U.S. Fish & Wildlife Service

Recovery Plan for the Coterminous United States Population of Bull Trout

(Salvelinus confluentus)

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Recovery Plan

for the

Coterminous United States Population of

Bull Trout

(*Salvelinus confluentus*)

Pacific Region

U.S. Fish and Wildlife Service

Portland, Oregon

Approved: Robyn Thorson

Regional Director, Pacific Region
U. S. Fish and Wildlife Service

SEP 28 2015

Date: ______________________

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Literature citation:

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An electronic copy of this recovery plan is also available at:

http://www.fws.gov/pacific/ecoservices/endangered/recovery/plans.html and

http://www.fws.gov/endangered/species/recovery-plans.html

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The U.S. Fish and Wildlife Service gratefully acknowledges the contributions of the numerous individuals who have worked tirelessly towards the conservation and recovery of bull trout (see USFWS 2015 for a list of individuals and organizations).

Executive Summary

Recovery Plan for the Coterminous United States Population of Bull Trout

CURRENT STATUS OF THE SPECIES

In November 1999, the U.S. Fish and Wildlife Service (Service) listed all populations of bull trout within the coterminous United States as a threatened species pursuant to the Endangered Species Act of 1973, as amended (Act) (64 FR 58910; November 1, 1999). Our 1999 listing applied to one distinct population segment (DPS) of bull trout within the coterminous United States by including bull trout in the Coastal-Puget Sound populations (Olympic Peninsula and Puget Sound regions) and Saint Mary-Belly River populations (east of the Continental divide in Montana) with previous listings of three separate distinct population segments of bull trout in the Columbia River, Klamath River, and Jarbidge River basins (63 FR 31647, June 10, 1998; 64 FR 17110, April 8, 1999).

Our most recent 5-year status review for bull trout was completed on April 8, 2008, and concluded that listing the species as “threatened” remained warranted range-wide in the coterminous United States. Based on this status review, in our most recent recovery report to Congress (USFWS 2012) we reported that bull trout were generally “stable” overall range-wide (species status neither improved nor declined during the reporting year), with some core area populations decreasing, some stable, and some increasing. The combination of core habitat (*i.e.*, habitat that could supply all elements for the long-term security of bull trout) and a core population (a group of one or more local bull trout populations that exist within core habitat) constitutes a core area, the basic unit on which to gauge recovery within a recovery unit. Since the listing of bull trout, there has been very little change in the general distribution of bull trout in the coterminous United States, and we are not aware that any known, occupied bull trout core areas have been extirpated. Additionally, since the listing of bull trout, numerous conservation measures have been and continue to be implemented across its coterminous range. These measures are being undertaken by a wide variety of local and regional partnerships, including State fish and game agencies, State and Federal land management and water resource agencies, Tribal governments, power companies, watershed working groups, water users, ranchers, and landowners. In many cases these bull trout conservation measures incorporate or are closely interrelated with ongoing work for the recovery of salmon and steelhead, which are limited by many of the same threats. The Service has compiled a comprehensive overview of conservation actions and successes since 1999 for bull trout in each recovery unit referenced in this recovery plan.

HABITAT REQUIREMENTS AND DISTRIBUTION

Of all the native salmonids in the Pacific Northwest of the United States, bull trout generally have the most specific habitat requirements (Rieman and McIntryre 1993), which are often referred to as "the four Cs": Cold, Clean, Complex, and Connected habitat. This includes cold water temperatures (often less than 12 degrees Celsius [54 degrees Fahrenheit]), complex stream habitat including deep pools, overhanging banks and large woody debris, and connectivity between spawning and rearing (SR) areas and downstream foraging, migration, and overwintering (FMO) habitats.

Within the coterminous United States, bull trout currently occur in the Columbia River and Snake River basins in Washington, Oregon, Montana, Idaho, and Nevada; Puget Sound and Olympic Peninsula watersheds in Washington; the Saint Mary basin in Montana; and the Klamath River basin of south-central Oregon. At the time of their coterminous United States listing in 1999, bull trout, although still widely distributed, were estimated to have been extirpated from approximately 60 percent of their historical range.

FACTORS AFFECTING THE SPECIES

Our listing rule that determined threatened status for the coterminous United States population of bull trout (USFWS 1999a) included a detailed evaluation of threats to bull trout at a landscape scale and a tabular analysis describing which threat factors acted on each individual subpopulation. However, the analysis was not quantitative and did not determine the threats that were deemed most significant in affecting bull trout at finer scales.

Based on our most recent status review (USFWS 2008a), historical habitat loss and fragmentation, interaction with nonnative species, and fish passage issues are widely regarded as the most significant primary threat factors affecting bull trout. The order of those threats and their potential synergistic effects vary greatly by core area and among local populations, and is described in greater detail in the recovery unit implementation plans (RUIPs) for each of the six recovery units included in this recovery plan. In some core areas within their extant range, bull trout experience no major threats and maintain healthy populations throughout most or all available habitat; some bull trout core areas experience limited but significant threats, but still retain strong populations in most available habitat; and some continue to experience severe and systemic threats and harbor relatively small populations that have been reduced to a limited portion of available habitat.

Additionally, climate change effects were not considered as a factor affecting bull trout at the time of listing in 1999. Since that time, several climate change assessments or studies have been published or are currently underway assessing the possible effects of climate change on bull trout. The results of these efforts will allow us to better understand how climate change may influence bull trout and help to identify suitable conservation actions to ensure that bull trout persist in the face of climate change.

STRATEGIC PLAN FOR RECOVERY

The primary strategy for recovery of bull trout in the coterminous United States is to: (1) conserve bull trout so that they are geographically widespread across representative habitats and demographically stable[1] in six recovery units; (2) effectively manage and ameliorate the primary threats[2] in each of six recovery units at the core area scale such that bull trout are not likely to become endangered in the foreseeable future; (3) build upon the numerous and ongoing conservation actions implemented on behalf of bull trout since their listing in 1999, and improve our understanding of how various threat factors potentially affect the species; (4) use that information to work cooperatively with our partners to design, fund, prioritize, and implement effective conservation actions in those areas that offer the greatest long-term benefit to sustain bull trout and where recovery can be achieved; and (5) apply adaptive management principles to implementing the bull trout recovery program to account for new information.

Although bull trout were believed to have undergone a significant reduction in their historical range prior to the time of their listing in 1999, the species continues to be found in suitable habitats and is geographically widespread across numerous major river basins in five western states. While the purpose of the Act is to protect and recover threatened or endangered species and the ecosystems upon which they exist, the Act does not necessarily require a species, in this case bull trout, to be recovered throughout its historical range or even in any set proportion of the currently suitable habitat. Instead, the Act requires that we recover threatened species such as bull trout such that they no longer are likely to become endangered within the foreseeable future throughout all or a significant part of their range.

In summary, ecologically viable populations of bull trout are necessary to produce stable core areas, which in turn will result in viable recovery units. The recovery principles described in this recovery plan take into account the threats and physical or biological needs of bull trout throughout its range and focus on range-wide recovery needs. This approach to achieving recovery should ensure adequate conservation of genetic diversity, life history features, and broad

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[1] Demographically Stable: A ‘recovered’ bull trout population described in terms of size, age structure, and density. Implies that bull trout populations, at the local population, core area or recovery unit scale, interact with their surrounding environment so that their population scale status is stable or increasing based on measurements and calculations of population size, density, and age structure. (*i.e.*, ecologically viable).

[2] Threat factors known or likely (*i.e.*, non-speculative) to negatively impact bull trout populations at the core area level, and accordingly require management actions to assure bull trout persistence to a degree necessary that bull trout will not be at risk of extirpation within that core area in the foreseeable future (approximately 50 years).

geographical representation (*i.e.*, adequate spatial distribution) of bull trout populations in the six recovery units that comprise the coterminous population of bull trout.

RECOVERY GOALS, OBJECTIVES AND CRITERIA

The ultimate **goal** of this recovery strategy is to manage threats and ensure sufficient distribution and abundance to improve the status of bull trout throughout their extant range in the coterminous United States so that protection under the Act is no longer necessary. When this is achieved, we expect that:

- Bull trout will be geographically widespread across representative habitats and demographically stable in each recovery unit;
- The genetic diversity and diverse life history forms of bull trout will be conserved to the maximum extent possible; and
- Cold water habitats essential to bull trout will be conserved and connected.

Specifically, the recovery plan outlines actions necessary to:

- **Effectively manage and ameliorate primary threats.** We will focus on effectively managing and ameliorating the primary threats identified for each recovery unit at the core area scale such that bull trout will respond and persist well into the future.

- **Work cooperatively with partners to implement bull trout recovery actions.** This includes: acknowledging and building upon the numerous and ongoing conservation actions that have already been implemented throughout much of the range of bull trout since the time of listing, and utilizing existing and new information, including decision support tools (e.g., structured decision making (SDM), climate change considerations) in developing and prioritizing conservation actions in each recovery unit.

- **Adaptively manage the bull trout recovery program**. Because the effectiveness of many of the recovery actions described in this recovery plan, as well as future climate effects, are not yet completely understood or fully predictable, we will apply adaptive management principles to future monitoring, implementation, and other recovery actions for bull trout. Specific recovery actions for bull trout in each of the six recovery units are described in the RUIPs.

Bull trout population status remains strong in some core areas. However, we acknowledge that despite our best conservation efforts identified in this recovery plan, it is possible that some existing bull trout core areas may become extirpated due to various factors including the effects of small populations, isolation, and climate change. Thus, our current approach to developing recovery criteria and necessary recovery actions for bull trout is intended to ensure adequate conservation of genetic diversity, life history features, and broad geographical representation of remaining bull trout populations, while acknowledging that a small number of local extirpations may occur without preventing recovery if threats are successfully managed in most core areas. Specifically, we have developed a recovery plan that: (1) focuses on the identification and effective management of known threat factors to bull trout; (2) acknowledges that some extant bull trout core area habitats will likely change (and may be lost) over time due to climate change effects; and (3) identifies and focuses recovery actions in those areas where success is likely to meet our goal of ensuring the conservation of genetic diversity, life history features, and broad geographical representation of remaining bull trout populations. Additionally, while the recovery plan recognizes that all existing bull trout core areas within the six recovery units contribute to the overall conservation of the species, we do not intend that all currently occupied core areas identified in this recovery plan must be recovered in order to meet the recovery criteria for the listed entity. We recognize that recovery at the recovery unit scale will require improvement in bull trout local populations relative to the time of listing and their habitats in some core areas, while other core areas will need to be "maintained" into the foreseeable future.

The recovery criteria in this recovery plan represent our best assessment of the conditions that would most likely result in a determination that listing under the Act is no longer required. For bull trout, these conditions will be met when sufficient conservation actions have been implemented to ameliorate the primary threats in suitable habitats. If the primary threats have been effectively managed in each recovery unit, the long-term persistence of bull trout should be ensured. The Service may initiate an assessment of whether recovery has been achieved and delisting is warranted when the following have been accomplished in each recovery unit:

- For the Coastal, Mid-Columbia, and Upper Snake Recovery Units: Primary threats are effectively managed in at least 75 percent of all core areas, representing 75 percent or more of bull trout local populations within each of these three recovery units (as identified in Table 1).

- For the Columbia Headwaters Recovery Unit: Primary threats are effectively managed in 75 percent of simple core areas and 75 percent of complex core areas, representing 75 percent or more of bull trout local populations in both simple and complex core areas.

- For the Klamath and Saint Mary Recovery Units, all primary threats are effectively managed in all existing core areas, representing all existing local populations. In addition, in the Klamath Recovery Unit, because 9 of 17 known local populations have already been extirpated and the remainder are significantly imperiled and require active management of threats, effective threat management is necessary in 100 percent of core areas, and the geographic range of bull trout within this recovery unit will need to be expanded through reestablishment of extirpated local populations.

- In recovery units where shared FMO habitat outside core areas has been identified, connectivity and habitat in shared FMO areas should be maintained in a condition sufficient for regular bull trout use and successful dispersal among the connecting core areas for those core areas to meet the criterion.

If threats are effectively managed as described in Table 1 (*i.e.*, 75 percent threshold in the Coastal, Mid-Columbia, Upper Snake, and Columbia Headwaters Recovery Units, and 100 percent for the Klamath and Saint Mary Recovery Units), we expect that bull trout will respond accordingly and reflect the biodiversity principles of resilience, redundancy, and representation. Specifically, achieving the proposed recovery criteria in each recovery unit would result in geographically widespread and demographically stable local bull trout populations within the range of natural variation, with their essential cold water habitats connected to allow their diverse life history forms to persist into the foreseeable future. Therefore, the species would be brought to the point where the protections of the Act are no longer necessary.

If recovery criteria are met in a recovery unit in the future, the Service may initiate an assessment of whether recovery has been achieved. We may consider, in coordination with our partners and consistent with applicable law at the time, whether pursuing the potential reclassification of the listed coterminous United States population of bull trout into multiple distinct population segments (DPSs) is a possible approach to delisting.

RECOVERY ACTIONS

Recovery of bull trout will entail effectively managing threats to ensure the long-term persistence of populations and their habitats, ensuring the security of multiple interacting groups of bull trout, and providing habitat conditions and access to them that allow for the expression of various life history forms within each of six recovery units. The recovery plan references associated comprehensive RUIPs for each recovery unit with an implementation schedule that includes core area-specific recovery actions. These RUIPs may be individually updated in the future independently of the Recovery Plan, as appropriate to reflect new information about threats, distribution, or management actions within a recovery unit. Recovery actions for bull trout, developed in cooperation with Federal, State, tribal, local, and other partners, fall generally into four categories:

1. Protect, restore, and maintain suitable habitat conditions for bull trout.
2. Minimize demographic threats to bull trout by restoring connectivity or populations where appropriate to promote diverse life history strategies and conserve genetic diversity.
3. Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.
4. Work with partners to 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, and considering the effects of climate change

TOTAL ESTIMATED COST OF RECOVERY

The total estimated cost of recovery, based on the recovery unit specific estimates identified in the RUIP implementation schedules, is

as follows:

Coastal Recovery Unit: $379,208,000

Klamath Recovery Unit: $37,655,000

Mid-Columbia Recovery Unit: $562,491,000

Upper Snake Recovery Unit: $14,535,000

Columbia Headwaters Recovery Unit: $528,665,000

Saint Mary Recovery Unit: $38,240,000

A large proportion of these costs represent actions that benefit bull trout but that may be already independently mandated through other environmental and legal processes (e.g., Federal Energy Regulatory Commission dam relicensing, Superfund restoration actions, National Forest Management Act, Clean Water Act and State water regulations), or coincide with ongoing or planned recovery actions for federally listed salmon and steelhead. The overlap in habitat requirements of bull trout and salmon results in substantial synergy in the recovery actions needed. Further discussion of such interrelated costs associated with land management and salmonid recovery is provided in the six RUIPs.

The total cost of recovery is only an estimate and may change substantially as efforts to recover the species continue. Detailed cost breakdowns for each recovery unit, with expected annual costs for the first 5 years of recovery implementation, are provided in the implementation schedules of the six RUIPs.

ESTIMATED DATE OF RECOVERY

The implementation schedules of the Columbia Headwaters, Mid-Columbia, Coastal, and Upper Snake RUIPs project recovery implementation costs based on an estimated timeframe of 25 years for recovery. In the Saint Mary Recovery Unit, where major elements of the recovery strategy are discrete actions to address passage and entrainment issues in the Saint Mary River, the RUIP estimates a timeframe of 10 to 25 years for recovery. In the Klamath Recovery Unit, where threats are generally the most severe and many extirpated local populations of bull trout will require reintroduction, the RUIP estimates a timeframe of 50 to 70 years for recovery. These estimates are subject to modification based on future circumstances. However, if recovery actions are successfully implemented, we maintain that recovery criteria can be met in the respective recovery units within these timeframes.

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A. Overview

Bull trout (*Salvelinus confluentus*) are members of the char subgroup of the family Salmonidae and are native to waters of western North America (Figure 1). In the United States, bull trout range widely through the Columbia River and Snake River basins, extending east to headwater streams in Idaho and Montana (including the Saint Mary headwaters east of the continental divide), into Canada and southeast Alaska, and to the Puget Sound and Olympic Peninsula watersheds of western Washington and the Klamath River basin of south-central Oregon (Cavender 1978; Howell and Buchanan 1992; USFWS 1999). Historically bull trout also occurred in the Sacramento River basin in California. In general, the current distribution of bull trout is fragmented and localized within the boundaries of its historical range.

Figure 1. **Mature bull trout**. Photograph by Joel Sartore with Wade Fredenberg, National Geographic stock, used with permission.

