriers or unsuitable habitat conditions for bull trout should be thoroughly evaluated. If the evaluation finds that an activity would likely create a barrier to fish movement, alternatives to the activity should be pursued if it can not be modified to allow fish passage.

4.3 Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation.

5 Conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks.

5.1 Design and implement a standardized monitoring program to assess the effectiveness of recovery efforts affecting bull trout and their habitats.

5.2 Conduct research evaluating relationships among bull trout distribution and abundance, bull trout habitat, and recovery tasks.

5.3 Conduct evaluations of the adequacy and effectiveness of current and past best management practices in maintaining or achieving habitat conditions conducive to bull trout recovery.

5.4 Evaluate effects of diseases and parasites on bull trout, and develop and implement strategies to minimize negative effects.

5.5 Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout.

5.5.1 Continue studies on bull trout distribution, abundance, life histories, and factors affecting them. Several aspects of bull trout in the recovery subunit have been investigated relatively recently in the Arrowrock and Anderson Ranch core areas (*e.g.,* distribution, timing of life-history events, age distribution). The studies should be expanded to generate information to increase our knowledge of bull trout and improve recovery tasks and their effects. Examples of studies include conducting surveys to evaluate bull trout presence and potential habitat in the Grimes Creek watershed, and evaluating effects of agricultural practices on bull trout and their habitats in the Boise River Recovery Subunit.

5.5.2 Continue studies on the distribution, status, and life history of bull trout in the Mores Creek watershed. Bull trout were recently found in upper Mores Creek, a tributary to Lucky Peak Reservoir. Systematic surveys need to be conducted in the watershed to determine bull trout distribution, life history characteristics, and other information (*e.g.,* genetic composition) so that their relation to fish in other parts of the basin can be assessed.

5.5.3 Identify unoccupied areas that may be suitable for bull trout spawning and rearing in the Lucky Peak Core Area and develop a strategy to establish additional local populations. The core area presently contains one local population. Establishing additional local populations would improve the likelihood of the core population to persist and contribute to recovery. Unoccupied areas that may support bull trout spawning and rearing need to be

identified and a strategy developed to encourage the establishment of additional local populations.

5.6 Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout.

6 Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.

6.1 Use partnerships and collaborative processes to protect, maintain, and restore functioning core areas for bull trout.

6.2 Use existing Federal authorities to conserve and restore bull trout.

6.3 Enforce existing Federal, State, and Tribal habitat protection standards and regulations and evaluate their effectiveness for bull trout conservation.

7 Assess the implementation of bull trout recovery by recovery units, and revise recovery unit plans based on evaluations.

7.1 Convene annual meetings of each recovery unit team to review progress on recovery plan implementation.

7.2 Assess effectiveness of recovery efforts.

7.3 Revise scope of recovery as suggested by new information.

Payette River Recovery Subunit

1 Protect, restore, and maintain suitable habitat conditions for bull trout.

1.1 Maintain or improve water quality in bull trout core areas or potential core habitat.

1.1.1 Reduce sediment production from roads. Use existing surveys and conduct new surveys to identify areas of sediment delivery to streams from roads. Use survey results to develop and implement sediment reduction treatments (*e.g.,* drain modifications, graveling, road closures and elimination). Focus

initially on areas where sediment delivery from roads has been documented such as specific streams in the Squaw Creek, Middle Fork Payette River, and South Fork Payette River core areas.

1.1.2 Investigate effects of sediment and potential toxic materials from Deadwood Mine on the upper Deadwood River and bull trout. The effects of Deadwood Mine on the Deadwood River and bull trout are uncertain. If negative effects are observed, develop and implement actions to correct them.

1.2 Identify barriers or sites of entrainment for bull trout and implement tasks to provide passage and eliminate entrainment.

1.2.1 Inventory culverts to identify those inhibiting fish passage, and develop program to improve fish passage. There are numerous culverts in the Payette River Recovery Subunit that may be inhibiting fish movement. Culverts acting as barriers need to be identified and remedied (*e.g.,* by using concrete box culverts, bridges, or other means).

1.2.2 Replace the culvert identified as a fish barrier in Second Fork Squaw Creek. The absence of bull trout in the Second Fork Squaw Creek is likely influenced by a culvert that has been identified as a fish passage barrier. The stream is also considered to have unoccupied spawning and rearing habitat, which may be suitable for an additional local population. The culvert replacement project should include an evaluation to determine the role of other factors in the stream that may affect bull trout (*e.g.,* sediment from roads, cattle grazing).

1.2.3 Identify and implement actions needed to prevent the loss of bull trout at irrigation diversions and improve fish passage. Irrigation diversions likely entrain and prevent or impair bull trout movement in various areas of the Payette River Recovery Subunit, especially in the Squaw Creek and North Fork Payette River core areas (*i.e.,* Gold Fork River). Specific actions to prevent fish loss and improve passage need to be developed and implemented.

1.2.4 Evaluate fish passage at diversions on Lake Fork and Fisher Creek and implement actions to prevent fish loss and improve passage, if necessary. In the North Fork Payette River Core

Area, bull trout were observed in Lake Fork and Fisher Creek during past surveys. More recent surveys have failed to detect bull trout; consequently, they may be in extremely low abundance or perhaps extirpated. Passage at the diversions may have influenced bull trout in these watersheds and could affect the potential for the streams to support bull trout in the future.

1.3 Identify impaired stream channel and riparian areas and implement tasks to restore their functions.

1.3.1 Identify areas where livestock grazing has negatively affected riparian and aquatic habitats, and implement actions to restore and improve stream and riparian habitats. For areas where grazing has affected habitats, restoration activities should reduce sediment production, increase stream bank and stream channel stability, and contribute to the integrity of riparian vegetation. Potential actions that encourage passive restoration include fencing and modifying livestock dispersal, timing of use, and herding. For example, fences can be used to exclude livestock from sensitive areas in Squaw Creek and a rider can reduce concentrations of livestock in unfenced areas of Squaw Creek and Gold Fork River.

1.3.2 Investigate and implement methods for restoring habitat conditions in the lower Middle Fork Payette River. Potential foraging, migrating, and overwintering habitat in the lower Middle Fork Payette River has been degraded by excess sedimentation. Sediments have filled pools, increased stream width:depth ratios, and reduced habitat complexity. Investigate restoration methods (*e.g.,* road modifications, increasing riparian vegetation) that reduce sediment delivery, reduce width to depth ratios, and increase habitat complexity.

1.4 Operate dams to minimize negative effects on bull trout in reservoirs and downstream.

1.4.1 Evaluate and implement appropriate operations at Deadwood Dam to provide adequate flows and temperatures for bull trout downstream of the dam. Water released from Deadwood Reservoir may not be conducive to bull trout recovery due to inappropriate temperatures and flow regime. Dam operation

should be evaluated relative to bull trout needs and modified if necessary.

1.4.2 Establish a conservation pool in Deadwood Dam. Deadwood Dam is presently operated to maintain a winter flow of 1.4 cubic meters per second (50 cubic feet per second) and a minimum pool of about 62 million cubic meters (50,000 acre-feet). Although these operations are not believed to adversely affect bull trout inhabiting Deadwood Reservoir, they need to be evaluated relative to recovery of bull trout in both the Deadwood River and South Fork Payette River core areas.