In June 1998, we listed two distinct population segments (DPS) of bull trout in the Columbia River and Klamath River basins as threatened (63 FR 31647, June 10, 1998). The Jarbidge River distinct population segment of bull trout was emergency listed as endangered (63 FR 42737; August 11, 1998) and was later listed as threatened (64 FR 17110; April 8, 1999). Subsequently, in November 1999, we listed all populations of bull trout within the coterminous United States as a threatened species pursuant to the Endangered Species Act of 1973, as amended (Act) (64 FR 58910; November 1, 1999). Our final listing defined one DPS by adding bull trout in the Coastal-Puget Sound populations (Olympic Peninsula and Puget Sound regions) and Saint Mary-Belly River populations (east of the Continental divide in Montana) to the previous listings. Based on our 2008 5-year status review (USFWS 2008a), bull trout have a recovery priority number of 9C on a scale of 1 (highest) to 18 (lowest (USFWS 1983), indicating that: (1) this population is a distinct population segment of a species; (2) the coterminous United States population is subject to a moderate degree of threat(s); (3) the recovery potential is high; and (4) the degree of potential conflict with construction or other development projects during recovery is high.

Between 2002 and 2004, we completed three separate draft bull trout recovery plans. In 2002, we completed a draft recovery plan that addressed bull trout populations within the Columbia, Saint Mary-Belly, and Klamath River basins (USFWS 2002b) and included individual chapters for 24 separate recovery units. In 2004, we developed draft recovery plans for the Coastal-Puget Sound drainages in western Washington, including two recovery unit chapters (USFWS 2004b), and for the Jarbidge River in Nevada (USFWS 2004c). Those draft recovery plans were not finalized, but they have served to identify recovery actions across the range of the species and to provide a framework for implementing numerous recovery actions by our partner agencies, local working groups, and others with an interest in bull trout conservation.

In completing this recovery plan, we incorporated and built upon: (1) new information received during the September 2014 public and peer review comment period; (2) new information found in numerous reports and studies regarding bull trout life history, ecology, etc., including a variety of implemented conservation actions, since the 2002 and 2004 draft recovery plans; and (3) recovery criteria revised from those proposed in the 2002 and 2004 draft recovery plans to focus on effective management of threats to bull trout at the core area level and de-emphasize achieving targeted point estimates of abundance of adult bull trout (demographics) in each core area.

B. Status of the Species

In 1999, when we listed all bull trout in the coterminous United States as one distinct population segment we found that "… sufficient evidence exists in each of the population segments that demonstrate they are threatened by a variety of past and ongoing threats" that were generally consistent across the bull trout's range. Since the time of the listings of bull trout in 1998 and 1999 (USFWS 1998a, 1998b, 1999a, 1999b), a great deal of new information has been collected on the status of bull trout, factors affecting the species, and ongoing conservation actions implemented throughout its coterminous United States range.

1. New Information

New information used in developing this recovery plan is found in a variety of documents, including several U.S. Fish and Wildlife Service (Service) documents: draft recovery plans (USFWS 2004b, 2004c), proposed and final critical habitat rules (USFWS 2002a, 2004a; 2005a, 2010a), Service Science Team Report (Whitesel *et al.* 2004), Bull Trout Core Area Templates (USFWS 2005b, 2009), Bull Trout Core Area Conservation Status Assessment (USFWS 2005c), revised Designation of Critical Habitat for Bull Trout (USFWS 2010a), and a 5-year Review (USFWS 2008a). In addition, new information is described in documents compiled by the five States (Montana, Idaho, Nevada, Washington, and Oregon) in which bull trout are found (Gamblin and Snyder 2005; M. Hagener *in litt*. 2005; M. Hanson *in litt*. 2005; R. Haskin *in litt*. 2005; IDFG 2005a; 2005b). A bull trout conservation strategy was published for U.S. Forest Service lands in western Montana (USFS 2013). Other new information includes articles describing bull trout population trends and probability of persistence in Idaho (High *et al.* 2008; Meyer *et al.* 2014); research on the larger role of climate change in affecting the status of bull trout throughout their range (Dunham *et al.* 2003; Rieman *et al*. 2007; Porter and Nelitz 2009; Isaak *et al*. 2010, 2011; Wenger *et al*. 2011; Leppi *et al.* 2012; Luce *et al.* 2013; Sawaske *et al.* 2014), and ensuring that management and restoration efforts focus on conservation priorities (Auerbach *et al.* 2015; Barnas, *et al.* 2015).

At the time of the listings, the assessment of the status of bull trout and its threats was reported by subpopulation. The Service identified 187 subpopulations range-wide in the Columbia, Klamath, Jarbidge, Saint Mary-Belly, and Coastal-Puget Sound DPSs. During the recovery planning process beginning in 2002, new information on fish movement supported refining the delineation of the 187 subpopulations into 121 bull trout core areas. Subsequently, we requested additional information regarding the status of bull trout for the purpose of designating critical habitat and refining the delineation of core areas, resulting in further refinement of our classification to comprise 109 currently occupied bull trout core areas, as well as 6 historically occupied core areas and 1 research needs area, totaling 116 (see Appendix F, Comparison of Current and Former Core Areas and Recovery Unit Classifications). During this period we also distinguished two types of core areas for conservation purposes: complex core areas and simple core areas. Complex core areas are core areas that contain multiple local populations; they are typically situated in a larger patch of habitat, often occupied by bull trout of both the migratory life history form and the resident form, and include a diverse pattern of connected spawning and rearing (SR) habitats and foraging, migratory, and overwintering (FMO) habitats. Simple core areas are core areas that contain a single local population; typically they are situated in a smaller patch of habitat that may not include FMO stream habitat (e.g., an isolated headwater lake with a single SR stream) and sometimes include only the resident life history form or a very simple migratory pattern.

To update the most recent information on bull trout status and their threats, we developed the Core Area Templates (USFWS 2005b, 2005c) with the most recent update being completed in 2009 (USFWS 2009). These documents represented a compilation, core area by core area, of the newest information since listing on population status, threats, habitat, regulatory mechanisms, and conservation efforts. This information was used in the bull trout core area conservation status assessment model to rank the conservation status of each of the 109 occupied core areas.

2. Life History and Ecology

Bull trout express both resident and migratory life history strategies (Rieman and McIntyre 1993). Resident forms of bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. Migratory bull trout spawn in tributary streams, where juvenile fish rear for 1 to 4 years before migrating to either a lake (adfluvial form) (Downs *et al*. 2006), river (fluvial form) (Fraley and Shepard 1989), or in certain coastal areas, to saltwater (anadromous) (Cavender 1978, McPhail and Baxter 1996; Washington Department of Fish and Wildlife. *et al.* 1997; Goetz *et al*. 2004; Brenkman and Corbett 2005; Jeanes and Morello 2006; Brenkman *et al*. 2007). Resident and migratory forms may be found together, and either form may give rise to offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993, Brenkman *et al*. 2007, Homel *et al.* 2008).

The size and age of bull trout at maturity depends upon habitat capacity and subsequent life history strategy. Resident fish tend to be smaller than migratory fish at maturity and produce fewer eggs (Fraley and Shepard 1989, Al-Chokhachy and Budy 2008). Bull trout normally reach sexual maturity in 4 to 7 years (Johnston *et al*. 2007); they frequently live for 10 years and occasionally for 20 years or more (McPhail and Baxter 1996, Al-Chokhachy and Budy 2008).

Of native salmonids in the Pacific Northwest of the United States, bull trout have the most specific habitat requirements (Rieman and McIntyre 1993), which are often referred to as “the four Cs”: Cold, Clean, Complex, and Connected habitat. These requirements include cold water temperatures compared to other salmonids (often less than 12 degrees Celsius [54 degrees

Fahrenheit]); the cleanest stream substrates; complex stream habitat including deep pools, overhanging banks and large woody debris; and connectivity between spawning and rearing areas and downstream FMO habitats.

Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and migratory corridors (Fraley and Shepard 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Howell and Buchanan 1992; Pratt 1992; Rieman and McIntyre 1993, 1995; Rich 1996; Watson and Hillman 1997, Shellberg 2002, Al-Chokhachy *et al*. 2010).

Migratory corridors link seasonal habitats for all bull trout life histories. For example, in Montana and northern Idaho, migratory bull trout make extensive migrations in the Flathead River system (Fraley and Shepard 1989). Resident bull trout in tributaries of the Bitterroot River move downstream to overwinter in tributary pools (Jakober 1995). Migratory (allacustrine) bull trout in the Pend Oreille River drainage make complex post-spawning migrations (Dupont *et al*. 2007). Anadromous bull trout on the Olympic Peninsula migrate extensively between the ocean and riverine habitat in multiple coastal watersheds (Brenkman and Corbett 2005). The ability to migrate is important to the persistence of bull trout as it allows them to seasonally or temporally occupy habitat that may be advantageous on an intermittent basis (Rieman and McIntyre 1993; M. Gilpin, *in litt.* 1997; Rieman *et al*. 1997, Dunham and Rieman 1999, Muhlfeld and Marotz 2005). In essence, bull trout aggregations can function as complex metapopulations (see Whitesel *et al*. 2004). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed, or stray, to non-natal streams. Local populations that are extirpated by catastrophic events may also become reestablished by bull trout migrants (Rieman *et al.* 1997).

Bull trout depend on cold streams, although individual fish can be found in larger, warmer river systems throughout the Columbia River basin (Fraley and Shepard 1989; Rieman and McIntyre 1993, 1995; Buchanan and Gregory 1997; Rieman *et al*. 1997; Ripley *et al*. 2005; Rieman *et al*. 2006). Water temperature above 15 degrees Celsius (59 degrees Fahrenheit) is believed to especially limit juvenile bull trout distribution, which may partially explain the patchy distribution within watersheds (Fraley and Shepard 1989; Rieman and McIntyre 1995; Dunham *et al.* 2003, McMahon *et al*. 2007). Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992; Rieman and McIntyre 1993; Rieman *et al*. 1997; Baxter and McPhail 1999, Baxter *et al*. 1999). Goetz (1989) suggested optimum water temperatures for juvenile rearing of about 7 to 8 degrees Celsius (44 to 46 degrees Fahrenheit) and optimum water temperatures for egg incubation of 2 to 4 degrees Celsius (35 to 39 degrees Fahrenheit).

Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989) and water temperatures of 5 to 9 degrees Celsius (41 to 48 degrees Fahrenheit) in late summer to early fall (Goetz 1989). Land use and water use may also influence spawning behavior and distribution (Starcevich *et al*. 2010). In the Swan River, Montana, abundance of bull trout redds (spawning areas) was positively correlated with the extent of bounded alluvial valley reaches, which are likely areas of groundwater to surface water exchange (Baxter and McPhail, 1999). Survival of bull trout embryos planted in stream areas of groundwater upwelling used by bull trout for spawning were significantly higher than embryos planted in areas of surface water recharge not used by bull trout for spawning (Baxter and McPhail 1999). Pratt (1992) indicated that increases in fine sediment reduce egg survival and emergence.

Bull trout typically spawn from August to November during periods of decreasing water temperatures. Water temperatures during spawning vary, but generally range from 4 to 10 degrees Celsius (39 to 51 degrees Fahrenheit) (Howell *et al*. 2010). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989; Pratt 1992; Rieman and McIntyre 1993). Migratory bull trout frequently begin spawning migrations as early as April and have been known to move upstream as far as 250 kilometers (155 miles) to spawning grounds in Montana (Fraley and Shepard 1989; Swanberg 1997). In Idaho, bull trout moved 109 kilometers (67.5 miles) from Arrowrock Reservoir to spawning areas in the headwaters of the Boise River (Flatter 1998). In the Blackfoot River, Montana, bull trout began spring migrations to spawning areas in response to increasing temperatures (Swanberg 1997). Depending on water temperature, egg incubation is normally 100 to 145 days (Pratt 1992), and after hatching, young fry remain in the substrate. Time from egg deposition to emergence of fry may surpass 200 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992; Ratliff and Howell 1992; McPhail and Baxter 1996).

Bull trout are opportunistic feeders, with food habits primarily a function of size and life history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro-zooplankton, and small fish (Goetz 1989; Donald and Alger 1993). Adult migratory bull trout feed primarily on a wide variety of resident and anadromous fish species (Fraley and Shepard 1989; Brown 1992; Donald and Alger 1993; Guy *et al*. 2011). In coastal areas of western Washington, bull trout feed on forage fish species such as Pacific herring (*Clupea pallasi*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) in near shore marine areas and the ocean (WDFW *et al.* 1997, Goetz *et al*. 2004).

3. Distribution

At the time of their coterminous United States listing in 1999, bull trout were still widely distributed although they had been extirpated from approximately 60 percent of their historical range (Quigley and Arbelbide 1997; Rieman *et al*. 1997; USFWS 1999). For example, although bull trout still existed in most river basins where they were found historically, they had been likely extirpated in the McCloud River basin, California; the upper Deschutes, North and South Fork Santiam, and Clackamas River basins, Oregon; the White Salmon, lower Nisqually, Satsop, Lake Chelan, Okanagan, Sanpoil, and Kettle River basins, Washington; and locally in numerous tributaries and in salt water, lake, and mainstem river environments in other areas. These declines resulted largely from habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, and the introduction and subsequent proliferation of nonnative fish species.

Since 1999, there has been very little change in the general distribution of bull trout in the coterminous United States and we are not aware that any known, occupied bull trout core areas have been extirpated. Advancements in radiotelemetry and hydroacoustic technology have been used to better understand bull trout movement patterns. Tracking movements of individual fish has greatly informed the proper application of fish passage technology, furthered the identification of metapopulation dynamics, contributed to verification of genetic patterns, and aided in assessment of movement timing and limiting factors. Radiotelemetry has contributed to the identification of previously undocumented migrations of anadromous bull trout in near-shore waters of Washington State (Brenkman and Corbett 2005), of fluvial bull trout of the Columbia River region of central Washington (USFWS 2001), and in the Snake River in Idaho (Chandler *et al.* 2001). These methods, in combination with stream temperature and habitat data, predictive distribution models (Isaak *et al.* 2009, 2015; USGS 2011; Falke *et al*. 2015), and newly developed environmental DNA survey methods (Wilcox *et al.* 2013, 2014), are improving our ability to assess bull trout distribution and identify watersheds where bull trout are at risk of extirpation.

4. Population Abundance and Trend

We completed a 5-year status review of bull trout on April 8, 2008 (USFWS 2008a), and found that listing the species as "threatened" remained warranted range-wide in the coterminous United States. We evaluated the status of the 121 core areas recognized at that time (see Appendix F for crosswalk with current classification); of those, 23 exhibited population trends that were declining from slightly to severely, 18 were stable, 14 were increasing, and 66 were unknown. We also found that 75 core areas had substantial or moderate, imminent threats, with the remainder being less threatened (substantial or moderate, imminent threats not necessarily equivalent to ‘primary threats’ as defined in this document). We concluded that the “foreseeable future” for evaluating actions affecting bull trout and their recovery was from 4 to 10 generations, or roughly 28 to 70 years. Based on the 2008 5-year status review, we reported in our most recent recovery report to Congress (USFWS 2012) that bull trout were “stable” overall range-wide (species status neither improved nor declined during the reporting year), with some core area populations decreasing, some stable, and some increasing.

Subsequent to completion of the 2008 5-year review, we worked with State, Federal and Tribal agency biologists to update bull trout status information for each of 118 core areas (currently occupied or historical) that were identified in February, 2009, with updated information in Service “core area template” files, or documents for each core area capturing 2009 status and threats information. From these data we and our partners developed a relative ranking of all bull trout core areas range-wide, using criteria in the updated NatureServe status assessment tool (Faber-Langendoen *et al*. 2009). This tool consists of a spreadsheet that generates conservation status rank scores for species or other biodiversity elements based on various user inputs of status and threats. We used nine factors to score bull trout status and threats: (1) linear distance of occupancy; (2) number of occurrences, or local populations; (3) adult population size; (4) environmental specificity; (5) intrinsic vulnerability [4 and 5 were the same for the species across all areas scored]; (6) short-term trend; (7) long-term trend; (8) threat scope; and (9) threat severity. Thus, each core area rank score can be compared to other core areas to gain a relative understanding of the status of that core area, with lower scores representing core areas that are less robust and more vulnerable to extirpation.

The status assessment scores for all bull trout core areas range from 0.36 to 3.83 (USFWS, *in litt.* 2012). The most robust, least threatened core areas include Hungry Horse Reservoir and Lake Koocanusa in Montana (Columbia Headwaters Recovery Unit) and the Middle Fork Salmon River and South Fork Salmon River in Idaho (Upper Snake Recovery Unit). The least robust, most threatened core areas include the North Fork Payette River and Weiser River in Idaho (Upper Snake Recovery Unit) and Asotin Creek in southeast Washington (Mid-Columbia Recovery Unit). A majority of core areas with low status assessment scores include ‘simple’ core areas comprised of only a single local bull trout population. We also applied the NatureServe status assessment tool to evaluate the tentative status of the six recovery units. The tool rated the Klamath Recovery Unit as the least robust, most vulnerable bull trout recovery unit and the Upper Snake Recovery Unit the most robust and least vulnerable recovery unit, with others at intermediate values (Figure 2).