1.5 Identify upland conditions negatively affecting bull trout habitats and implement tasks to restore appropriate functions.

2 Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.

2.1 Develop, implement, and enforce public and private fish stocking policies to reduce stocking of nonnative fishes that affect bull trout.

2.2 Evaluate enforcement policies for preventing illegal transport and introduction of nonnative fishes.

2.3 Provide information to the public about ecosystem concerns of illegal introductions of nonnative fishes.

2.4 Evaluate biological, economic, and social effects of control of nonnative fishes.

2.4.1 Evaluate various methods to reduce the abundance of brook trout. Throughout the range of bull trout, various projects to reduce brook trout abundance have typically had mixed results and were conducted in areas where both species occur. A variety of methods should be developed and evaluated that can be used to eradicate or substantially reduce brook trout abundance in habitats where they coexist with bull trout or where their removal would facilitate establishment of a new bull trout local population. For instance, aggressive methods can be investigated in streams where bull trout do not occur with brook trout and can encompass relatively large areas (*e.g.,* entire drainages or portions of drainages of moderate size). The

biological, economic, and social feasibility of methods to reduce brook trout should be evaluated, especially in areas presently unoccupied by bull trout that are necessary for bull trout recovery (*e.g.,* potential spawning and rearing habitat).

2.5 Implement control of nonnative fishes where found to be feasible and appropriate.

2.5.1 If feasible, reduce brook trout abundance where they overlap with bull trout and in areas where bull trout may become established. In the Gold Fork River drainage, the North Fork of Kennally Creek and Rapid Creek are located in largely undisturbed and roadless areas. High densities of brook trout within these streams make it unlikely that bull trout could become established. The feasibility of reducing brook trout abundance should be evaluated in portions of these streams to investigate the possibility of establishing additional local populations of bull trout in the core area. Similar evaluations should be conducted in the Squaw Creek (*i.e.,* in the mainstem Squaw Creek and Third Fork Squaw Creek) and Middle Fork Payette River (*i.e.,* Bull Creek) core areas with the intent of improving abundance of existing local populations of bull trout.

2.6 Develop tasks to reduce negative effects of nonnative taxa on bull trout.

3 Establish fisheries management goals and objectives compatible with bull trout recovery, and implement practices to achieve goals.

3.1 Develop and implement State and Tribal native fish management plans integrating adaptive research.

3.2 Evaluate and prevent overharvest and incidental angling mortality of bull trout.

3.2.1 Continue and expand public education programs for fish identification, angling regulations, reasons for protective regulations on bull trout, and fish handling practices. Surveys have indicated that anglers' inability to correctly identify salmonids is common. Improving anglers' ability to correctly identify fishes, awareness of regulations, and fish handling will reduce incidental harvest and hooking mortality of bull trout. Educational techniques that can be used in programs include

signs at popular fishing access areas, and flyers and brochures at license vendors and resource agency offices.

3.2.2 Continue enforcement of current fishing regulations and increase patrols. Patrols should focus on popular fishing areas and areas used seasonally by bull trout when they may be particularly vulnerable to capture (*e.g.,* spawning and staging areas, overwintering areas).

3.2.3 Evaluate compliance of angling regulations and incidence of bull trout poaching in Gold Fork River from Kennally Creek upstream to the confluence of the North Fork and South Fork Gold Fork River. Because of low abundance of bull trout in the Gold Fork River, every individual is important to the population. If the evaluation indicates that poaching or incidental mortality of bull trout is substantial, close the watershed to angling until a fish identification and fishing regulation education program has been successful in reducing bull trout mortality.

3.3 Evaluate potential effects of introduced fishes and associated sport fisheries on bull trout recovery and implement tasks to minimize negative effects on bull trout.

3.3.1 Evaluate the effects of fish stocking and the fishery on bull trout in Deadwood Reservoir. Although Atlantic salmon and chinook salmon were stocked in Deadwood Reservoir prior to 1998 and may have preyed on bull trout, sterile rainbow trout and kokanee are the only species currently stocked. Potential effects of the fishery (*e.g.*, poaching and incidental mortality) on bull trout should be evaluated and corrective actions implemented, if necessary.

3.4 Evaluate effects of existing and proposed sport fishing regulations on bull trout.

4 Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.

4.1 Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery and management plans.

4.1.1 Collect samples for genetic analysis to contribute to establishing a program to understand the genetic baseline and monitor genetic changes throughout the range of bull trout (see Chapter 1 narrative).

4.1.2 Describe and monitor genetic and phenotypic characteristics of bull trout in core areas, and incorporate information into management strategies. The interaction of bull trout genetic composition with particular environments results in phenotypic diversity and perhaps local adaptation. Such information for particular groups of bull trout and their habitats should be generated and incorporated into management strategies to improve their effectiveness.

4.2 Maintain existing opportunities for gene flow among bull trout populations.

4.2.1 Prevent the establishment of barriers that may inhibit the movement of bull trout within the Payette River Recovery Subunit. Proposed activities that might result in structural barriers or unsuitable habitat conditions for bull trout should be thoroughly evaluated. If the evaluation finds that an activity would likely create a barrier to fish movement, alternatives to the activity should be pursued if it can not be modified to allow fish passage.

4.3 Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation.

5 Conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks.

5.1 Design and implement a standardized monitoring program to assess the effectiveness of recovery efforts affecting bull trout and their habitats.

5.2 Conduct research evaluating relationships among bull trout distribution and abundance, bull trout habitat, and recovery tasks.

5.3 Conduct evaluations of the adequacy and effectiveness of current and past Best Management Practices in maintaining or achieving habitat conditions conducive to bull trout recovery.

5.4 Evaluate effects of diseases and parasites on bull trout, and develop and implement strategies to minimize negative effects.

5.5 Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout.

5.5.1 Conduct additional surveys focusing on migratory bull trout and bull trout habitat. Surveys should be completed in the Deadwood River, Middle Fork Payette River, and South Fork Payette River. Specific streams on which to focus include, Bull, Peace, Valley, upper Silver, and Long Fork Silver creeks.

5.5.2 Compile and synthesize historic information concerning bull trout presence, distribution, and abundance in the South Fork Payette River basin. Minimal information concerning bull trout in the area have been analyzed. Additional information may exist.

5.5.3 Conduct comprehensive surveys for bull trout in the upper North Fork Payette River Core Area. Bull trout were observed in Lake Fork and Fisher Creek watersheds during past surveys, but were not found during subsequent sampling in Fisher Creek. A comprehensive survey should resample sites where bull trout were observed in the past and additional sites including areas where bull trout may occur.

5.5.4 Develop a strategy to establish new local populations in unoccupied areas identified as having potential spawning and rearing habitat. The Middle Fork Payette River, North Fork Payette River, and Squaw Creek core areas each contain few local populations. Unoccupied areas identified as having potential spawning and rearing habitat need to be assessed to determine the feasibility of encouraging the establishment of additional local populations, and a strategy to establish new local populations developed.

5.6 Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout.

6 Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.

6.1 Use partnerships and collaborative processes to protect, maintain, and restore functioning core areas for bull trout.

6.2 Use existing Federal authorities to conserve and restore bull trout.

6.3 Enforce existing Federal, State, and Tribal habitat protection standards and regulations and evaluate their effectiveness for bull trout conservation.

7 Assess the implementation of bull trout recovery by recovery units, and revise recovery unit plans based on evaluations.

7.1 Convene annual meetings of each recovery unit team to review progress on recovery plan implementation.

7.2 Assess effectiveness of recovery efforts.

7.3 Revise scope of recovery as suggested by new information.

Weiser River Recovery Subunit

1 Protect, restore, and maintain suitable habitat conditions for bull trout.

1.1 Maintain or improve water quality in bull trout core areas or potential core habitat.

1.1.1 Reduce sediment production from roads. Develop a comprehensive transportation management plan that identifies roads that deliver sediments to streams, and implement activities to reduce sediment delivery (*e.g.,* drainage designs, graveling, road closure and elimination).

1.2 Identify barriers or sites of entrainment for bull trout and implement tasks to provide passage and eliminate entrainment.

1.2.1 Inventory culverts to identify those inhibiting fish passage, and develop a program to improve fish passage. There are numerous culverts in the Weiser River Recovery Subunit that may be inhibiting fish movement. Culverts acting as barriers need to be identified and passage improved (*e.g.,* by using concrete box culverts, bridges, or other means).

1.2.2 Identify facilities and actions needed to prevent the loss of bull trout at irrigation diversions. Irrigation diversions are thought to entrain and prevent or impair bull trout movement in several areas of the Weiser River Recovery Subunit, especially in potential foraging, migrating, and overwintering habitat. Specific actions to prevent fish loss and improve passage need to be developed and implemented.

1.3 Identify impaired stream channel and riparian areas and implement tasks to restore their functions.

1.3.1 Identify areas where livestock grazing has negatively affected riparian and aquatic habitats, and implement actions to restore and improve stream and riparian habitats. For areas where grazing has affected habitats, restoration activities should reduce sediment production, increase stream bank and stream channel stability, and contribute to the integrity of riparian vegetation. Potential actions include fencing and others that address livestock dispersal, timing of use, and herding.

1.4 Operate dams to minimize negative effects on bull trout in reservoirs and downstream.

1.5 Identify upland conditions negatively affecting bull trout habitats and implement tasks to restore appropriate functions.

2 Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.

2.1 Develop, implement, and enforce public and private fish stocking policies to reduce stocking of nonnative fishes that affect bull trout.

2.2 Evaluate enforcement policies for preventing illegal transport and introduction of nonnative fishes.

2.3 Provide information to the public about ecosystem concerns of illegal introductions of nonnative fishes.

2.4 Evaluate biological, economic, and social effects of control of nonnative fishes.

2.4.1 Evaluate various methods to reduce the abundance of brook trout. Throughout the range of bull trout, various projects to reduce brook trout abundance have typically had mixed results and were conducted in areas where both species occur. A variety of methods should be developed and evaluated that can be used to eradicate or substantially reduce brook trout abundance in habitats where they coexist with bull trout or where their removal would facilitate establishment of a new bull trout local population. For instance, aggressive methods can be investigated in streams where bull trout do not occur with brook trout and can encompass relatively large areas (*e.g.,* entire drainages or portions of drainages of moderate size). The biological, economic, and social feasibility of methods to reduce brook trout should be evaluated, especially in areas presently unoccupied by bull trout that are necessary for bull trout recovery (*e.g.,* potential spawning and rearing habitat).

2.5 Implement control of nonnative fishes where found to be feasible and appropriate.

2.5.1 Conduct surveys to determine the distribution of brook trout in the Weiser River Recovery Subunit. Although brook trout occur with bull trout in some streams (*e.g.,* upper Weiser River, Dewey Creek, and East Fork Weiser River), brook trout distribution and abundance is not well known throughout the recovery subunit.

2.5.2 Conduct a study on the feasibility of reducing brook trout abundance where they overlap with bull trout and in areas where bull trout may become reestablished. Brook trout occur with bull trout in some streams (*e.g.,* upper Weiser River, Dewey Creek, and East Fork Weiser River), and approaches to reduce brook trout abundance should be evaluated.

2.6 Develop tasks to reduce negative effects of nonnative taxa on bull trout.

3 Establish fisheries management goals and objectives compatible with bull trout recovery, and implement practices to achieve goals.

3.1 Develop and implement State and Tribal native fish management plans integrating adaptive research.

3.2 Evaluate and prevent overharvest and incidental angling mortality of bull trout.

3.3 Evaluate potential effects of introduced fishes and associated sport fisheries on bull trout recovery and implement tasks to minimize negative effects on bull trout.

3.3.1 Evaluate the effects of fish stocking and the fisheries on bull trout. Sterile rainbow trout are currently stocked in the Weiser River. Potential effects of the fishery (*e.g.,* poaching and incidental mortality) on bull trout should be evaluated and corrective actions implemented, if necessary.

3.4 Evaluate effects of existing and proposed sport fishing regulations on bull trout.

4 Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.

4.1 Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery and management plans.

4.1.1 Collect samples for genetic analysis to contribute to establishing a program to understand the genetic baseline and monitor genetic changes throughout the range of bull trout (see Chapter 1 narrative).

4.1.2 Describe and monitor genetic and phenotypic characteristics of bull trout in core areas, and incorporate information into management strategies. The interaction of bull trout genetic composition with particular environments results in phenotypic diversity and perhaps local adaptation. Such information for particular groups of bull trout and their habitats should be generated and incorporated into management strategies to improve their effectiveness.

4.2 Maintain existing opportunities for gene flow among bull trout populations.

4.2.1 Prevent the establishment of barriers that may inhibit the movement of bull trout within the Weiser River Recovery

Subunit. Proposed activities that might result in structural barriers or unsuitable habitat conditions for bull trout should be thoroughly evaluated. If the evaluation finds that an activity would likely create a barrier to fish movement, alternatives to the activity should be pursued if it can not be modified to allow fish passage.

4.3 Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation.

5 Conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks.

5.1 Design and implement a standardized monitoring program to assess the effectiveness of recovery efforts affecting bull trout and their habitats.

5.2 Conduct research evaluating relationships among bull trout distribution and abundance, bull trout habitat, and recovery tasks.

5.3 Conduct evaluations of the adequacy and effectiveness of current and past Best Management Practices in maintaining or achieving habitat conditions conducive to bull trout recovery.

5.4 Evaluate effects of diseases and parasites on bull trout, and develop and implement strategies to minimize negative effects.

5.5 Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout.

5.5.1 Continue surveys to refine information on bull trout distribution, abundance, life histories, and habitats. Studies should be conducted to generate information to expand our knowledge of bull trout and improve recovery tasks and their effects in the Weiser River Recovery Subunit.

5.5.2 Develop a strategy to establish new local populations in unoccupied areas identified as having potential spawning and rearing habitat. The Weiser River Core Area contains relatively few local populations. Unoccupied areas identified as having potential spawning and rearing habitat need to be assessed to determine the feasibility of encouraging the establishment of

additional local populations, and a strategy to establish new local populations developed.

5.6 Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout.

6 Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.

6.1 Use partnerships and collaborative processes to protect, maintain, and restore functioning core areas for bull trout.

6.2 Use existing Federal authorities to conserve and restore bull trout.

6.3 Enforce existing Federal, State, and Tribal habitat protection standards and regulations and evaluate their effectiveness for bull trout conservation.