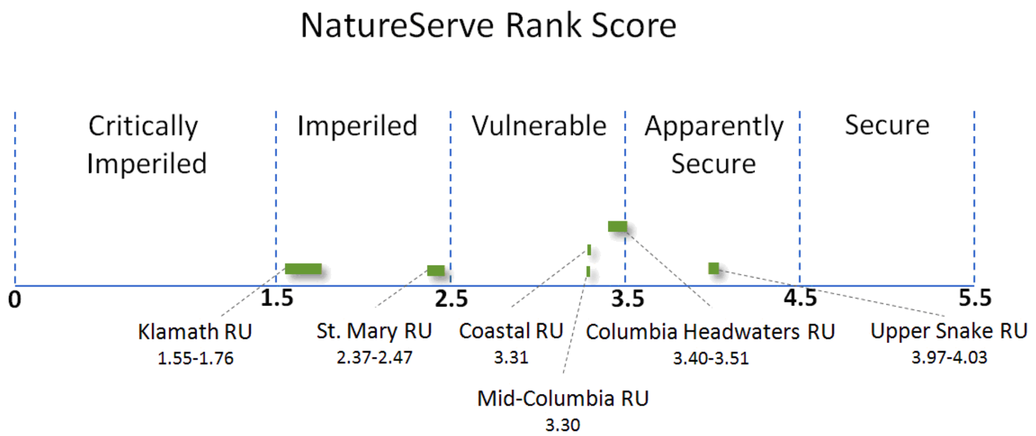

Figure 2. Distribution of 2008 NatureServe status assessment tool scores for each of the six bull trout recovery units (Faber-Langendoen *et al*. 2009). The Klamath Recovery Unit (RU) is considered the least robust and most vulnerable, and the Upper Snake RU the most robust and least vulnerable.

5. Habitat Use and Condition

Information on the complex migratory movements of fluvial, adfluvial, and anadromous life history forms (e.g., see USFWS 2002b; 2004a; 2004b, USFWS 2005b, 2005c) has now increased our understanding of the extensive habitat use and connectivity requirements of the migratory life history form. This information has affirmed that the use of migratory corridors is critical to the survival of bull trout (e.g., see Bahr and Shrimpton 2004, Brenkman and Corbett 2005, Mogen and Kaeding 2005; 2007, Nelson *et al*. 2002, Neraas and Spruell 2001, Homel and Budy 2008, Monnot *et al* 2008). Additionally, a variety of broader-scale stream habitat monitoring programs and predictive models provide information on status and trends in stream habitat condition, structure, and water temperature (Isaak *et al*. 2010; Merritt and Hartman 2012; Larson 2012; Isaak and Rieman 2013; USFS 2014; Falke *et al.* 2015; see also Anlauf *et al.* 2011). Much of this new information was useful in our determination of critical habitat for bull trout (USFWS 2004a, 2010a) and informed the development of conservation actions in this recovery plan for important FMO bull trout habitats.

6. Factors Affecting the Species

Supporting documentation for listing the coterminous United States population of bull trout as threatened (USFWS 1999a) included a detailed evaluation of threats to bull trout at a landscape scale and a tabular analysis describing which threat factors acted on each individual subpopulation. However, the analysis did not determine the threat factors that were deemed most significant in affecting bull trout at finer scales.

The 2002 and 2004 draft bull trout recovery plans for the Columbia River, Klamath River and Saint Mary-Belly populations (USFWS 2002a), and for the Coastal-Puget and Jarbidge populations (USFWS 2004b, 2004c), included detailed information on threats primarily at the recovery unit scale, similar to regional watersheds. In developing these draft recovery plans (USFWS 2002a, 2004a, 2004b), as well as earlier State restoration planning processes in Montana and Idaho (e.g., Montana Bull Trout Restoration Team 2000; Batt 1996), common categories were used to describe and evaluate the various threats affecting bull trout. Threat factors identified and evaluated for these earlier efforts included: passage barriers including dams, forest management practices, livestock grazing, agricultural practices, transportation networks, mining, residential development and urbanization, fisheries management activities, as well as natural events (e.g., wildfire, drought, flooding) that may contribute to core area isolation and habitat fragmentation. These general threat categories to bull trout were also evaluated by an expert science panel convened by the Service in March 2005 as part of the 5-year review process (USFWS 2008a).

Since our listing of bull trout, numerous conservation measures have been and continue to be implemented across the six recovery units that comprise the coterminous United States population, to address many of the threats identified in the earlier draft recovery plans. These include removal of migration barriers (culvert removal or redesign at stream crossings, fish ladder construction, dam removal, etc.) to allow access to spawning or FMO habitat; screening of water diversions to prevent entrainment into unsuitable habitat in irrigation systems; non-native fish suppression efforts; habitat improvement (riparian revegetation or fencing, placement of coarse woody debris in streams) to improve spawning suitability, habitat complexity, and water temperature; instream flow enhancement to allow effective passage at appropriate seasonal times and prevent channel dewatering; and water quality improvement (decommissioning roads, implementing best management practices for grazing or logging, setting pesticide use guidelines) to minimize impacts from sedimentation, agricultural chemicals, or warm temperatures. A more comprehensive overview of conservation successes since 1999 can be found in the individual recovery unit implementation plan (RUIP) chapters and is summarized in a summary of bull trout conservation successes and actions since 1999 document (USFWS 2013).

More recently, in developing this recovery plan and RUIPs, the Service integrated new information regarding life history, ecology, conservation actions, climate change effects, etc., learned since 1999 and worked with various partners to revise, update and describe threat factors (e.g., primary threats) affecting bull trout at the core area scale in each of the six recovery units.

Today, most of the threats affecting bull trout generally fall into three broad categories: (1) habitat threats, (2) demographic threats, and (3) nonnative species threats. Habitat threats are those threats that impact bull trout habitats, demographic threats are those threats that impact individuals or local populations, and nonnative species threats result from introduced fish species or their management that impact bull trout individuals or populations.

The following discussion briefly summarizes our current understanding of the factors affecting the status of bull trout across the species coterminous United States range. A more complete and specific description of the primary threat factors affecting bull trout can be found in the RUIPs developed for each of the six recovery units that comprise the coterminous United States population of bull trout.

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Many of the factors affecting bull trout fall into the category of destruction, modification, or curtailment of habitat (Habitat Threats) and are described and characterized in a wide variety of documents, including various State plans (e.g., Montana Bull Trout Restoration Team 2000; Batt 1996); earlier draft recovery plans (USFWS 2002a, 2004a, 2004b); bull trout critical habitat determinations (USFWS 2004a; 2005a; 2010a); the original and updated Bull Trout Core Area Templates (USFWS 2005b, 2009); the Bull Trout Core Area Conservation Status Assessment (USFWS 2005c); and most recently the 2014/2015 Technical Partner meetings used to develop the six RUIPs. Most of these impacts (e.g., dewatering, sedimentation, thermal modification, water quality degradation) are a consequence of specific land and water management activities. Today, these types of impacts are normally mitigated or moderated, especially on Federal lands and there is often a greater conservation emphasis in headwater areas where suitable bull trout spawning and rearing habitat occurs. For example, trends for riparian habitats have been generally improving over at least the past 25 years on Federally managed timber lands, due in part to recent improvements in management practices, declining timber harvest, and virtual cessation of road building on Federal lands (USFS 2013). A multitude of restoration actions have been implemented or planned on many National Forests and nearby private timber lands within the six recovery units and in several watersheds the most egregious road and sediment problems have been addressed.

Core areas where “legacy effects” of past land use practices continue to degrade bull trout habitats, or where habitat restoration has not yet occurred or has not yet been demonstrated to be effective, are identified in the RUIPs along with core area-specific actions that still need to occur. Because the legacy effects from past management may persist for decades it may take many years (generations) for bull trout populations to respond to management actions and we can evaluate the effectiveness of future conservation actions. There are numerous recent examples of restoration of degraded habitat, improvement of fish passage, and changes in angling regulations, across the range of bull trout (USFWS 2013), including documented examples where these actions have benefited bull trout (Pierce *et al* 2013; Erhardt and Scarnecchia 2014).

Drought and wildfire impacts occur across the entire range (USFWS 2002b), and their potential magnitude, severity, and intensity remain high for bull trout. Throughout much of the range of bull trout, wildfires will likely continue to increase in both scope and magnitude in forests, prairie, and arid land ecosystems in the coming decades (Littell *et al*. 2009). Mote *et al*. (2014) stated that: "The combined impacts of increasing wildfire, insect outbreaks, and tree diseases are already causing widespread tree die-off and are virtually certain to cause additional forest mortality by the 2040s and long-term transformation of forest landscapes. Under higher (greenhouse gas) emissions scenarios, extensive conversion of subalpine forests to other forest types is projected by the 2080s".

Warmer and drier springs and summers, lower soil moisture and prolonged periods of elevated fire-danger all contribute to higher vulnerability to fire for forests and non-forests in the Northwest (Littell *et al*. 2009; Abatzoglou and Kolden 2013). Wetter winters are correlated with fire in non-forested habitats due to higher fuel availability in the summer in the form of grasses and shrubs, while fire in forested areas is highly associated with year-of-fire low precipitation (Littell *et al*. 2009; Abatzoglou and Kolden 2013). Also, snowpack losses and earlier snow melt at lower elevation forests (Mote *et al*. 2005; Pederson *et al*. 2013) are increasing fire risk in these areas (Abatzoglou and Kolden 2013). Wildfire frequency in western forests has increased four-fold during the period 1987 to 2003 as compared to 1970 to 1986, while the total area burned increased six-fold (Westerling *et al*. 2006). This study demonstrated that earlier snowmelt dates correspond to increased wildfire frequency. Trouet *et al*. (2006) confirm that these increases in area burned are tied to climate conditions despite forest fire suppression management practices such as thinning. Prolonged dry and hot periods are generally required for large fires (Gedalof *et al*. 2005) and future conditions will make these periods, and resultant wildfires, more likely (Falke *et al.* 2015).

Fish passage and impaired connectivity continue to impact bull trout and contribute to their decline, and isolation and habitat fragmentation in several core areas within the six recovery units. Large and small dams, irrigation diversions, and road crossings occur across the coterminous United States range of bull trout and often form impassable barriers to fish movement, cause entrainment, change suitable temperature regimes, fragment habitats that isolate bull trout local populations and affect the availability of suitable FMO habitat.

Water control structures and agricultural diversions have contributed to the decline of bull trout in several recovery units. For example, bull trout in all three core areas within the Klamath River Recovery Unit are currently impacted from unscreened irrigation diversions existing in each of the three core areas. Providing fish screens and fish passage at existing water control structures, and ensuring sufficient water quantity for bull trout, has been identified as necessary for recovery within the Klamath River Recovery Unit.

While the detrimental effects from dams continue across the range of bull trout, there are numerous examples of significant conservation benefits to bull trout realized since 1999, resulting from FERC relicensing of major hydropower facilities. For example, within the Coastal Recovery Unit, fish passage or complete dam removal (Elwha and Glines Canyon dams on Elwha River, Conduit Dam on White Salmon River, and Powerdale Dam on Hood River) have occurred at a number of formerly impassible sites.

Factor B. Overutilization for Commercial, Scientific, or Educational Purposes

At the time of listing in 1999, illegal harvest and ongoing incidental take (hooking mortality) of bull trout by anglers catching and releasing fish or pursuing other species were identified as factors affecting the species in several areas (USFWS 1998a). Today, angling regulations have been adjusted in all States where bull trout occur to minimize angling impacts to bull trout, and legal, managed bull trout harvest is permitted in a handful of locations with relatively robust bull trout populations (USFWS 1998a). Current State fishing regulations have generally resolved most pre-listing concerns about overutilization of bull trout by anglers, although incidental bycatch mortality may impact bull trout in some core areas (Fredenberg 2014). Bull trout numbers appear to have responded positively to angling restrictions in some areas (USFWS 2005b; Erhardt and Scarnecchia 2014).

In certain core areas, however, there remains concern about the vulnerability of large, migratory adult bull trout to the effects of illegal fishing and poaching; and incidental harvest from legal fisheries. Incidental bycatch of anadromous bull trout in commercial gill-net fisheries occurs on the Olympic Peninsula (Brenkman *et al.* 2007). Bull trout can be locally vulnerable to angling pressure, particularly in late summer, when they stage for spawning in small streams. Enhanced enforcement of existing regulations, combined with angler education, is generally the best remedy to address this issue, and may include site-specific actions to control access and enforce take prohibitions. Thus, while at a range-wide scale we consider angling impacts to be a relatively minor threat, some significant localized impacts may remain that should be considered in core area management.

Overutilization for scientific purposes, including collecting, is not considered a threat factor for bull trout. For purposes of bull trout population monitoring, we authorize a limited take of bull trout (usually nonlethal capture by net, trap, angling, or electrofishing; marking or PIT [passive integrated transponder] tagging; measurement and tissue sampling; and release) for scientific research through issuing section 10(a)(1)(A) recovery permits under the Act with appropriate special terms and conditions to minimize impacts to bull trout populations.

Factor C. Disease or Predation

Disease was considered only a minor threat at the time of listing (USFWS 1998a, 1999a). Since the time of listing, we are not aware of any confirmed disease effects on bull trout populations, although whirling disease has some potential to affect bull trout either directly or indirectly through its effects on prey.

In watersheds where bull trout populations have been severely reduced or extirpated and connectivity impairment is likely to prevent natural recolonization, active reintroduction or supplementation of bull trout from appropriate source populations may help reestablish viable local populations to improve core area status. Active reintroduction or supplementation has some potential to introduce fish pathogens, but there is little information available on specific effects to bull trout. Some guidelines and agreements among fisheries managers have been developed for salmonids to reduce these risks and identify high- and low-risk transfers based on distance of transfer, species susceptibility, life stage, and pathogen findings (J. Evered *in litt*. 2014). Future translocation programs should consider appropriate precautions against the introduction of fish pathogens to new watersheds.

Nonnative fish were identified as a significant threat in the original listing of bull trout (USFWS 1998a, 1999a), and the threat has grown significantly since that time (USFWS 2008a). Today, in several core areas across the six recovery units, nonnative fishes constitute the single most often cited primary threat. Nonnative fish of primary concern include both lake trout and brook trout. Lake trout, a congeneric species whose niche has strong overlap with bull trout, can outcompete and prey upon bull trout in lake environments where they co-occur or other large predators that may prey upon and/or compete or hybridize with bull trout. The effects from lake trout are most pronounced in the Columbia Headwaters recovery unit. For example, lake trout have expanded since the time of listing and are cited as the dominant primary threat in 4 of 15 complex core areas (*i.e.*, Lake Pend Oreille, Priest Lakes, Flathead Lake, and Swan Lake), and 8 of 20 simple core areas (*i.e.*, Bowman Lake, Quartz Lakes, Lower Quartz Lake, Logging Lake, Harrison Lake, Whitefish Lake, Upper Stillwater Lake, Lindbergh Lake, and Holland Lake), which together include nearly half of the Columbia Headwaters Recovery Unit landscape (USFWS, 2010c). The expansion of lake trout shows no signs of abating, though there has been some success with gill-net suppression efforts in Lake Pend Oreille, Upper Priest, and Quartz lakes (Hansen, et al., 2010) (Fredenberg, 2015) (Ryan, et al., 2014).

Brook trout represent another threat to bull trout populations. Brook trout is a congeneric species that competes with, and can hybridize with, bull trout. Fluvial bull trout core areas are more likely to be influenced by the widespread distribution and abundance of brook trout. Core areas with fluvial and/or resident bull trout populations are more likely to be influenced by the widespread distribution and abundance of brook trout. Several authors project that brook trout will continue increasing their range in several areas (an upward shift in elevation) due to the effects from climate change (Wenger *et al*. 2011, Isaak *et al*. 2010, 2014; Peterson *et al.* 2013). Negative effects of brook trout on bull trout appear to vary substantially between watersheds, being relatively severe in small, low-gradient streams with resident or fluvial populations; while bull trout in larger or steeper streams, particularly large individuals with migratory life histories, can often successfully coexist with brook trout (Peterson *et al*. 2013, D. Isaak *in litt*. 2014).

Additionally, brown trout and northern pike have been documented as predators on juvenile and sub-adult bull trout, and can be found in many bull trout core areas. In addition, walleye and smallmouth bass are continuing to spread in several large rivers and lakes occupied by bull trout. The complex species interactions that lead to bull trout decline are often not well understood, but there is widespread concern that predation on bull trout by piscivorous (fish-eating) nonnative species may play an increasingly large role. At this time, one of the few management options available is direct predator removal through netting, trapping, or angler incentives (largely by State and Tribal managers). Due in part to the high costs and social constraints, application of these techniques has been limited and broader implementation remains problematic. Many of the predator species are also highly sought after sport fish species and may be preferred by the public and even promoted.

The long-term compatibility of brown trout and bull trout is not well understood. In some cases brown trout, which generally spawn later in the fall than bull trout, have been shown to superimpose their redds on bull trout redds, which may impact bull trout egg survival and hatching (Moran 2004). Brown trout are piscivorous at larger sizes and may prey upon juvenile bull trout in areas where they co-occur. Because brown trout occur in relatively warm waters, coldwater habitats below about 11 degrees Celsius (52 degrees Fahrenheit) appear to be protected from brown trout invasion, but climate change is expected to reduce the extent of this habitat (Isaak *et al*. 2015). The niche overlap between brown trout and bull trout is considerable and, as a result, brown trout may replace bull trout in certain circumstances.

Factor D. Inadequacy of Existing Regulatory Mechanisms

Existing regulatory mechanisms were considered mostly inadequate to conserving bull trout in the original listing rule for bull trout (USFWS 1998a), and changes in those mechanisms have been taken into account in our analysis, as described below. Under the Act, Federal agencies consult with the Service on the effects of their management and operations on bull trout. Ongoing land management plans (primarily the Bureau of Land Management and the Forest Service) and facility operations (primarily U.S. Army Corps of Engineers, Bonneville Power Administration, Bureau of Reclamation, and power producers operating under Federal Energy Regulatory Commission permits) include provisions to minimize adverse effects to bull trout where possible, and avoid jeopardizing the continued existence of the species. Implementation of management measures by Federal agencies directly responsible for adhering to the section 7(a)(1) and 7(a)(2) requirements of the Act is likely to result in a progressive diminishment of some threats on Federal lands and at Federal facilities (e.g., effects of timber harvest, road building, grazing, and other land management actions conducted by the Forest Service and the Bureau of Land Management). Section 7(a)(1) directs Federal agencies to utilize their authorities in furtherance of the purposes of the Act by carrying out programs for the conservation of listed species.

State forest practice rules have been revised and updated in Washington and Oregon, at least partly in response to concern for the conservation of sensitive, threatened and endangered species, including bull trout. Oregon has adopted various amendments to its Forest Practices rules and Washington has developed an entire set of new regulations primarily in response to Federal listings of several salmonid species, including bull trout, in the late 1990s. The Nevada forest practices remain essentially unchanged since the listing of bull trout in 1998. In Idaho, the Snake River Basin Adjudication Idaho Forestry Program is currently in development (e.g., draft EIS with no firm date of completion) and would supplement the existing Idaho Forestry Program to address aquatic species protected by the Act. The objective of the supplemental forestry program is the protection of listed salmon and bull trout, within the Salmon/Clearwater River basins, and private landowners will be encouraged to participate. However, since the Program has not yet been approved or funded, the future effectiveness of the Snake River Basin Adjudication Idaho Forestry Program is undetermined. In 2011 Montana completed a multi-species habitat conservation plan (HCP) that also included bull trout. The Montana HCP includes best management practices designed to minimize impacts to bull trout and its associated habitat (http://dnrc.mt.gov/HCP/links.asp).

In addition to consultation with other Federal agencies, the Service has engaged several private corporations and public agencies in the HCP process to provide for the conservation of bull trout. The development and implementation of HCPs has resulted in land management practices that generally exceed State regulatory requirements. As is the case with consultation with Federal agencies under the Act, the development and implementation of HCPs does not eliminate take or the adverse effects of legacy land management practices, but avoids jeopardy to bull trout by specifying actions that reduce threats and compensate for the effects of take. Habitat conservation plans addressing bull trout cover habitat across Montana, Oregon, Washington, Nevada, and Idaho. Additional HCPs are under active negotiation in several locations.

Factor E. Other Natural or Manmade Factors Affecting its Continued Existence

Demographic Threats: Demographic threats include actions or conditions that impair connectivity or cause direct loss of individuals, potentially resulting in unacceptably small population size, which can lead to genetic or demographic bottlenecks and reduce the probability of persistence over time. Small population size has been identified as a primary threat in several core areas across the six recovery units, including all three remaining core areas in the Klamath Recovery Unit.

Competition and Hybridization: As discussed previously in Factor C, many of the same invasive predatory fish species that prey on smaller juvenile bull trout can also compete effectively with adult bull trout. Lake trout, brown trout, brook trout, and northern pike are large piscivorous species that overlap with bull trout in several core areas, and compete for the prey base of smaller forage fish. Direct competition for redd sites is also possible with brown and brook trout.

Brook trout are the only species known to commonly hybridize with bull trout throughout their range. There are numerous examples where bull trout hybridization with brook trout has been documented resulting in bull trout declines or even local extirpations (Leary *et al*. 1983, DeHaan and Godfrey 2009, Ardren *et al*. 2011). When bull trout hybridize with brook trout, the resulting hybrid offspring are often, but not always, sterile (Kanda *et al*. 2002, DeHaan *et al*. 2010), which leads to "wasted" reproductive effort, and likely compete with remaining bull trout for food and space.

Climate Change: At the time of the listing in 1999, climate change effects were not considered as a factor affecting bull trout. Bull trout are vulnerable to the effects of warming climates, changing precipitation and hydrologic regimes, and are considered a useful indicator species of the effects climate change will have on the mountainous stream ecosystems where they reside. In addition to increased degradation of bull trout habitat and increased competition from non-native fish, as described above (see Factors A and C), climate change in the Pacific Northwest, as summarized by Mote *et al*. (2014) includes rising air temperature, changes in the timing of streamflow related to changing snowmelt, increases in extreme precipitation events, lower summer stream flows, and other changes. Late summer streamflow in Pacific coastal ranges and the central Rockies has significantly declined since the mid-20th century (averaging about 20 percent decline), in association with warmer and drier climate, smaller snowpacks, and earlier melt (Leppi *et al*. 2012; Sawaske *et al.* 2014). In Pacific Northwest streams over this period, high-elevation precipitation has decreased due to a slowing in westerly winds during winter, a trend which is projected to continue over the 21st century (Luce *et al.* 2013). Variability in annual streamflow has also increased as drier years result in more extreme reductions of streamflow (Luce and Holden 2009). These impacts can affect bull trout habitat in a number of ways. Several climate change assessments or studies have been published (Dunham *et al.* 2003; Rieman *et al.* 2007; Porter and Nelitz. 2009; Rieman and Isaak. 2010; Isaak *et al*. 2010, 2011, 2015; Wenger *et al*. 2011; Leppi *et al.* 2012; Luce *et al.* 2013; Eby *et al.* 2014; Sawaske *et al.* 2014; Falke *et al.* 2015) or are currently underway (USGS 2011) assessing the possible effects of climate change on bull trout. The results of these efforts allow us to better understand how climate change may influence bull trout and help to identify suitable conservation actions to improve the status of bull trout throughout their range and ensure bull trout persist in the face of climate change. Issues include: the effects of rising air temperatures and lower summer flows on range contractions; changing stream temperatures, influenced by stream characteristics (e.g., amount of groundwater base flow contribution to the stream, stream geomorphology, etc.) affecting suitable bull trout spawning and rearing habitat; threats to redds and juvenile habitat from stream scouring caused by increased winter precipitation extreme events and increased rain in lower elevations (rather than snow); lower summer flows inhibiting movement between populations and from spawning and rearing habitat to foraging habitat; and increased frequency and extent of wildfires resulting in loss and fragmentation of habitat.

For example, a study of changing stream temperatures over a 13-year period in the Boise River basin estimated an 11 to 20 percent loss of suitable coldwater bull trout spawning and early juvenile rearing habitats (Isaak *et al*. 2010). Across the Pacific Northwest, water temperatures in free-flowing streams have increased by about 0.2 degrees Celsius [0.36 degrees Fahrenheit] per decade since 1980, due to air temperature increases and flow reduction (Isaak *et al*. 2011). Resurveys of historical bull trout sites in the Bitterroot basin, Montana, indicate that over 20 years, site extirpations exceeded site colonizations and were more frequent at warm, low-elevation sites (Eby *et al.* 2014). These results suggest that a warming climate already may be affecting some suitable bull trout instream habitats. This is consistent with the conclusions of Rieman *et al*. (2007) and Wenger *et al*. (2011) that bull trout distribution is strongly influenced by climate, and predicted warming effects could result in substantial loss of suitable bull trout habitats over the next several decades. Stream isotherms in Idaho are projected to shift upstream at a rate of about 0.3 to 3.0 kilometers per decade, depending on stream slope (Isaak and Rieman 2013). Wenger *et al.* (2011) also noted that bull trout already seem to inhabit the coldest available streams in study areas and in several watersheds bull trout do not have the potential to shift upstream with warming stream temperatures at lower elevations. In the Flathead basin, Montana, projected losses of thermally suitable spawning and rearing habitat for bull trout in

August ranged from 13 to 82 percent across three plausible climate scenarios for the year 2099; losses of FMO habitat in August ranged from 38 to 91 percent (Jones *et al*. 2014).

Sensitivity of stream temperature to changes in air temperature is complex and is influenced by geological and vegetation factors such as topography, groundwater recharge, glaciation history, and riparian vegetation (Isaak *et al*. 2010, Isaak and Rieman 2013). A new stream temperature data collection, modeling and mapping project, NorWeST, provides a much improved foundation for assessing bull trout coldwater habitat (USFS 2014). Stream temperature data for the northwestern United States have been compiled from hundreds of biologists and hydrologists working for dozens of resource agencies and contains more than 45,000,000 hourly temperature recordings at more than 15,000 unique stream sites. These temperature data are being used with spatial statistical stream network models to develop an accurate and consistent set of climate scenarios for all streams.

Fine-scale assessments of the current and projected future geographic distribution of coldwater streams and suitable bull trout habitat have been recently developed through the NorWeST (Isaak *et al*. 2015) and Bull Trout Vulnerability Assessment (Dunham 2015) processes. These assessments model probability of presence using the NorWeST stream temperature data and models, and map suitable habitat "patches" using fish presence, local threats, migratory connectivity, and climate sensitivity. The climate sensitivity parameters affecting bull trout occurrence within patches include flow variability (e.g., frequency of winter floods), thermal variability (proportion of very cold streams), fire history (proportion of patch area severely burned), and snowpack (snow cover frequency). Other threats factors include composite indicators of human impacts and nonnative trout presence. Connectivity parameters include data among patches (stream/lake/sea distance to nearest occupied patch), migratory connectivity (distance to lake/sea), local barriers (culverts, diversions), and natural geomorphic features. The relationship of bull trout occurrence to most of these factors shows substantial spatial variability, indicating that threats to bull trout are often specific to particular core areas. Products of the Bull Trout Vulnerability Assessment model are being applied to informing specific management issues in several core areas, including fire management and climate change effects on streams in the Wenatchee basin (Falke *et al.* 2015) and conservation planning within the Klamath and lower Pend Oreille basins.

All these efforts to address climate change effects to bull trout have informed the development of the bull trout recovery plan. They suggest that effective long-term conservation and recovery of bull trout will require a decision framework to assess possible climate change effects to bull trout. Utilizing the best available information regarding climate change should ensure that future conservation resources will be allocated to those areas with the coldest water temperatures that offer the greatest long-term benefit to sustain bull trout and their required coldwater habitats.

7. Bull Trout Genetics and Population Structure

At the time that we determined threatened status for all populations of bull trout in the coterminous United States (64 FR 58910), five potential distinct population segments (DPSs) were identified: (1) Klamath River, (2) Columbia River, (3) Coastal-Puget Sound, (4) Jarbidge River, and (5) Saint Mary-Belly River. The five DPSs were disjunct and geographically isolated from one another with no genetic interchange between them due to natural and man-made barriers, but were listed collectively since they included the entire distribution of bull trout in the coterminous United States.

Since listing, advances in genetics techniques and increased bull trout genetic sampling have improved our understanding of the genetic structure and relationships among bull trout populations throughout the coterminous United States. This information, useful in the identification of appropriate units for conservation of bull trout as part of past and current bull trout recovery planning strategies, continues to evolve and inform how we look at bull trout conservation needs. For example, Rieman and Allendorf (2001) examined available demographic information to evaluate effective population size for bull trout. They determined that most bull trout populations were at risk of reduced genetic variation due to small population size and recommended that recovery should include maintaining and improving connectivity and gene flow between populations. Spruell *et al.* (2003) described the genetic population structure of 65 bull trout populations from the northwestern United States, using 4 microsatellite loci. Their study concluded that genetic variation within populations was relatively low; variation between populations was relatively high; and the data supported the existence of at least three major genetically differentiated groups of bull trout, described as “Coastal,” “Snake,” and “Upper Columbia”. An earlier, broader scale analysis, which included western Canada (Taylor *et al.* 1999), reached similar conclusions. Whitesel *et al.* (2004) further analyzed the available scientific information associated with bull trout population structure and size to describe appropriate ‘groupings’ of bull trout and identify units of conservation. They concluded that for bull trout, “… a Conservation Unit should represent a complete and diverse environmental template that allows full expression of genotypic, phenotypic and spatial diversity among bull trout populations…” to “…help ensure resilience and persistence when environmental changes occur”.

More recently, Ardren *et al.* (2011) used newly developed and more variable genetic markers than previous studies and examined genetic variation among 75 representative bull trout populations sampled throughout the coterminous United States. They determined that 76 percent of the populations had an effective number of breeders less than 50 and indicated high divergence among populations caused by genetic drift and a high degree of natal fidelity. Their results suggested that bull trout conservation efforts should be focused at the core area level and affirm the hierarchical conservation strategy for bull trout as described in the recovery strategy narrative of this recovery plan.

8. Bull Trout Conservation Successes

Since our listing of bull trout in 1999, numerous conservation measures that contribute to the conservation and recovery of bull trout have been and continue to be implemented across its range in the coterminous United States These measures are being undertaken by a wide variety of local and regional partnerships, including State fish and game agencies, State and Federal land management and water resource agencies, Tribal governments, power companies, watershed working groups, water users, ranchers, and landowners. In many cases, these bull trout conservation measures incorporate or are closely interrelated with work being done for recovery of salmon and steelhead, which are limited by many of the same threats. These include removal of migration barriers (culvert removal or redesign at stream crossings, fish ladder construction, dam removal, etc.) to allow access to spawning or FMO habitat; screening of water diversions to prevent entrainment into unsuitable habitat in irrigation systems; habitat improvement (riparian revegetation or fencing, placement of coarse woody debris in streams) to improve spawning suitability, habitat complexity, and water temperature; instream flow enhancement to allow effective passage at appropriate seasonal times and prevent channel dewatering; and water quality improvement (decommissioning roads, implementing best management practices for grazing or logging, setting pesticide use guidelines) to minimize impacts from sedimentation, agricultural chemicals, or warm temperatures. At sites that are vulnerable to development, protection of land through fee title acquisition or conservation easements is important to prevent adverse impacts or allow conservation actions to be implemented. In several bull trout core areas, fisheries management to manage or suppress non-native species (particularly brown trout, brook trout, lake trout, and northern pike) is ongoing and has been identified as important in addressing effects of non-native fish competition, predation, or hybridization (Fredenberg *et al.* 2007; DeHaan *et al.* 2010; DeHaan and Godfrey 2010; Fredericks and Dux 2014; Rosenthal and Fredenberg 2014).

A more comprehensive overview of conservation successes since 1999, described for each recovery unit, is found in the Summary of Bull Trout Conservation Successes and Actions since 1999 (USFWS 2013).

9. Critical Habitat

We first designated critical habitat for bull trout on October 6, 2004 (USFWS 2004a), including 1,748 miles and 61,235 acres of bull trout habitat in the Columbia and Klamath River basins only. This designation was subsumed within the range-wide designation of critical habitat on September 26, 2005 (USFWS 2005a), including 3,828 miles and 143,218 acres of bull trout habitat. The 2005 designation was challenged in the U.S. District Court for the District of Oregon, in part because of concern over large exclusions of habitat that were made from the final rule compared to that which had been proposed. The Court directed the agency to complete a proposed revision by December 31, 2009, with a final designation to be delivered to the Federal Register by September 30, 2010. Final critical habitat was designated for bull trout and was published on October 18, 2010 (USFWS 2010a), including 19,729 miles and 488,252 acres of bull trout habitat.

We identified 32 critical habitat units (CHUs) in our 2010 bull trout critical habitat listing rule (USFWS 2010a), reflecting single core areas or groups of core areas that are in close proximity geographically and that are included in 6 recovery units (see Figure 4). These CHUs are specific to critical habitat designation and interagency consultation procedures under section 7 of the Act. The CHUs are generally a level of organization at the major river basin scale that are intermediate in size and scope between recovery units and core areas in the hierarchical structure, and represent groupings of habitats that facilitate implementation of the rule, generally as aggregations of core areas within major river basins.