7 Assess the implementation of bull trout recovery by recovery units, and revise recovery unit plans based on evaluations.

7.1 Convene annual meetings of each recovery unit team to review progress on recovery plan implementation.

7.2 Assess effectiveness of recovery efforts.

7.3 Revise scope of recovery as suggested by new information.

IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows describes recovery task priorities, task numbers, task descriptions, duration of tasks, potential or participating responsible parties, total cost estimate and estimates for the next 5 years, if available, and comments. These tasks, when accomplished, will lead to recovery of bull trout in the Southwest Idaho Recovery Unit. Costs estimates are not provided for tasks which are normal agency responsibility under existing authorities.

Parties with authority, responsibility, or expressed interest to implement a specific recovery task are identified in the Implementation Schedule. Listing a responsible party does not imply that prior approval has been given or require that party to participate or expend any funds. However, willing participants will benefit by demonstrating that their budget submission or funding request is for a recovery task identified in an approved recovery plan, and is therefore part of a coordinated recovery effort to recover bull trout. In addition, section 7(a)(1) of the Endangered Species Act directs all Federal agencies to use their authorities to further the purposes of the Endangered Species Act by implementing programs for the conservation of threatened or endangered species.

Following are definitions to column headings and keys to abbreviations and acronyms used in the implementation schedule:

Priority Number: All priority 1 tasks are listed first, followed by priority 2 and priority 3 tasks.

Priority 1: All actions that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2: All actions that must be taken to prevent a significant decline in species population, habitat quality, or some other significant negative effect short of extinction.

Priority 3: All other actions necessary to provide for full recovery (or reclassification) of the species.

Task Number and Task Description: Recovery tasks are numbered as in the recovery outline. Refer to the action narrative for task descriptions.

Task Duration: Expected number of years to complete the corresponding task. Study designs can incorporate more than one task, which when combined, may reduce the time needed for task completion.

Responsible or Participating Party: Federal, State, Native American Tribes, non-governmental organizations, or universities with responsibility or capability to fund, authorize or carry out the corresponding recovery task. Additional identified agencies or parties are considered cooperators in conservation efforts.

Bold face type indicates the agency or agencies that have the lead role for task implementation and coordination, though not necessarily sole responsibility.

Identified parties include:

BC	Boise Corporation
BLM	Bureau of Land Management
EPA	Environmental Protection Agency
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDL	Idaho Department of Lands
IDT	Idaho Department of Transportation
IDWR	Idaho Department of Water Resources
landowners	private landowners
NRCS	Natural Resources Conservation Service
operators	diversion operators
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USFWS	U.S. Fish and Wildlife Service
USFS	U.S. Forest Service

Cost Estimates: Cost estimates are rough estimates and are only provided for general guidance. Total costs are estimated for both the duration of the task, are itemized annually for the next 5 years, and include estimates of expenditures by local, Tribal, State, and Federal governments and private business and individuals.

An asterisk (*) in the total cost column indicates ongoing tasks that are currently being implemented as part of normal agency responsibilities under existing authorities. Because these tasks are not being done specifically or solely for bull trout conservation, they are not included in the cost estimates. Some of these efforts may be occurring at reduced funding levels and/or in only a small portion of the watershed.

Double asterisk (**) in the total cost column indicates that estimated costs for these tasks are not determinable at this time. Input is requested to help develop reasonable cost estimates for these tasks.

Triple asterisk (***) indicates costs are combined with or embedded within other related tasks.

Implementation Schedule for the Bull Trout Recovery Plan: Southwest Idaho Recovery Unit, Boise River Recovery Subunit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
1	1.1.1	Reduce sediment production from roads.	25	IDEQ, IDT, **USFS**	***						Coordinate with task 1.1.2.
1	1.1.2	Evaluate and improve drainage from existing roads.	25	IDEQ, IDT, **USFS**	***						Coordinate with task 1.1.1.
1	1.2.1	Inventory culverts to identify those inhibiting fish passage, and develop a program with schedules for their replacement or modification to improve fish passage.	10	**USFS**	*						Ongoing[1]
1	1.2.3	Install screens on the irrigation diversions in Big Smokey and Willow creeks in the Anderson Ranch Core Area.	1	IDFG, **IDWR**, NRCS, **operators**	*						
1	1.2.4	Evaluate possible barriers to fish passage in the Mores Creek watershed and improve passage where necessary.	2	**IDFG**, IDT, **USFS**	40	20	20				Cost estimate for evaluation of barriers.

[1]Ongoing tasks are currently being implemented as part of normal agency responsibilities that may benefit bull trout. Because these actions are not specifically being done to address bull trout conservation, they are not included in the cost estimates. Some of these efforts may be occurring at reduced funding levels and/or in only a small portion of the watershed

Implementation Schedule for the Bull Trout Recovery Plan: Southwest Idaho Recovery Unit, Boise River Recovery Subunit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
1	1.4.1	Establish conservation pools in Anderson Ranch Reservoir and Arrowrock Reservoir.	5	**USBR**, IDFG, IDWR, USFWS	198	78	30	15	45	30	Ongoing, see USFWS 1999; Rieber, USBR, *in litt.* 2001.
1	1.4.2	Identify and implement operational actions and facilities necessary to prevent or reduce fish passage through dams.	5	**USBR**, IDFG, IDWR, USFWS	290	40	72	74	52	52	Ongoing, see USFWS 1999, 2001; Rieber, USBR, *in litt.* 2001.
1	2.4.1	Evaluate various methods to reduce the abundance of brook trout.	5	BLM, **IDFG**, USFWS, USFS	250	50	50	50	50	50	Ongoing.
1	2.5.1	Reduce competition with brook trout where they overlap with bull trout, especially in spawning and rearing habitat.	25	BLM, **IDFG**, USFWS, USFS	***						Task dependent on results of task 2.4.1.
1	4.2.1	Prevent the establishment of barriers that may inhibit the movement of bull trout within the Boise River Recovery Subunit.	25	**BLM, USBR, IDFG, IDL, USFWS, USFS**	*						Ongoing.
2	1.3.1	Restrict suction dredge mining in bull trout spawning and rearing habitat.	25	**IDL**, USFS	*						No additional costs expected to existing permit system.

Implementation Schedule for the Bull Trout Recovery Plan: Southwest Idaho Recovery Unit, Boise River Recovery Subunit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
2	1.3.2	Identify areas where livestock grazing has negatively affected riparian and aquatic habitats, and implement actions to restore and improve stream and riparian habitat.	25	**BLM**, IDFG, **landowners**, NRCS, **USFS**	500	20	20	20	20	20	Cost estimate for identifying areas affected by grazing.
2	5.5.1	Continue studies on bull trout distribution, abundance, life histories, and factors affecting them.	5	**BLM, USBR, IDFG, IDL, USFWS, USFS**	125	25	25	25	25	25	Ongoing.
2	5.5.2	Continue studies on the distribution, status, and life history of bull trout in the Mores Creek watershed.	3	USBR, IDFG, **USFS**	150	50	50	50			Ongoing.
2	5.5.3	Identify unoccupied areas that may be suitable for bull trout spawning and rearing in the Lucky Peak Core Area and develop a strategy to establish additional local populations.	3	USBR, IDFG, **USFS**, USFWS	150		50	50	50		Coordinate with task 5.5.2.
3	1.1.3	Assess the risk of negative effects of historic mine tailings on bull trout, and implement actions to eliminate or reduce them, if necessary.	5	**EPA, IDEQ**, IDFG, IDL, USFWS, USFS	100	20	20	20	20	20	Ongoing, in part. Cost estimate for assessment.
3	1.2.2	Evaluate bull trout use of the fish ladder at Atlanta Dam.	10	**IDFG**	150	15	15	15	15	15	Ongoing

Implementation Schedule for the Bull Trout Recovery Plan: Southwest Idaho Recovery Unit, Boise River Recovery Subunit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
3	3.2.1	Continue and expand public education programs for fish identification, angling regulations, reasons for protective regulations on bull trout, and fish handling practices.	25	BLM, **IDFG**, USFS	250	10	10	10	10	10	Ongoing, cost estimate for production of educational materials.
3	3.2.2	Continue enforcement of current fishing regulations and increase patrols.	25	**IDFG**	*						Ongoing.
3	3.4.1	Investigate compliance with fishing regulations and opportunities to benefit bull trout.	25	**IDFG**	***						Ongoing, coordinate with tasks 3.2.1 and 3.2.2.
3	4.1.1	Collect samples for genetic analysis to contribute to establishing a program to understand the genetic baseline and monitor genetic changes throughout the range of bull trout (see Chapter 1 narrative).		**BLM, USBR, IDEQ, IDFG, IDL, USFWS, USFS**	*						See Chapter 1.

Implementation Schedule for the Bull Trout Recovery Plan: Southwest Idaho Recovery Unit, Boise River Recovery Subunit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
3	4.1.2	Describe and monitor genetic and phenotypic characteristics of bull trout in core areas, and incorporate information into management strategies.	5	**BLM, USBR, IDEQ, IDFG, IDL, USFWS, USFS**	100	20	20	20	20	20	Cost estimate for the collection of tissue during existing surveys.
1	1.1.1	Reduce sediment production from roads.	25	IDEQ, IDT, **USFS**	*						
1	1.2.1	Inventory culverts to identify those inhibiting fish passage, and develop program to improve fish passage.	25	IDFG, IDT, **USFS**	*						
1	1.2.3	Identify and implement actions needed to prevent the loss of bull trout at irrigation diversions and improve fish passage.	25	IDFG, **IDWR**, NRCS, **operators,** USFS	*						
1	1.4.1	Evaluate and implement appropriate operations at Deadwood Dam to provide adequate flows and temperatures for bull trout downstream of the dam.	3	**USBR**, IDFG, IDWR, USFWS	180		50	50	80		Coordinate with task 1.4.2. See Rieber, USBR, *in litt.* 2001.
1	1.4.2	Establish a conservation pool in Deadwood Dam.	4	**USBR**, IDFG, IDWR, USFWS	125	40	30	45	10		Ongoing, see Rieber, USBR, *in litt.* 2001.
1	2.4.1	Evaluate various methods to reduce the abundance of brook trout.	5	BLM, **IDFG,** USFWS, USFS	250	50	50	50	50	50	Ongoing.

1	2.5.1	If feasible, reduce brook trout abundance where they overlap with bull trout and in areas where bull trout may become established.	25	BLM, **IDFG**, USFWS, USFS	*						Task dependent on results of task 2.4.1.
1	4.2.1	Prevent the establishment of barriers that may inhibit the movement of bull trout within the Payette River Recovery Subunit.	25	**BLM, USBR, IDFG, IDL,** USFWS, **USFS**	*						Ongoing.
2	1.3.1	Identify areas where livestock grazing has negatively affected riparian and aquatic habitats, and implement actions to restore and improve stream and riparian habitat.	25	**BLM**, IDFG, **landowners**, NRCS, **USFS**	500	20	20	20	20	20	Cost estimate for identifying areas affected by grazing.
2	1.3.2	Investigate and implement methods for restoring habitat conditions in the lower Middle Fork Payette River.	25	IDFG, **USFS**	500	20	20	20	20	20	Cost estimate for investigate of methods.
2	5.5.1	Conduct additional surveys focusing on migratory bull trout and bull trout habitat.	5	**BLM, USBR, IDEQ, IDFG, IDL, USFWS, USFS**	250	50	50	50	50	50	
2	5.5.3	Conduct comprehensive surveys for bull trout in the upper North Fork Payette River Core Area.	3	IDFG, **USFS**	150	50	50	50			
2	5.5.4	Develop a strategy to establish new local populations in unoccupied areas identified as having potential spawning and rearing habitat.	3	IDFG, USFWS, **USFS**	150		50	50	50		
3	1.1.2	Investigate effects of sediment and potential toxic materials from Deadwood Mine on the Deadwood River and bull trout.	2	**EPA, IDEQ,** IDFG, USFS	100	50	50				

3	1.2.2	Replace the culvert identified as a fish barrier in Second Fork Squaw Creek.	1	**USFS**	*						
3	1.2.4	Evaluate fish passage at diversions on Lake Fork and Fisher Creek and implement actions to prevent fish loss and improve passage, if necessary.	2	IDFG, **IDWR, operators,** USFS	*						
3	3.2.1	Continue and expand public education programs for fish identification, angling regulations, reasons for protective regulations on bull trout, and fish handling practices.	25	BLM, **IDFG**, USFS	*						Ongoing.
3	3.2.2	Continue enforcement of current fishing regulations and increase patrols.	25	**IDFG**	*						Ongoing.
3	3.2.3	Evaluate compliance of angling regulations and incidence of bull trout poaching in Gold Fork River from Kennally Creek upstream to the confluence of the North Fork and South Fork Gold Fork River.	3	**IDFG**	*						
3	3.3.1	Evaluate the effects of fish stocking and the fishery on bull trout in Deadwood Reservoir.	3	**IDFG**	150	50	50	50			
3	4.1.1	Collect samples for genetic analysis to contribute to establishing a program to understand the genetic baseline and monitor genetic changes throughout the range of bull trout (see Chapter 1 narrative).		**BLM, USBR, IDEQ, IDFG,** IDL, **USFWS, USFS**	*						See chapter 1.

3	4.1.2	Describe and monitor genetic and phenotypic characteristics of bull trout in core areas, and incorporate information into management strategies.	5	**BLM, USBR, IDEQ, IDFG, IDL, USFWS, USFS**	100	20	20	20	20	20	Cost estimate for the collection of tissue during existing surveys.
3	5.5.2	Compile and synthesize historic information concerning bull trout presence, distribution, and abundance in the South Fork Payette River basin.	3	IDFG, **USFS**	75	25	25	25			

Implementation schedule for the bull trout recovery plan: Southwest Idaho Unit, Weiser River Recovery Subunit

Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
1	1.1.1	Reduce sediment production from roads.	25	BC, BLM, IDEQ, IDL, IDT, **USFS**	*						Ongoing.
1	1.2.1	Inventory culverts to identify those inhibiting fish passage, and develop program to improve fish passage.	25	BC, BLM, IDFG, IDL, **USFS**	*						Ongoing
1	1.2.2	Identify facilities and actions needed to prevent the loss of bull trout at irrigation diversions.	25	IDFG, **IDWR**, NCRS, **operators,** USFS	*						
1	1.3.1	Identify areas where livestock grazing has negatively affected riparian and aquatic habitats, and implement actions to restore and improve stream and riparian habitat.	25	**BLM**, CDFG, IDL, **landowners**, NRCS, USFWS, **USFS**	500	20	20	20	20	20	Cost estimates for identifying areas affected by grazing.