In designating bull trout critical habitat, we considered the conservation relationship between critical habitat and recovery planning (see Appendix G). Recovery plans formulate the recovery strategy for a species; however, unlike critical habitat, they are not regulatory documents, and there are no specific protections, prohibitions, or requirements afforded a species based solely on a recovery plan. While we expect that the 2010 critical habitat designation will contribute to the overall recovery strategy for bull trout described in this recovery plan, designated critical habitat, by itself, does not achieve recovery plan goals.

C. Previous Recovery Planning Efforts

Three separate draft bull trout recovery plans were completed between 2002 and 2004. The 2002 draft recovery plans addressed bull trout populations within the Columbia, Saint Mary-Belly, and Klamath River basins (USFWS 2002b). They included individual chapters for 24 separate recovery units. In 2004, draft recovery plans were developed for the Coastal-Puget Sound drainages in western Washington, including two recovery unit chapters (USFWS 2004b), and a single recovery unit chapter for the Jarbidge River in Nevada (USFWS 2004c). In total, the 2002 and 2004 draft recovery plans accounted for 27 separate recovery unit chapters.

This recovery plan represents an integration of information collected since the 1999 listing regarding bull trout life history, distribution, demographics, conservation successes, etc., and an update of all previous bull trout recovery planning efforts across the range of the single DPS currently listed under the Act, including all bull trout populations within the range of the species in the coterminous United States. This recovery plan supersedes and replaces previous draft recovery plans. The recovery unit structure has been reorganized in this current plan, combining the previous 27 recovery units into 6 recovery units: (1) Coastal Recovery Unit; (2) Klamath Recovery Unit; (3) Mid-Columbia Recovery Unit; (4) Upper Snake Recovery Unit; (5) Columbia Headwaters Recovery Unit; and (6) Saint Mary Recovery Unit. Additionally, recovery criteria proposed in the 2002 and 2004 draft recovery plans were revised to focus on effective management of threats to bull trout at the core area level in each recovery unit, and de-emphasized achieving targeted point estimates of abundance of adult bull trout (demographics) in each core area.

The major changes between the earlier 2002 and 2004 draft bull trout recovery plans and this recovery plan were summarized in the revised draft recovery plan (USFWS 2014).

II. Strategic Plan for Recovery

A. Overview

The primary recovery strategy for recovery of bull trout in the coterminous United States is to: (1) conserve bull trout so that they are geographically widespread across representative habitats and demographically stable; (2) manage and ameliorate the primary threats in each of six recovery units at the core area scale such that bull trout are not likely to become endangered in the foreseeable future; (3) work cooperatively with partners to develop and implement bull trout recovery actions in each of the six recovery units; and (4) account for new information and future climate effects, apply adaptive management principles and focus on actions, and potentially locations, that provide the greatest resilience to climate-related threats.

Bull trout recovery will require building upon the numerous and ongoing conservation actions implemented on behalf of bull trout since their listing in 1999. Recovery will require improving our understanding of how various threat factors potentially affect the species, and using that information to work cooperatively with our partners to design, fund and implement effective conservation actions in areas that offer the greatest long-term benefit to sustain bull trout and in areas where recovery can be achieved.

Although bull trout are believed to have undergone a significant reduction in their historical range prior to the time of their listing in 1999, the species continues to be found in suitable habitats and is geographically widespread across numerous major river basins in five western states. The Act does not require a species, in this case bull trout, to be recovered throughout its historical range or even in any set proportion of currently suitable habitat. Instead, the Act requires that we recover listed species such that they no longer meet the definitions of "threatened species" or "endangered species," *i.e.*, are no longer in danger of extinction now or in the foreseeable future.

This recovery plan also includes a ***Threat Assessment Tool*** (Appendix E) that will be integral to an evaluation of bull trout conservation status at the range-wide and recovery unit scales based on analyses of threats at the level of the component core areas. Preliminary core-area assessments can inform the recovery process by highlighting conservation actions that should be given locally higher priority, and by aiding managers in assessing how well recovery criteria are being met at the recovery unit level, thus allowing managers to target those core areas where conservation resources can be most efficiently directed. Furthermore, core area-level assessments will be useful in recovery criteria evaluation and status assessments conducted as part of future 5-year reviews and 5-factor threats analysis in any future delisting evaluation for a bull trout distinct population segment.

B. Recovery Strategy

As described in our recovery planning guidance (NMFS and USFWS 2010), the recovery strategy provides "a logical construct that identifies the assumptions and logic underlying the selection of one path over another to achieve the objectives and goal". Thus it constitutes the framework linking key facts and assumptions about the species' biology, threats, and environmental constraints with the recommended recovery actions. The major threats and constraints affecting bull trout (addressed in detail with specific citations above in sections I.B.2, *Life History and Ecology* and I.B.6, *Factors Affecting the Species*), need to be addressed with appropriate management actions as described below to allow survival and recovery of the species.

Bull trout have specific requirements for spawning and rearing habitat: appropriate spawning substrate (loose, clean gravel with minimal fine sediment); cold water (influenced by flow levels, groundwater infiltration, cold springs, riparian shading, solar radiation, valley geomorphology, air temperature, temperature of upstream tributaries, and other factors); excellent water quality (high dissolved-oxygen concentrations and minimal contamination from chemicals and sediment); low-gradient stream segments with stable channel structure; and presence of complex cover (woody debris, undercut banks, boulders, and pools). While bull trout expressing the resident life history will remain localized to watersheds with spawning and rearing habitat, the expression of migratory life history strategies (fluvial, adfluvial, or anadromous) is also dependent on the presence of appropriate FMO habitat, suitable flow levels, and lack of barriers (physical or thermal) to connectivity. Metapopulation structure, genetic exchange, and recolonization of extirpated local populations are dependent on unrestricted movement of migratory individuals through downstream FMO habitat. Appropriate timing and seasonality of streamflow is important for successful spawning (avoiding redd mortality from drying or flood scouring events), adult survival (e.g., preventing stranding in side channels), and to provide adequate flow for migratory movement past barriers. A suitable prey base is necessary for successful survival and reproduction: smaller bull trout such as juveniles and adult residents feed on a diverse array of zooplankton, aquatic insects, and small fish (and are themselves vulnerable to predation by larger predatory fish), while larger migratory adults feed on a variety of larger forage fish. Most of the threat factors affecting bull trout operate by impairing one or more of these biological requirements, which are also reflected in the primary constituent elements of bull trout critical habitat (USFWS 2010a). Below, we summarize the mechanisms by which these threat factors affect bull trout and the general recovery actions that are appropriate to effectively respond to these threat factors. Specific details and relative emphasis of these conservation measures will vary among different core areas and recovery units. Conservation actions described for bull trout recovery are summarized by core area for the six recovery units in the Recovery Actions section below, and will be discussed in more detail in the associated RUIPs.

When fine sediments enter streams at levels beyond natural background conditions, they can accumulate within spawning gravels and reduce survival of eggs and embryos (Pratt 1992) by impairing their access to oxygenated water, as well as negatively affecting juveniles and adults by interfering with foraging, clogging gills, physically abrading tissues, and disrupting orientation and movement patterns. Accumulation of sediment can degrade stream structure by filling in pools and changing substrate composition. Sedimentation can result from wildfire; erosion or debris flows from unstable slopes; and a variety of management activities, including instream construction, excessive grazing, timber harvest, agricultural inputs, urban/residential land uses, road maintenance and construction, and mining. Therefore, minimizing this threat requires reduction of these activities or implementing best management practices to minimize erosion and release of sediment into streams. For example, sediment impacts from roads can be addressed by identifying sediment-producing areas; redirecting runoff to downslope areas away from stream channels; maintaining bridges, culverts, and crossings; or decommissioning surplus roads and removing culverts and bridges on closed roads. Mining impacts can be reduced by removing or stabilizing mine tailings and waste rock within stream channels and floodplains. Compatible grazing practices include fencing of riparian areas, rotation of grazing, and relocating salt and watering facilities away from sensitive riparian areas. Timber harvest and other upland management impacts should avoid buffer areas along riparian zones and retain forest cover on unstable slopes above spawning streams. Additional research on effectiveness of these practices and alternative methods may be useful to adaptively improve management of bull trout habitat.

Other impacts to water quality can negatively affect bull trout, including but not limited to: pH changes and heavy metal contamination from mines; runoff of pesticides, fecal coliform, or nutrients from agricultural activities or urban development; associated low dissolved oxygen concentrations; and oil from roads. Fish exposed to contaminants such as heavy metals and pesticides can suffer direct mortality at high levels, or at lower levels can experience chronic sublethal impacts to performance, swimming ability, migratory behavior, reproductive success, and survival rates. Therefore, water quality in bull trout habitat should be maintained at high levels by implementing best management practices and enforcing water quality standards.

Bull trout have extremely low tolerance for warm water temperatures, especially in spawning and rearing habitat. Thermal tolerances are narrowest during egg incubation, when warm water reduces egg survival rates and size at hatching. In juvenile and adult bull trout, warm water has sublethal effects such as reducing feeding rate and growth rate, or at sufficiently high temperatures can directly cause mortality. Because water temperature is affected by riparian cover and inputs of cold water from groundwater and springs, management practices to promote coldwater habitats include identifying geomorphic zones that act as sources of cold water and protecting riparian areas from timber harvest, wildfire, and livestock grazing impacts (Dunham *et al*. 2003). Moreover, we expect the geographic distribution of coldwater habitat to progressively diminish over the next 50 to 100 years as effects of climate change become more intense; as ambient air temperature increases, stream reaches with viable cold water sources will become increasingly valuable to bull trout and should be targeted early for protection and management (Leppi *et al.* 2012; Isaak *et al*. *in review*). Adult bull trout, particularly the migratory life history forms, may use comparatively warm river and stream reaches seasonally, moving out of them during warm seasons when water temperatures increase; thus, their ability to adaptively respond to changing water temperatures depends on full connectivity for movement between headwater and mainstem habitats, as discussed further below.

Streams with complex structure, including deep pools, overhanging banks, riparian vegetation, and large woody debris, provide local sites of cool microclimate, pockets of slow water, and physical shelter, thus increasing bull trout spawning success and adult and juvenile survivorship. Removal of these structural components (e.g., stream channelization; grazing, forestry, or other impacts to riparian vegetation; reduction of woody debris in streams, either by direct removal from streams or by harvest of riparian trees that could supply woody debris in future; sediment accumulation reducing pool depth) may negatively affect bull trout populations. Implementing management practices that prevent these impacts or restore complex structural components to streams will benefit bull trout reproductive success and survivorship. Most management practices discussed above to address sedimentation effects can help to mitigate impacts to structural complexity of stream and directly restore structural components and compensate for past impacts.

Connectivity between spawning and rearing habitat and downstream FMO habitat sufficient for bull trout to move freely and with minimal risk is necessary for the expression of migratory life history patterns. In core areas where multiple local populations exist, interaction among local populations through movement of migratory individuals is critical to maintaining genetic diversity and recolonizing local populations that become extirpated. Thus, when connectivity with FMO habitat is impaired or blocked, bull trout populations tend to become restricted to isolated local populations of small resident fish, which may have low genetic diversity, are vulnerable to extirpation, and cannot be readily recolonized. Barriers to connectivity may consist of natural physical features such as waterfalls; river reaches that create mortality risks or prevent movement of adult fish because of entrainment; excessively warm water, or poor water quality; instream structures such as culverts or weirs; or dams. The severity of passage barriers is generally affected by the volume of streamflow, which can vary with seasonal precipitation, droughts, and dam operations so that passage is available only at certain times of year.

Thus, removing or minimizing the effects of connectivity barriers is important for restoring expression of migratory life history and movement among local populations within core areas. Core areas should be assessed for significant passage barriers that impair their connectivity. Depending on impacts and cost effectiveness, restoration actions may include removal or improvement of culverts, modifying seasonal instream flows, or reconfiguring natural passage barriers. However, the potential for facilitating colonization by nonnative fishes should also be considered before implementing these projects.

Dams that were designed without fish passage facilities, or with fish passage capability inadequate for movement of bull trout, can impair or block connectivity. Some dams can block movement by causing seasonal dewatering of downstream reaches; or at the other extreme, high volumes of spill can also result in nitrogen supersaturation downstream, which can impair or kill bull trout by causing gas bubble disease. Seasonal flow regimes resulting from dam operations may differ substantially from the flow patterns needed for bull trout migration, for example by release of high flows in summer to supply agricultural uses. Therefore, in each core area where dam operations are a significant threat to recovery they should be reviewed to determine whether they are impairing bull trout passage, and modified if necessary to minimize impacts. Where fish passage facilities are lacking or inadequate, it may be appropriate to construct improved facilities, or in some cases consider decommissioning the dam.

Water diversions at dams, ditches, small agricultural intakes, and hydropower facilities can entrain juvenile or adult bull trout, killing them or permanently removing them from access to spawning habitat. Therefore, to prevent this impact in core areas where it is a threat, water diversion structures or hydropower facilities within bull trout spawning or FMO habitat should be prioritized by their level of impact; screens or other remedial actions that are adequate to exclude juvenile bull trout should be installed or implemented.

Lack of suitable habitat within FMO habitat, including shared FMO habitats in mainstem, estuarine, and near-shore areas, can increase mortality of migratory individuals or discourage movement through these areas, resulting in reduced connectivity among local populations or core areas. Therefore, impaired FMO areas should be identified within core areas and in shared FMO habitats, and habitat improvement measures should be implemented where feasible. Recovery actions in mainstem river habitats may include flow and water temperature management, channel restoration, and improvement of structural habitat components. In estuarine and near-shore habitats projects may include improving beach nourishment; removing or modifying structures such as riprap, dikes, and tide gates; contaminant remediation; or restoring eelgrass or kelp beds.

In watersheds where bull trout populations have been severely reduced or extirpated and connectivity impairment is likely to prevent natural recolonization, active reintroduction or supplementation of bull trout from appropriate source populations may help reestablish viable local populations to improve core area status. Such efforts may involve direct translocation from more vigorous populations or captive breeding of bull trout in controlled propagation facilities. Such translocation programs should consider appropriate precautions against introduction of fish pathogens to new watersheds.

Because bull trout depend on the availability of invertebrates and smaller fish as prey, they can be vulnerable to the introduction of other species with overlapping diets (lake trout, northern pike, brown trout, brook trout, and bass) that can compete effectively for these resources and reduce the prey base. Insufficient availability of food or behavioral exclusion from foraging habitat due to competition can result in decreased growth and survival of bull trout. Brown trout and brook trout may also compete directly for spawning and rearing areas, damaging bull trout redds and reducing incubation success. Introduction of nonnative fishes can also interact with changes in habitat, so that other species that are better adapted to warmer water temperatures might competitively exclude bull trout as water temperatures increase. Moreover, larger predatory species (particularly lake trout, northern pike, and brown trout) can prey directly on smaller bull trout. Once established, nonnative fish populations can often colonize connected watersheds and can be difficult to eradicate.

Therefore, minimizing or eliminating these negative effects from past introductions and preventing new introductions into bull trout habitat is important for recovery of bull trout, and is a critical issue in certain recovery units. Because nonnative species issues vary greatly among core areas depending on ecosystem characteristics and the particular species involved, competitive and predatory interactions within watersheds should be reviewed and the feasibility of eradication or suppression (for example through targeted experimental removal or liberal harvest regulations) should be assessed. Where these measures will benefit bull trout and are cost-effective and feasible, nonnative fish species should be actively controlled. Ongoing public and private fish stocking programs should be reviewed and modified if necessary to avoid any additional introductions of nonnatives; moreover, the potential for illegal introductions should be addressed with a combination of public education and enforcement policies. Removal of barriers within streams, while usually beneficial for migratory movement of bull trout, should also be evaluated with respect to the potential for facilitating colonization by nonnative fishes.

Introduced brook trout can also hybridize with bull trout. Hybrid individuals do not contribute to perpetuation of bull trout populations; they are usually sterile and if not, their offspring are of mixed genetic composition and could result in introgression of brook trout genetics into the population. Thus, hybridization represents wasted reproductive effort for bull trout, and should be avoided in order to maintain ecologically viable and genetically pure bull trout populations. Many of the same measures discussed above for competitive and predatory interactions with nonnative fishes are appropriate for addressing hybridization; however, genetic studies of bull trout populations that coexist with brook trout can also be useful to evaluate the extent of hybridization and identify introgressed individuals.

We currently consider disease a minor threat to bull trout. Whirling disease has potential to affect bull trout either directly or indirectly through its impacts on prey species or competitors. Therefore, research into its effects on fish communities and potential management remedies may be important in core areas where this is an issue.