Implementation schedule for the bull trout recovery plan: Southwest Idaho Unit, Weiser River Recovery Subunit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
1	2.4.1	Evaluate various methods to reduce the abundance of brook trout.	5	BLM, **IDFG**, USFWS, USFS	250	50	50	50	50	50	
1	4.2.1	Prevent the establishment of barriers that may inhibit the movement of bull trout within the Weiser River Recovery Subunit.	Perpetual	**BLM, IDFG, IDL, USFWS, USFS**	*						Ongoing.
2	2.5.1	Conduct surveys to determine the distribution of brook trout in the Weiser River Recovery Subunit.	3	**BLM, IDFG, USFS**	150		50	50	50		
2	2.5.2	Conduct a study on the feasibility of reducing brook trout abundance where they overlap with bull trout and in areas where bull trout may become established.	3	BLM, **IDFG,** USFWS, USFS	150			50	50	50	Task dependent on results of task 2.4.1.
2	5.5.1	Continue surveys to refine information on bull trout distribution, abundance, life histories, and habitats.	5	**BLM, IDEQ, IDFG, IDL, USFWS, USFS**	125	25	25	25	25	25	
2	5.5.2	Develop a strategy to establish new local populations in unoccupied areas identified as having potential spawning and rearing habitat.	3	IDFG, IDL, USFWS, **USFS**	150		50	50	50		
3	3.3.1	Evaluate the effects of fish stocking and the fisheries on bull trout.	3	**IDFG**	150		50	50	50		

Implementation schedule for the bull trout recovery plan: Southwest Idaho Unit, Weiser River Recovery Subunit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
3	4.1.1	Collect samples for genetic analysis to contribute to establishing a program to understand the genetic baseline and monitor genetic changes throughout the range of bull trout (see Chapter 1 narrative).		**BLM, IDEQ, IDFG, IDL, USFWS, USFS**	*						See chapter 1.
3	4.1.2	Describe and monitor genetic and phenotypic characteristics of bull trout in core areas, and incorporate information into management strategies.	5	**BLM, IDEQ, IDFG, IDL, USFWS, USFS**	100	20	20	20	20	20	Cost estimate for the collection of tissue during existing surveys.

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Appendix A: Summary of bull trout information for environmental baselines in biological assessments by the Boise National Forest. Subpopulation watersheds and local population watersheds do not necessarily correspond to similar terms used in the listing rule for bull trout and this recovery plan (see sources for specific locations).

Subpopulation watershed	Local population watershed	Size[1]	Growth and survival[2]	Source	Comments in biological assessments
North and Middle Forks Boise Basin	Bear River	234	0.4 101,000	Burton 1999a	excessive fines, burned and debris floods afterwards, culvert barriers and road sedimentation especially in Bear Creek, brook trout present, priorities are road restoration and addressing brook trout
North and Middle Forks Boise Basin	Blackwarrior	2,341	0.2 220,900	Burton 1999a	strong population with migratory fish, good habitats except barriers in some tributaries, need to evaluate effects of sheep grazing in watershed, priority on investigations of culvert barriers
North and Middle Forks Boise Basin	upper Crooked	728	0.9 94,500	Burton 1999a	reduce risk of fire, reduce brook trout competition, reduce road sedimentation, remove culvert barriers
North and Middle Forks Boise Basin	Johnson Cr.	556	0.2 70,000	Burton 1999a	mostly wilderness but depressed population, needs investigation
North and Middle Forks Boise Basin	Lostman	87	0.3 41,000	Burton 1999a	
North and Middle Forks Boise Basin	lower Crooked		adjunct, nodal	Burton 1999a	reduce fire risks, reduce road sediment production and drainage, increase bull trout signs, reduce brook trout competition, identify culvert barriers

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Subpopulation watershed	Local population watershed	Size[1]	Growth and survival[2]	Source	Comments in biological assessments
North and Middle Forks Boise Basin	lower Middle Fork Boise		nodal	Burton 1999a	
North and Middle Forks Boise Basin	Middle North Fork Boise		adjunct, nodal	Burton 1999a	spawning restricted to one small drainage in roadless section, excessive fines, watershed heavily roaded, burned and debris floods in some tributaries, remove barriers, obliterate unneeded roads, reduce long-term sediment potential in RHCA from roads, need long-term restoration
North and Middle Forks Boise Basin	upper Middle Fork Boise		adjunct	Burton 1999a	excellent habitat, need passage at Kirby Dam, investigate potential natural barrier to Lynx Creek
North and Middle Forks Boise Basin	Queens River	2,549	0.15 200,000	Burton 1999a	almost all wilderness with strong population and excellent habitat, suction dredge mining and angling are main threats
North and Middle Forks Boise Basin	Rabbit-French		adjunct, nodal	Burton 1999a	currently no spawning, road restoration with culvert removal and sediment reduction
North and Middle Forks Boise Basin	Roaring River	838	0.8 164,200	Burton 1999a	mostly roadless with excellent habitats, population not extensive or strong, need to investigate culverts in lower Roaring River and restore passage

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Subpopulation watershed	Local population watershed	Size[1]	Growth and survival[2]	Source	Comments in biological assessments
North and Middle Forks Boise Basin	Silver-Cow	156	1.4 97,600	Burton 1999a	depressed population, historic dredge mining along North Fork, much is roadless, avoid further destabilization of North Fork channel
North and Middle Forks Boise Basin	upper NF Boise	3,566	0.7 120,000	Burton 1999a	strong population, all in wilderness, excellent habitats, no actions recommended
North and Middle Forks Boise Basin	Yuba River	1,750	0.7 250,000	Burton 1999a	mostly roadless, historic mining in lower reaches, suction dredging is main threat
Lower Boise River	Rattlesnake	1,205	1.1 100,000	Burton and Erickson 1999b	severely depressed likely due to past grazing and roads, recent wildfires, and high sediment associated with moderate road densities; degraded and has experienced logging, roading, and livestock grazing, and wildfire followed by high rates of erosion and sediment production in the lower part of the watershed; priority is improving habitat conditions and allow natural healing
Lower Boise River	Lower South Fork Boise		nodal	Burton and Erickson 1999b	
Lower Boise River	Sheep Creek	2,328	1.4 61,920	Burton and Erickson 1999b	strong local population is strong, many landslides in lower creek

Appendix A: Summary of bull trout information for environmental baselines in biological assessments by the Boise National Forest. Subpopulation watersheds and local population watersheds do not necessarily correspond to similar terms used in the listing rule for bull trout and this recovery plan (see sources for specific locations).

Subpopulation watershed	Local population watershed	Size[1]	Growth and survival[2]	Source	Comments in biological assessments
Lower Boise River	Arrowrock Reservoir			Burton and Erickson 1999b	
Upper Deadwood River	Deadwood Reservoir	371	0.24 39,408	Burton 1999b	sediment, potential barriers, and large pools at risk, probably due to RHCA road sedimentation and inherent erodiability of drainage
Upper Deadwood River	Upper Deadwood	789	0.23 86,749	Burton 1999b	sediment, potential barriers, and large pools at risk, probably due to RHCA road sedimentation and inherent erodiability of drainage
South Fork Payette	Five-Eightmile	<1,500	0	Burton and Erickson 1999a	need to verify bull trout occurrence (5/1/98), problems with sedimentation, barriers, lack of large woody debris and limited large pools and refugia
South Fork Payette	Canyon Creek	2,653	0.36 94,7000	Burton and Erickson 1999a	strong population with few effects to population or habitat from management activities
South Fork Payette	Clear Creek	1,100	0.7 74,043	Burton and Erickson 1999a	depressed population, sedimentation is a limiting factor, past fishing pressure has also had an effect on population size and strength
South Fork Payette	lower Deadwood		nodal	Burton and Erickson 1999a	provides nodal habitat to focal and adjunct habitat upstream, key features include overwintering habitat found in large pools.

Appendix A: Summary of bull trout information for environmental baselines in biological assessments by the Boise National Forest. Subpopulation watersheds and local population watersheds do not necessarily correspond to similar terms used in the listing rule for bull trout and this recovery plan (see sources for specific locations).

Subpopulation watershed	Local population watershed	Size[1]	Growth and survival[2]	Source	Comments in biological assessments
South Fork Payette	lower South Fork Payette		adjunct, nodal	Burton and Erickson 1999a	primarily nodal habitat, adjunct habitat in Rock Creek but amount is probably not sufficient in size to for a strong bull trout population, problems with sedimentation, barriers, lack of large woody debris and limited large pools and refugia
South Fork Payette	Middle South Fork Payette	224	0.42 22,609	Burton and Erickson 1999a	small population, adjacent tributaries provide adjunct habitat and should be evaluated for possible reestablishment of bull trout, problems with sedimentation, barriers, lack of large woody debris and limited large pools and refugia
South Fork Payette	upper South Fork Payette	NA	NA	Burton and Erickson 1999a	watersheds mostly within wilderness and is not affected by management activities
South Fork Payette	Whitehawk-Scott	3,315	0.45 118,398	Burton and Erickson 1999a	strong population of bull trout, fishing, barriers, and sediment tied to roads are primary concerns within the watershed, problems with sedimentation, barriers, lack of large woody debris and limited large pools and refugia
South Fork Payette	Warm Springs		adjunct, nodal	Burton and Erickson 1999a	small population in middle South Fork Payette, adjacent tributaries provide adjunct habitat and should be evaluated for possible reestablishment of bull trout, problems with sedimentation, barriers, lack of large woody debris and limited large pools and refugia

Appendix A: Summary of bull trout information for environmental baselines in biological assessments by the Boise National Forest. Subpopulation watersheds and local population watersheds do not necessarily correspond to similar terms used in the listing rule for bull trout and this recovery plan (see sources for specific locations).

Subpopulation watershed	Local population watershed	Size[1]	Growth and survival[2]	Source	Comments in biological assessments
Middle Fork Payette	Bull Creek	142 (2,550 in Bull and 16:1 creeks, Newberry (2002))	1.13 35,605	Burton 2000a (Newberry 2002)	depressed population, threatened by brook trout in the headwaters and naturally high sediment levels within the roadless area
Middle Fork Payette	Bulldog/Rattlesnake		nodal	Burton 2000a	
Middle Fork Payette	Silver Creek		adjunct, nodal	Burton 2000a	upper portion is adjunct habitat that is heavily affected by barriers and sediment tied primarily to dispersed recreation, brook trout occur in drainage, opportunities exist to remove brook trout, improve dispersed recreation, and return bull trout to suitable habitat within the drainage
Middle Fork Payette	Upper Middle Fork Payette	2,390 (2,932 Newberry (2002))	0.61 77,770	Burton 2000a (Newberry 2002)	strong population, concerns for brook trout establishment, barriers associated with roads, and sediment levels
Middle Fork Payette	West Fork Middle Fork Payette		adjunct, nodal	Burton 2000a	

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Subpopulation watershed	Local population watershed	Size[1]	Growth and survival[2]	Source	Comments in biological assessments
Middle Fork Payette	Lower Middle Fork Payette			Burton 2000a	provides migratory corridor for bull trout in Bull Creek and upper MF Payette, sediment levels and lack of pools are the primary concern, weak migratory component
Middle Fork Payette	Middle Middle Fork Payette			Burton 2000a	adult bull trout have been observed, but weak migratory component, sediment is concern in lower portion of watershed, steep gradients, small watershed areas, and barriers may be a problem for bull trout in adjunct habitat within tributaries
Middle Fork Payette	Lightning Creek			Burton 2000a	adjunct and nodal habitats, current concerns relate to sediment levels and large woody debris
Gold Fork Payette River	Gold Fork	1,830 (~1,600 Newberry (2000))	0.52 183,024	Burton 1998 (Newberry 2000)	depressed population, threatened by active timber sales, brook trout, and high road densities and associated sedimentation/barriers/runoff increases
Gold Fork Payette River	Kennally Creek		adjunct	Burton 1998	extensive brook trout population, no bull trout observed, road density is high in the lower reaches of watershed
Squaw Creek	Main Squaw Creek	62	0.3 62,000	Burton 1999c	depressed population, threatened by brook trout in the headwaters and high road densities and associated sedimentation/barriers/runoff increases

Appendix A: Summary of bull trout information for environmental baselines in biological assessments by the Boise National Forest. Subpopulation watersheds and local population watersheds do not necessarily correspond to similar terms used in the listing rule for bull trout and this recovery plan (see sources for specific locations).

Subpopulation watershed	Local population watershed	Size[1]	Growth and survival[2]	Source	Comments in biological assessments
Squaw Creek	Second Fork		adjunct	Burton 1999c	bull trout extinct in watershed, possible causes include barriers from roads and dams, high road sedimentation, disruption of habitats by cattle grazing/concentrations, especially on private lands, possibility of establishing an adfluvial population in Sagehen Reservoir because good spawning and rearing habitat is above lake, may be possible to restore fluvial population in creek
Squaw Creek	Third Fork	2,388	0.87 48,600	Burton 1999c	strong bull trout populations, habitats in headwaters are still in excellent condition, threatened by high road densities and possible culvert blockages, need to protect the remaining refuges in the headwaters if bull trout are to persist

[1] Estimated abundance of bull trout within a local population watershed.

[2] For the two values, the first is the estimated ratio of adult to pre-adult bull trout and the second value is estimated occupied habitat (square meters) for local population watersheds that contain "focal" habitat (*i.e.,* occupied spawning and rearing habitat). Habitat types are presented for local population watersheds that do not contain "focal" habitat; "adjunct" habitat describes unoccupied areas that may be suitable for bull trout spawning and rearing, "nodal" habitat describes areas used as migratory corridors.

Appendix B: Waters within the Southwest Idaho Recovery Unit appearing on Idaho's 1998 303(d) list (IDEQ 1998).