Impacts to bull trout through fishing include killing by legal harvest (in a few watersheds where allowed by State fishing regulations at the time of listing) or illegal poaching; harassment and inadvertent injury or hooking mortality, for individuals incidentally caught and released by recreational anglers targeting other species; and bycatch in nets. Where bull trout populations are healthy and angling pressure is relatively low they may be able to sustain a moderate level of harvest or bycatch mortality, so it may be reasonable to establish recreational fisheries under State management authority in core areas that are proven to have fully met recovery targets. However, excessive harvest has potential to depress population levels and slow or reverse progress toward recovery, so existing regulations should be enforced and the development of State or Tribal fish management plans should employ a conservative approach based on watershed-specific fisheries research on bull trout population status and potential for overharvest.

Climate change is an independent threat to bull trout that exacerbates many of the other threats discussed above, and that we expect to increase in severity over coming decades. Stream temperature modeling indicates that increasing air temperatures and other changes to hydrology and other factors, modified by local habitat conditions, will tend to result in increased water temperatures, reducing the amount of stream habitat with suitable cold water conditions to scattered refugia protected by groundwater inputs or other factors. Warm dry conditions are also likely to increase the frequency and extent of forest fires, which in addition to their acute effects on streams can increase sedimentation and cause longer-term warming of water by eliminating riparian shading. Projected lower instream flows and warmer water in FMO habitats will exacerbate the lack of connectivity within and between bull trout core areas. Moreover, we expect increased water temperatures to alter competitive interactions between bull trout and other fish species that are better adapted to warm conditions, resulting in increased risk of bull trout habitat being colonized by fishes that will outcompete and/or prey upon them. Climatic warming will change seasonality of streamflow, as increased spring runoff from rain-on-snow events causes flooding and scouring of spawning gravels, while glacial retreat and reduction of summer snowpack reduces coldwater flows during summer months. Sea-level rise will result in the loss of, and changes to, near-shore and estuarine habitat. Although addressing the root causes of greenhouse gas emissions and climate change is not within our jurisdiction, management planning should account for these increased threats and proactively protect those habitats that are expected to best maintain coldwater conditions suitable for bull trout.

Adequate responses to all of these threats will require cooperative work from a wide variety of partners, including Federal and State land and water management agencies, regulatory agencies, State fish and game departments, Tribes, and user groups. Enforcement of fisheries regulations and habitat protection standards by State, Federal, and Tribal agencies is critical for protecting bull trout and their habitat. In a number of core areas local working groups are already implementing a wide variety of these recovery actions for bull trout, and they will continue to be a crucial resource for working toward recovery (*i.e.*, Yakima Basin Fish and Wildlife Recovery Board and Lower Columbia Fish Recovery Board in WA; Avista Native Salmonid Restoration Program in MT; Malheur River Bull Trout Technical Advisory Committee in OR) (USFWS 2014). See Appendix G for additional information on recovery implementation approaches for State, Federal, and Tribal governments.

<u>The Role of Artificial Propagation and Translocation in Bull Trout Recovery</u>

Bull trout remain widely distributed but have been extirpated from major portions of their range within the coterminous United States, particularly in the southern and western portions of their range including the McCloud River in California, parts of north-central Washington, and substantial portions of the Klamath, Deschutes and Willamette basins in Oregon. In some watersheds where bull trout populations have been severely reduced or extirpated and connectivity impairment is likely to prevent natural recolonization, active reintroduction or supplementation of bull trout from appropriate source populations may help reestablish viable local populations to improve core area status. Such efforts may involve direct translocation (transplantation) from more vigorous populations or captive breeding of bull trout in controlled artificial propagation facilities. Such translocation programs should consider appropriate precautions against introduction of fish pathogens to new watersheds.

Artificial propagation refers to the production of individuals, generally within a managed environment, for the purpose of augmenting a wild population, or for the purpose of reintroduction to the wild (USFWS 2000). Translocation, while broadly defined as the intentional release of animals to the wild to establish, reestablish, or augment a population (IUCN 1987), is often more narrowly described in the fisheries literature as the capture and movement of wild fish from one location to another (George *et al*. 2009; Shively *et al*. 2007). Artificial propagation and translocation are the two primary methods of accomplishing species introductions, reintroductions, and augmentations (sometimes referred to as supplementation). Introduction refers to the release of fish outside their native range whereas reintroduction is the release of fish within their native range (George *et al*. 2009). Augmentation refers to the addition of individuals to an existing wild population.

Although guidance specific to bull trout is limited, there are readily available guidelines for translocation and artificial propagation (Williams *et al*. 1988; Minckley 1995; IUCN 1998; George *et al*. 2009; Seddon *et al*. 2007). Dunham *et al*. (2011) provided guidance specific to reintroduction feasibility assessments with a framework applied to a recent bull trout reintroduction effort in the Clackamas River, Oregon. Guidance on artificial propagation is provided in the joint policy of the Service and the National Marine Fisheries Service regarding the controlled propagation of listed species (65 FR 56916).

The Montana Bull Trout Scientific Group (MBTSG) evaluated seven strategies for the potential use of artificial propagation in the recovery of bull trout (MBTSG 1996). The report evaluated the use of hatcheries in establishing genetic reserves, restoration stocking (*i.e*., reintroductions), research activities, supplementation (*i.e*., augmentation) programs, introductions to expand distribution, and the establishment of "put, grow, and take" fisheries. The report concluded that the potential use of hatcheries in bull trout recovery could include the establishment of genetic reserves for declining populations, restoration stocking (*i.e*., reintroductions), and some research activities including the evaluation of hybridization. However, the report concluded that the use of hatcheries for bull trout supplementation programs, "put, grow, and take" stocking, and introductions outside historical range were not appropriate. For bull trout recovery planning purposes, the Service generally supports these recommendations from the MBTSG (1996).

Relative to other widely distributed native trout in North America, the record of bull trout propagation and translocation is sparse (MBTSG 2006, Shively *et al*. 2007). Propagation and translocation programs that have occurred since bull trout were federally listed in 1998 have been sporadic and geographically dispersed due in part to an absence of clear bull trout recovery goals and objectives to guide these programs and a lack of a large-scale system of prioritization that would help assess the biological value of these programs relative to other recovery actions. To bridge this gap,, models recently developed through the NorWeST (Isaak *et al*. 2015) and Bull Trout Vulnerability Assessment (Dunham 2015) processes will be valuable to conduct a range-wide assessment of current and projected future coldwater habitats and the threats to the persistence of bull trout in the coterminous United States. Utilizing existing data, climate and non-climate threats can be evaluated by the independent or interactive influences of these factors on the probability of persistence of local populations. Spatial structuring of bull trout populations and habitats across the species' range can be described by mapping and attributing occupied and unoccupied patches of habitat in all designated core areas. The identification of suitable but unoccupied habitats, based on probabilistic models of bull trout presence, can prove valuable for guiding implementation of recovery tasks such as translocations or passage if such areas are found consistent with recovery and do not pose unintended consequences for other species (e.g., Dunham *et al*. 2011). We anticipate that this effort, utilized in combination with recovery criteria for individual recovery units, will be a critical tool for evaluating and prioritizing areas for reintroduction and for weighing the biological benefits of reintroduction against other recovery actions.

C. Recovery Units

Our bull trout recovery strategy is founded on a hierarchical approach (Figure 3) to geographic classification. Bull trout are listed as a single DPS within the five-state area of the coterminous United States. This single DPS is subdivided into six biologically-based recovery units, as described below. Recovery units are population units that have been "…documented as necessary to both the survival and recovery of the species in a final recovery plan" (NMFS and USFWS 2010). A viable recovery unit should demonstrate that the three primary principles of biodiversity have been met: representation (conserving the breadth of the genetic makeup of the species to conserve its adaptive capabilities); resilience (ensuring that each population is sufficiently large to withstand stochastic events); and redundancy (ensuring a sufficient number of populations to provide a margin of safety for the species to withstand catastrophic events). Therefore, each recovery unit is "*individually necessary* to conserve [biological features that are] necessary for long-term sustainability of the *entire listed entity*," and thus "recovery criteria for the listed entity should address each identified recovery unit, and every recovery unit must be recovered, before the species can be delisted" (NMFS and USFWS 2010).

A distinct population segment (DPS) differs from a recovery unit in that it is an individual listed entity, designated through a rule-making process pursuant to Section 4 of the Act, and can be listed or delisted independently of other populations of the same species. Our 1996 DPS policy (USFWS 1996) defines the elements we consider when deciding whether to list a DPS under the Act: (1) discreteness of the population segment in relation to the remainder of the species to which it belongs; (2) significance of the population segment to the species to which it belongs; and (3) the population segment's conservation status in relation to the Act's

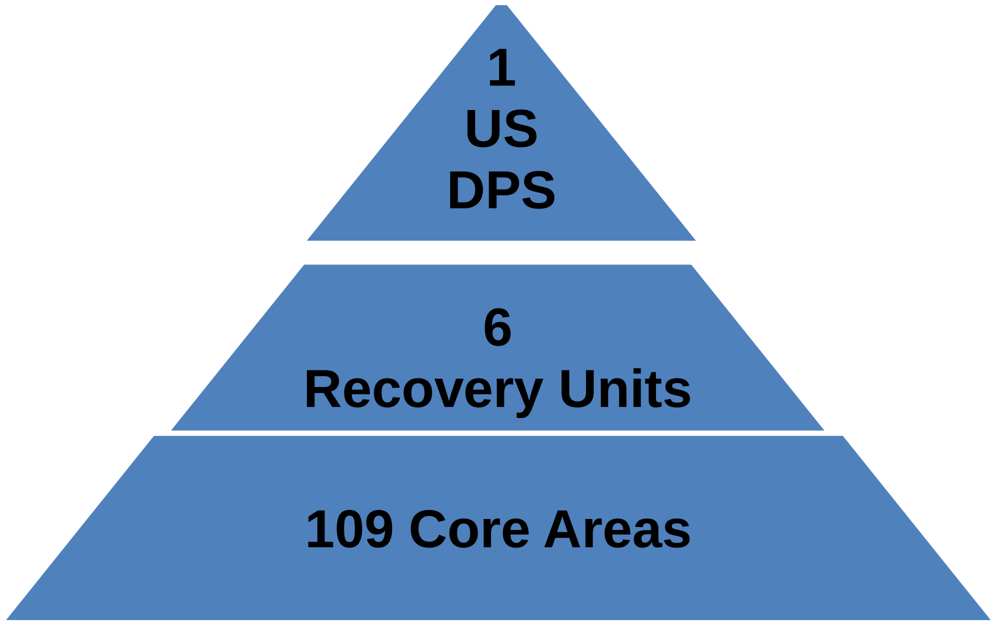

Figure 3. Hierarchical relationship of bull trout geographic classification units.

standards for listing. It is possible for a recovery unit to also meet these criteria and qualify as a DPS, but because DPSs can be designated only through a federal rule-making process, a recovery plan cannot designate a DPS or treat a recovery unit as one (NMFS and USFWS 2010).

Upon completion of our 2008 5-year review, we determined that bull trout should still be listed as threatened and that the Service should “develop a number of recovery units for bull trout (perhaps 5 to 10 for management purposes) that contain assemblages of core areas that retain genetic and ecological integrity, and allow potential future options to pursue regulatory relief/delisting on a recovery unit basis”. We then conferred with State and Federal partners to determine the best course of action and determined that there was a desire from partners to complete a final recovery plan to help ensure that recovery actions would continue to be implemented.

Each of the six recovery units are further organized into multiple bull trout core areas, which are mapped as non-overlapping watershed-based polygons, and each core area includes one or more local populations. Within the coterminous United States we currently recognize 109 occupied core areas, which comprise 600 or more local populations. In addition, there are six core areas where bull trout historically occurred but are now extirpated, and two “research needs areas” where bull trout were known to occur historically, but their current presence and historical use of the area are uncertain. The core areas are designated based on the best available information, and since the publication of the 2002 and 2004 draft recovery plans some core areas have been modified, split, or combined as more specific distribution, migratory patterns, and genetic information have been gathered. Core areas are functionally similar to bull trout metapopulations, in that bull trout within a core area are much more likely to interact, both spatially and temporally, than are bull trout from separate core areas. While bull trout are not listed in Canada, some core areas are heavily dependent on upstream or downstream SR or FMO habitat in Canada (e.g., Saint Mary River, Kootenai River, and Skagit River).

Each occupied core area is composed of often patchily distributed occupied areas of bull trout habitat which include one or more local populations. Core areas can be further described as complex or simple core areas. Complex core areas are core areas that contain multiple local bull trout populations; typically they are situated in a larger patch of habitat, sometimes occupied by bull trout of both the migratory life history form and the resident form, which includes a diverse pattern of connected SR and FMO habitats. Simple core areas are those that contain one bull trout local population. Simple core areas are almost always small in scope, with a population size that is necessarily restricted by the size of the habitat. Typically, simple core areas are ecologically if not physically isolated from other core areas by natural, not anthropogenic factors (e.g., natural barriers, thermal gradients, or large spatial separation from other core areas) that have been operable for thousands of years. However, simple core areas may represent extremes of the range or habitat and may contain unique genetic or life history adaptations worthy of preservation. If additional local populations are discovered or are colonized within simple core areas, it could be reclassified as a complex core area. The relative importance of any core area will need to be assessed with regard to the specific recovery unit in which the core area is located. If a core area contains a unique phenotype or genotype the relative importance of that core area should be assessed in terms of resilience, redundancy, and representation compared to all core areas (simple or complex) in a specific recovery unit.

In the bull trout critical habitat rule (USFWS 2010a) we also identified a number of marine or mainstem riverine habitat areas outside of bull trout core areas that provide primary constituent elements of critical habitat. These areas do not include SR habitat, but provide FMO habitat that is typically shared by bull trout originating from multiple core areas. These shared FMO areas thus support the viability of bull trout populations by contributing to successful overwintering survival and dispersal among core areas.

Since the early 2000s, new data and reanalysis have suggested that the coterminous United States listed entity would be more appropriately divided into 6 recovery units, rather than the 5 DPSs identified in the original listing rules or the 27 recovery units identified in the 2002 and 2004 draft recovery plans. We worked with a number of State, Federal, and Tribal partners in 2008 and 2009 to evaluate alternatives for organizing core areas into possible recovery units that would also be consistent with the “discreteness” and “significance” criteria in the DPS policy. Ten alternatives were evaluated that explored from 2 to 69 potential recovery units, based on mitochondrial and microsatellite DNA analysis, and on biogeographical considerations, including geological establishment of major watersheds, isolation of portions of watersheds above major waterfalls, co-occurrence with other fish species, and occurrence in different ecological zones (Ardren *et al*. 2011). The six recovery units identified in this plan (Figure 4) reflect this most recent information and analysis, and were first described in the 2010 proposed critical habitat rule (USFWS 2010a). They include: (1) Coastal Recovery Unit; (2) Klamath Recovery Unit; (3) Mid-Columbia Recovery Unit; (4) Upper Snake Recovery Unit; (5) Columbia Headwaters Recovery Unit; and (6) Saint Mary Recovery Unit (Figure 4).