HUC[1]	Water body	Boundaries	Length (mile)	Pollutant(s)
North Fork and Middle Fork Boise River				
17050111	Browns Creek	Headwaters to Middle Fork Boise River	6.4	sediment
17050111	Buck Creek	Headwaters to Middle Fork Boise River	7.2	sediment
Boise-Mores				
17050112	Macks Creek	Headwaters to Grimes Creek	6.4	sediment
17050112	Minneha Creek	Headwaters to Mores Creek	8.8	sediment
South Fork Boise River				
17050113	Cayuse Creek	Headwaters to South Fork Boise River	3.2	sediment
17050113	Deer Creek	Headwaters to Anderson Ranch River	1.3	sediment
17050113	Elk Creek	Headwaters to Feather River	7.0	sediment
17050113	Little Smokey Creek	Headwaters to Carrie Creek	11.3	sediment

Appendix B: Waters within the Southwest Idaho Recovery Unit appearing on Idaho's 1998 303(d) list (IDEQ 1998).

HUC[1]	Water body	Boundaries	Length (mile)	Pollutant(s)
17050113	Rattlesnake Creek	Headwaters to South Fork Boise River	16.0	sediment
17050113	Smith Creek	Tiger Creek to South Fork Boise River	14.5	sediment
17050113	South Fork Boise River	Anderson Ranch to Arrowrock	28.7	sediment
17050113	Willow Creek	Headwaters to Arrowrock	14.9	sediment
		Lower Boise River		
17050114	Blacks Creek	Headwaters to Blacks Creek Reservoir	13.2	sediment
17050114	Boise River	Notus to Snake River	15.8	sediment, temperature
17050114	Boise River	Star to Notus	21.5	bacteria, nutrients, sediment, temperature
17050114	Boise River	Barber Diversion to Star	25.2	sediment
17050114	Boise River	Lucky Peak to Barber Diversion	5.2	flow alteration
17050114	Cottonwood Creek	Headwaters to Freestone Creek	6.8	unknown
17050114	Fivermile Creek	Headwaters to fifteenmile Creek	28.9	DO, nutrients, sediment
17050114	Indian Creek	NY Canal to Boise River	16.6	DO, nutrients, oil/gas, sediment

Appendix B: Waters within the Southwest Idaho Recovery Unit appearing on Idaho's 1998 303(d) list (IDEQ 1998).

HUC[1]	Water body	Boundaries	Length (mile)	Pollutant(s)
17050114	Indian Creek	Headwaters to NY Canal	39.0	nutrients, sediment
17050114	Lake Lowell			DO, nutrients
17050114	Mason Creek	Headwaters to Boise River	17.8	DO, nutrients, sediment
17050114	Sand Hollow Creek	Headwaters to Boise River	23.6	DO, nutrients, sediment
17050114	Tenmile Creek	Headwaters to Fifteenmile Creek	27.2	DO, nutrients, sediment
17050114	Willow Creek	Headwaters to Boise River	51.4	unknown
		South Fork Payette River		
17050120	South Fork Payette River	Wilderness boundary to Payette River	59.4	sediment
		Middle Fork Payette River		
17050121	Middle Fork Payette River	Big Bulldaog Creek to South Fork Payette River	13.0	sediment

Appendix B: Waters within the Southwest Idaho Recovery Unit appearing on Idaho's 1998 303(d) list (IDEQ 1998).

HUC[1]	Water body	Boundaries	Length (mile)	Pollutant(s)
		Lower Payette River		
17050122	Big Willow Creek	Rock Creek to Payette River	23.4	unknown
17050122	Bissel Creek	Headwaters to Payette river	17.0	sediment
17050122	Black Canyon Reservoir			nutrients, oil/gas, sediment
17050122	Payette River	Black Canyon Dam to Snake River	39.2	bacteria, nutrients, temperature
17050122	Soldier Creek	Headwaters to Squaw Creek	9.0	sediment
		North Fork Payette River		
17050123	Big Creek	Horsethief Creek to North Fork Payette River	6.5	sediment
17050123	Boulder Creek	Headwaters to Cascade Reservoir	20.4	DO, flow alteration, nutrients, sediment, temperature
17050123	Browns Pond			habitat
17050123	Brush Creek	Headwaters to North Fork Payette River	5.0	unknown

Appendix B: Waters within the Southwest Idaho Recovery Unit appearing on Idaho's 1998 303(d) list (IDEQ 1998).

HUC[1]	Water body	Boundaries	Length (mile)	Pollutant(s)
17050123	Cascade Reservoir			DO, pH, nutrients
17050123	Clear Creek	Headwaters to North Fork Payette River	17.8	sediment
17050123	Duck Creek	Headwaters to Cascade Reservoir	2.0	unknown
17050123	Elip Creek	Headwaters to Lemah Creek	3.0	unknown
17050123	Gold Fork River	Flat Creek to Cascade Reservoir	5.4	nutrients, sediment
17050123	Lake Fork Creek	Headwaters to Cascade Reservoir	26.0	unknown
17050123	Landing Creek	Headwaters to Deadhorse Creek	2.4	unknow
17050123	Mud Creek	Headwaters to cascade Reservoir	12.0	bacteria, DO, NH_3, nutrients, sediment
17050123	North Fork Payette River	Clear Creek to Smiths Ferry	9.5	flow alteration, habitat, nutrients, sediment, temperature
17050123	Round Valley Creek	Headwaters to North Fork Payette River	5.6	sediment
17050123	Tripod Creek	Headwaters to North Fork Payette River	5.4	unknown
17050123	Van Wyck Creek	Headwaters to Cascade Reservoir	2.5	unknown
17050123	Willow Creek	Headwaters to Cascade Reservoir	8.2	unknown

Appendix B: Waters within the Southwest Idaho Recovery Unit appearing on Idaho's 1998 303(d) list (IDEQ 1998).

HUC[1]	Water body	Boundaries	Length (mile)	Pollutant(s)
		Weiser River		
17050124	Cove Creek	Headwaters to Weiser River	14.0	nutrients, sediment
17050124	Crane Creek	Crane Creek Reservoir to Weiser	12.6	bacteria, nutrients, sediment
17050124	Crane Creek Reservoir			nutrients, sediment
17050124	Johnson Creek	Headwaters to Weiser River	13.6	unknown
17050124	Little Weiser River	Indian Valley to Weiser River	17.2	nutrients, sediment
17050124	Mann Creek	Mann Creek Reservoir to Weiser River	13.0	sediment
17050124	North Crane Creek	Headwaters to Crane Creek Reservoir	24.6	bacteria, flow, nutrients, sediment, temperature
17050124	South Crane Creek	Headwaters to Crane Creek Reservoir	9.2	unknown
17050124	Weiser River	Galloway Dam to Snake River	12.4	bacteria, nutrients, sediment, temperature, DO
17050124	Weiser River	West Fork Weiser River to Little Weiser River	20.8	nutrients, sediment
17050124	Weiser River	Little Weiser River to Galloway	32.0	bacteria, nutrients, sediment

Appendix B: Waters within the Southwest Idaho Recovery Unit appearing on Idaho's 1998 303(d) list (IDEQ 1998).

HUC[1]	Water body	Boundaries	Length (mile)	Pollutant(s)
17050124	West Fork Weiser River	Headwaters to Weiser River	15.9	unknown

[1] Hydrological unit code.

Appendix C: List of Chapters