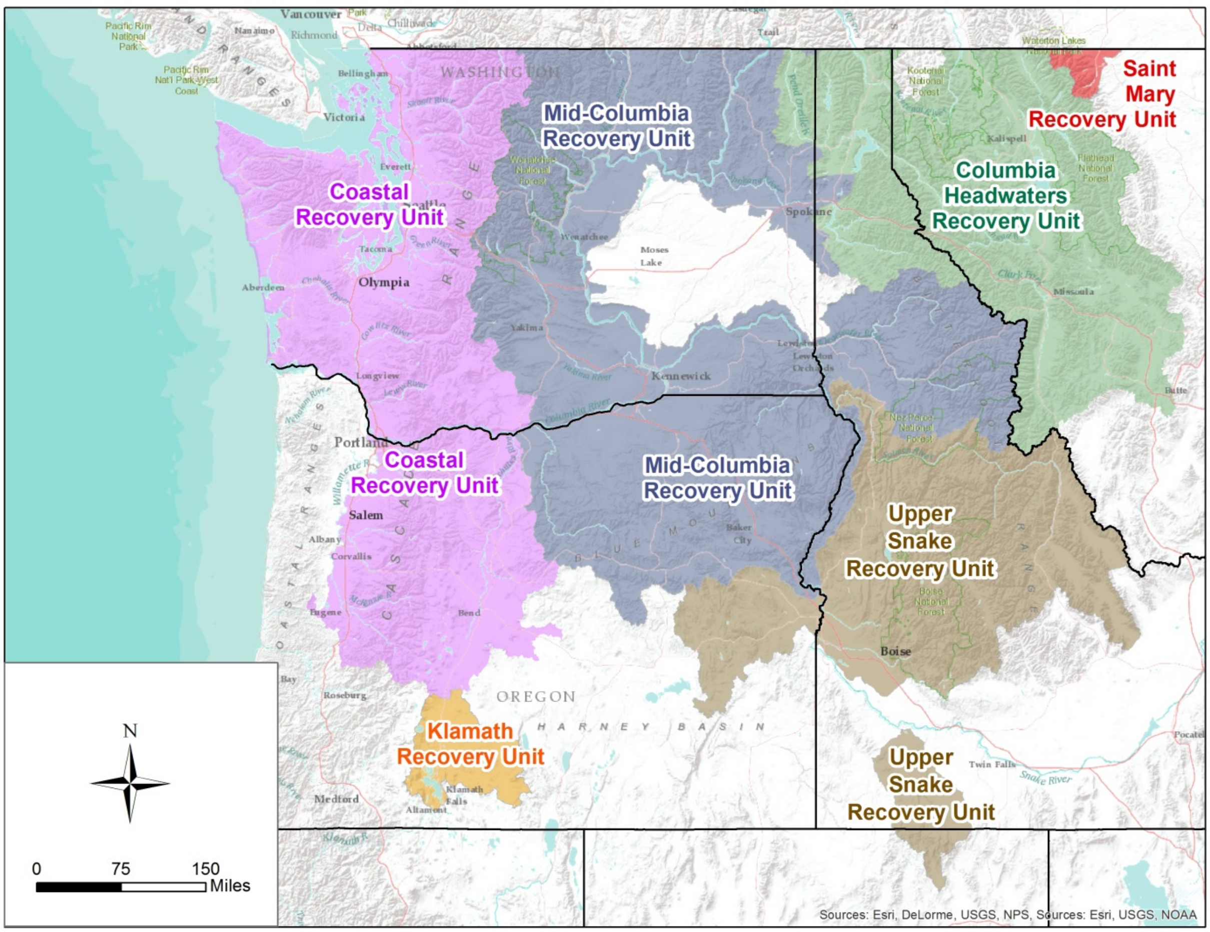

Figure 4. Locations of the six bull trout recovery units in the coterminous United States.

A brief description of the six recovery units (Figures 5 to 10) identified in this recovery strategy is provided below; see Appendix D for a more complete description of each recovery unit. Each recovery unit comprises several neighboring core areas that share similar bull trout genetic, geographic (hydrographic), and/or habitat characteristics. Conserving bull trout at the core area level allows for the maintenance of broad representation of genetic diversity. Neighboring core areas will benefit from potential source populations in the event of local extirpations and provides a broad array of options among neighboring core areas to contribute recovery under uncertain future environmental change.

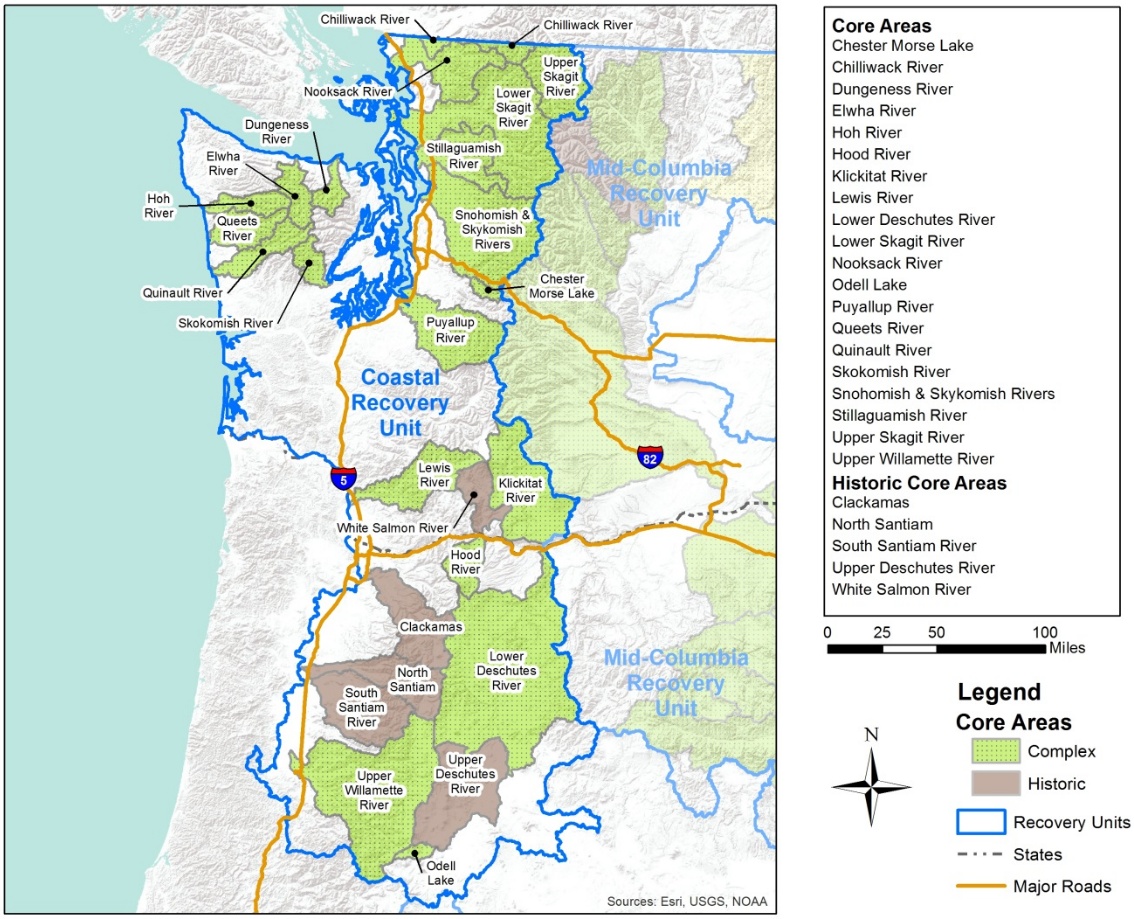

Figure 5. Map of the Coastal Recovery Unit.

The Coastal Recovery Unit is located within western Oregon and Washington. Major drainages include the Olympic Peninsula, Puget Sound, and Lower Columbia River basins, Upper Willamette River, Hood River, Lower Deschutes River, Odell Lake, and the Lower Mainstem Columbia River. In the Coastal Recovery Unit, we have designated 21 existing bull trout core areas (including the Clackamas River core area where bull trout had been extirpated and were reintroduced in 2011) and identified 4 historically occupied core areas that could be reestablished. Core areas within the recovery unit are distributed among three geographic regions: Puget Sound (includes one core area that is actually part of the lower Fraser River system), Olympic Peninsula, and Lower Columbia River. The only core areas currently supporting anadromous local populations of bull trout are located within the Puget Sound and Olympic Peninsula geographic regions.

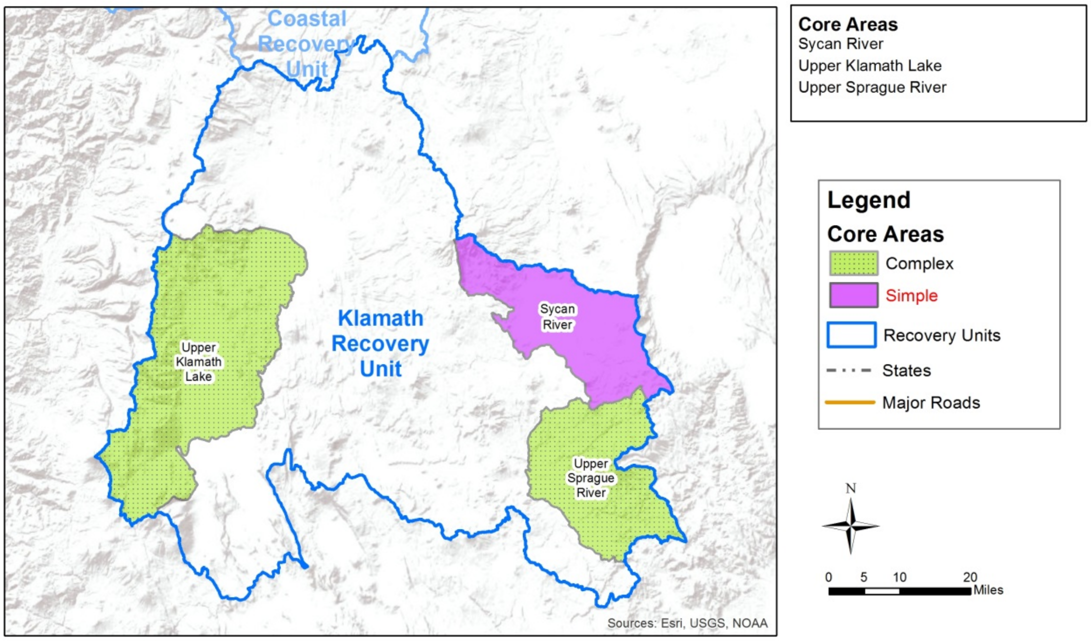

Figure 6. Map of the Klamath Recovery Unit.

The Klamath Recovery Unit is located in southern Oregon and comprises three bull trout core areas, all within the Klamath River drainage. The Upper Klamath Lake core area is comprised of the northern portion of the lake and its immediate major and minor tributaries. The Sycan River core area is comprised of Sycan Marsh and its tributaries and the Sycan River and its tributaries. The Upper Sprague River core area is comprised of drainages of the North Fork and South Fork of the Sprague River.

Eight local populations presently occur in the Klamath Recovery Unit. In addition to these eight, nine other local populations previously existed (*i.e.*, Annie Creek, Cherry Creek, Sevenmile Creek, Fort Creek, Calahan Creek, Coyote Creek, Sycan River, North Fork Sprague River, and South Fork Sprague River; Arant 1911, Light *et al*. 1996, Buchanan *et al*. 1997, Service 2002a). This recovery unit is the most significantly imperiled, having experienced considerable extirpation and geographic contraction of local populations and declining demographic condition, and natural recolonization is constrained by dispersal barriers and presence of nonnative brook trout.

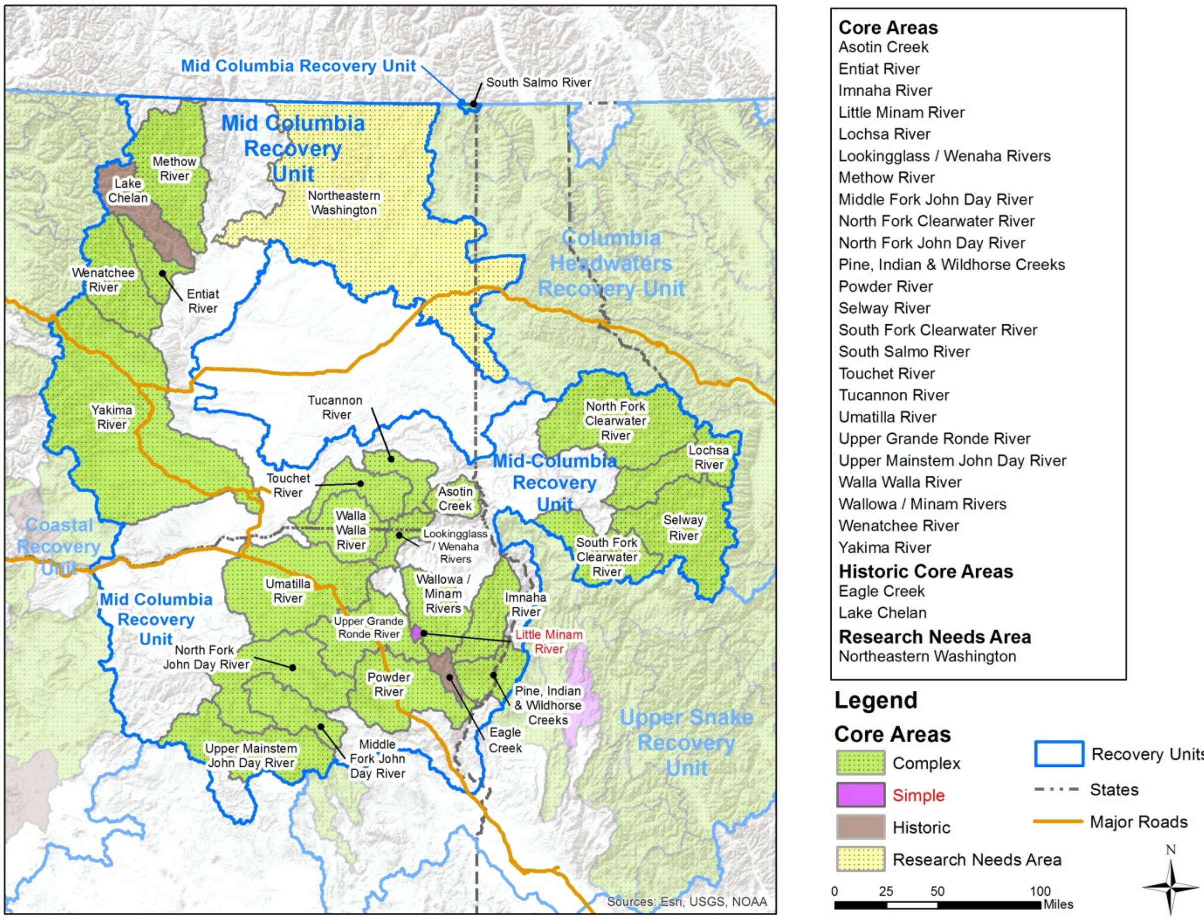

Figure 7. Map of the Mid-Columbia Recovery Unit.

The Mid-Columbia Recovery Unit is located within eastern Washington, eastern Oregon, and portions of Idaho. Major drainages include the Yakima River, John Day River, Umatilla River, Walla Walla River, Grande Ronde River, Imnaha River, Powder River, Clearwater River, and small drainages along the Snake River and Columbia River. The Mid-Columbia Recovery Unit includes 24 occupied core areas in 4 geographic regions: (1) the Lower Mid-Columbia (6 core areas in the John Day, Umatilla, and Walla Walla basins); (2) the Upper Mid-Columbia (5 core areas from the Yakima basin north to the Canadian border); (3) the Lower Snake (11 core areas in the Clearwater, Tucannon, Asotin, Grande Ronde, and Imnaha basins); and (4) the Mid-Snake (2 core areas in the Powder basin and Pine, Indian and Wildhorse Creeks). There are also two historically occupied core areas (Eagle Creek and Chelan River) and one Research Needs Area (Northeastern Washington) in this recovery unit.

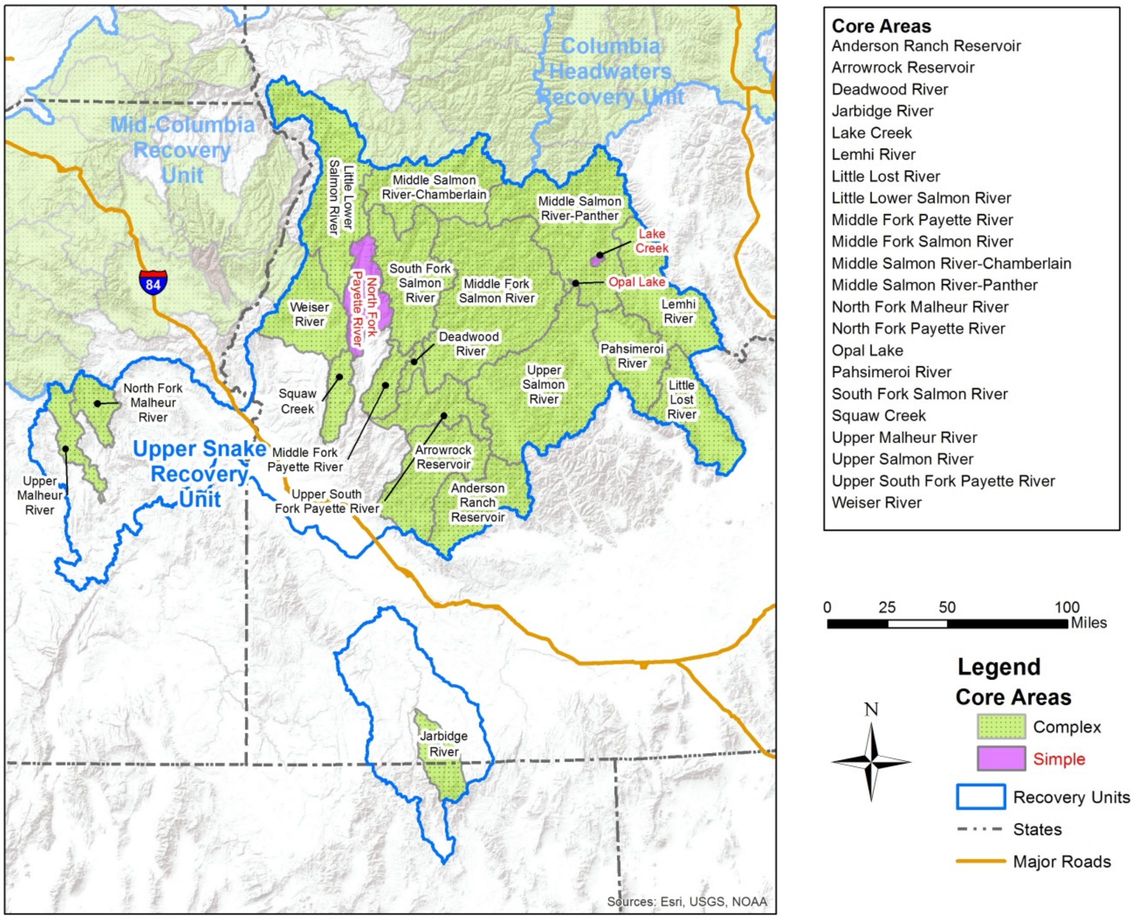

Figure 8. Map of the Upper Snake Recovery Unit.

The Upper Snake Recovery Unit occurs within central Idaho, northern Nevada, and eastern Oregon. Major drainages include: the Salmon River, Malheur River, Jarbidge River, Little Lost River, Boise River, Payette River, and the Weiser River. The Upper Snake Recovery Unit contains 22 bull trout core areas found in 7 geographic regions: Boise River, Jarbidge River, Little Lost River, Malheur River, Payette River, Salmon River and Weiser River. The only core areas currently supporting adfluvial populations of bull trout are located in the Upper Salmon River, Deadwood River, Anderson Ranch, Arrowrock, Opal Lake, and Lake Creek core areas. All remaining core areas contain resident populations and most have fluvial populations.

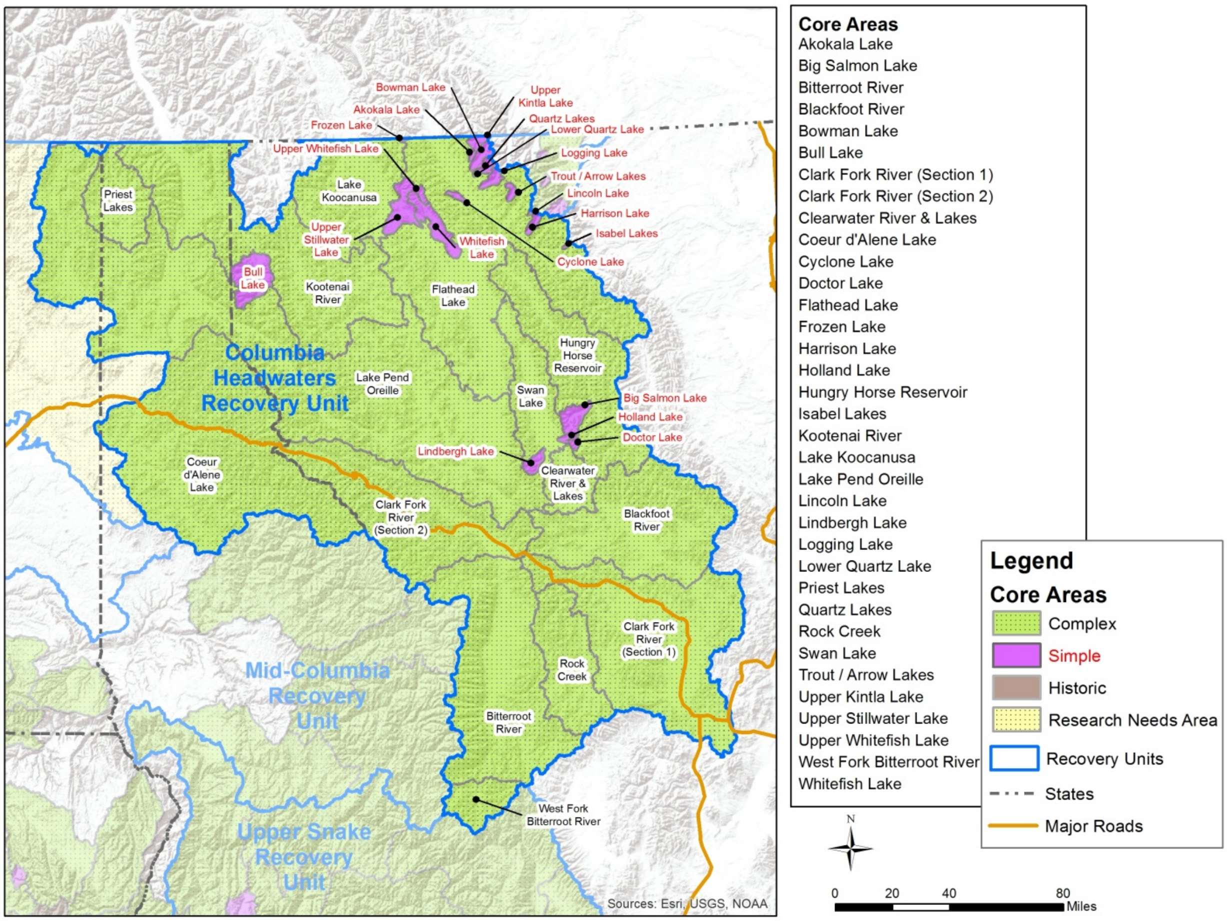

Figure 9. Map of the Columbia Headwaters Recovery Unit.

The Columbia Headwaters Recovery Unit occurs within western Montana, northern Idaho, and a portion of northeastern Washington. Major drainages include the Coeur d'Alene Lake Basin, Kootenai River Basin, and the Clark Fork River Basin. There are 35 bull trout core areas that occur in 4 geographic regions: Clark Fork River, Flathead Lake, Coeur d'Alene Lake, and Kootenai River. Fifteen of the 35 core areas are referred to as "complex" core areas as they represent larger interconnected habitats, each containing multiple spawning streams considered to host separate and largely genetically identifiable local populations. The other 20 are "simple" core areas represented primarily by isolated headwater lakes (most are in Glacier National Park) with single local populations.

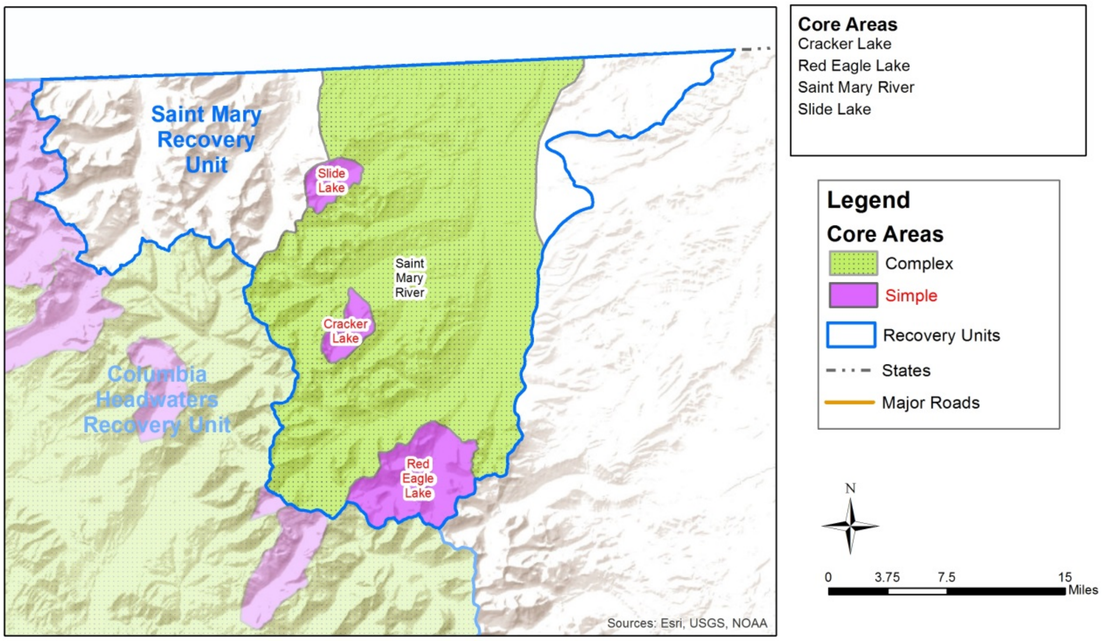

Figure 10. Map of the Saint Mary Recovery Unit.

The Saint Mary Recovery Unit, which is located in Montana but is heavily linked to downstream resources in southern Alberta, Canada, comprises four core areas; only one (Saint Mary) is a complex core area with multiple (four) local populations. The remaining three core areas (Slide Lake, Cracker Lake, and Red Eagle Lake) are simple core areas that occur upstream of seasonal or permanent barriers comprised of genetically isolated single local populations in Glacier National Park.

D. Recovery Goals, Objectives, and Criteria

The ultimate **goal** of this recovery strategy is to manage threats and ensure sufficient distribution and abundance to improve the status of bull trout throughout their extant range in the coterminous United States so that protection under the Act is no longer necessary. When this is achieved, we expect that:

- Bull trout will be geographically widespread across representative habitats and demographically stable;
- The genetic diversity and diverse life history forms of bull trout will be generally conserved; and
- Cold water habitats essential to bull trout will be conserved and connected.

Specifically, this recovery plan outlines actions needed to:

- **Effectively manage and ameliorate primary threats.** We will focus on effectively managing and ameliorating the primary threats identified for each recovery unit at the core area scale such that bull trout will respond and persist well into the future.

- **Work cooperatively with partners to develop and implement bull trout recovery actions.** This includes: acknowledging and building upon the numerous and ongoing conservation actions that have already been implemented throughout much of the range of bull trout since the time of listing, and utilizing existing and new information, including decision support tools (*i.e.*, Structured Decision Making, climate change considerations) in developing and prioritizing conservation actions in each recovery unit that have been included in their associated RUIPs.

- **Adaptively manage the bull trout recovery program**. Because the effectiveness of many of the recovery actions described in this recovery plan, as well as current and future climate effects to all populations, are not completely understood, we will apply adaptive management principles to future population monitoring, recovery implementation, and other recovery actions, including threat management interactions, for bull trout. Specific recovery actions for bull trout in each of the six recovery units are described in greater detail in the associated RUIPs and accompanying implementation schedules included in this recovery plan.

- **Focus recovery efforts on actions, and potentially within recovery units, which provide the greatest resilience against difficult-to-manage threats such as climate change**. Emerging decision support tools such as the NorWeST regional stream temperature database, mapping and modeling provide information on prioritizing recovery investments.

It should be emphasized that although bull trout are believed to have undergone a significant reduction in their historical range prior to the time of their listing in 1999, the species continues to be found in suitable habitats and is geographically widespread across numerous major river basins in five western states. The Act does not require a species, in this case bull trout, to be recovered throughout its historical range or even in any set proportion of the currently suitable habitat. Instead, the Act requires that we recover listed species such that they no longer meet the definitions of “threatened species” or “endangered species”.

E. How Much Is Enough?

The goals, objectives and criteria stated above are intended to meet the purposes of the Act which include "to provide a means whereby the ecosystems upon which [species] depend may be conserved," and to bring species to the point where the protections of the Act are no longer necessary. The threshold of when protections are no longer necessary can vary depending on the degree of certainty of conservation sought over time; e.g., minimally viable species (least certain over shortest time) (Reed *et al.* 2003, Trail *et al.* 2007); ecologically viable species (moderately certain into foreseeable future) (Peery *et al.* 2003), or species with viability of evolutionary potential (most certain over longest time) (Lynch and Lande 1998).

Our recovery planning guidance (NMFS and USFWS 2010) recommends that recovery criteria be SMART: Specific, Measurable, Achievable, Realistic, and Time-referenced. We seek to identify recovery criteria for bull trout that meet these practical directives and are based in a sound scientific rationale, reflecting biodiversity principles of resilience (ecological quality and ability to persist), redundancy (maintaining multiple replicates of populations/habitats to insure against catastrophic loss), and representation (conserving the full range of natural variation) (Shaffer and Stein 2000, Tear *et al*. 2005). We have additionally identified seven principles of conservation specific to bull trout (USFWS 2010): (1) conserve the opportunity for diverse life history expression; (2) conserve the opportunity for genetic diversity; (3) ensure bull trout are distributed across representative habitats; (4) ensure sufficient connectivity among populations; (5) ensure sufficient habitat to support population viability (e.g., abundance, trend indices); (6) address threats, including climate change; and (7) ensure sufficient redundancy in conserving population units. These recovery principles take into account the threats and physical or biological needs of the species throughout its range and focus on the range-wide recovery needs.

Bull trout continue to be found in suitable habitats and are geographically widespread, and their population status remains strong in some core areas, across numerous major river basins within the six recovery units that comprise the coterminous distinct population segment. However, we also acknowledge that despite our best conservation efforts identified in this recovery plan, it is possible that some existing bull trout core areas may become extirpated due to various factors, including the effects of small populations and isolation. Thus, our current approach to identifying recovery criteria and necessary recovery actions for bull trout is intended to ensure adequate, long-term conservation of genetic diversity, life history features, and broad geographical representation of bull trout populations, while acknowledging a small number of local extirpations may occur without preventing recovery if threats are successfully managed in most core areas. Specifically, we have developed a recovery approach that: (1) focuses on the identification of and effective management of known and remaining threat factors to bull trout in each core area; (2) acknowledges that some extant bull trout core area habitats will likely change (and may be lost) over time; and (3) identifies and focuses recovery actions in those areas where success is likely to meet our goal of ensuring the certainty of conservation of genetic diversity, life history features, and broad geographical representation of remaining bull trout populations so that the protections of the Act are no longer necessary.

F. Bull Trout Recovery Criteria

The recovery criteria represent our best assessment of the conditions that would most likely result in a determination that listing under the Act is no longer required. For bull trout, these conditions will be met when conservation actions have been implemented to ameliorate the primary threats in suitable habitats. If the primary threats have been effectively managed in each recovery unit, the long-term persistence of bull trout should be ensured.

The Service may initiate an assessment of whether recovery has been achieved and delisting is warranted when the following has been accomplished in each recovery unit:

- For the Coastal, Mid-Columbia, and Upper Snake Recovery Units: Primary threats are effectively managed in at least 75 percent of all core areas, representing 75 percent or more of bull trout local populations within each of these three recovery units (Table 1).

- For the Columbia Headwaters Recovery Unit: Primary threats are effectively managed in 75 percent of simple core areas and 75 percent of complex core areas, representing 75 percent or more of bull trout local populations in both simple and complex core areas (Table 1).

- For the Klamath and Saint Mary Recovery Units: All primary threats are effectively managed in all existing core areas, representing all existing local populations. In addition, because 9 of the 17 known local populations in the Klamath Recovery Unit have been extirpated and others are significantly imperiled and require active management, we maintain that the geographic distribution of bull trout within this recovery unit needs to be substantially expanded before it can be considered to have met recovery goals. To achieve recovery, we seek to add seven additional local populations distributed among the three core areas (two in the Upper Klamath Lake core area, three in the Sycan core area, and two in the Upper Sprague core area) (Table 1).

- In recovery units where shared FMO habitat outside core areas has been identified, connectivity and habitat in shared FMO areas should be maintained in a condition sufficient for regular bull trout use and successful dispersal among the connecting core areas for those core areas to meet the criterion. Shared FMO areas that function sufficiently to meet the criterion should provide the primary constituent elements of critical habitat specific to migration habitat.

Table 1. Recovery (Delisting) Criteria: For each recovery unit, number of core areas (and local populations) where threats must be effectively managed; reaching this 'threshold' would initiate the delisting evaluation process.

Recovery Unit	Existing		Threshold	
	Total Number of Extant Core Areas	Total Number of Local Populations within Extant Core Areas	Minimum Number of Core Areas with Threats Effectively Managed	Minimum Number of Local Populations within Effectively Managed Core Areas
Coastal RU[1]	20	84	**15**	**63**
Mid-Columbia RU	24	142	**18**	**107**
Upper Snake RU	22	207	**17**	**156**
Columbia Headwaters RU[2] (simple core areas)	20	20	**15**	**15**
Columbia Headwaters RU[2] (complex core areas)	15	143	**12**	**108**
Klamath RU[3]	3	8	**3***	**8***
Saint Mary RU	4	7	**4**	**7**

[1]Reintroduced population in Clackamas River core area is considered a potential local population until confirmed as established; if successful, it may contribute toward meeting the Coastal RU thresholds.

[2] For the Columbia Headwaters RU: primary threats are effectively managed in 75 percent of simple core areas <u>and</u> 75 percent of complex core areas.

[3]Klamath RU: effective primary threat management in 100 percent of existing core areas and local populations, plus additional reintroductions.

Outcome: If threats are effectively managed as described in Table 1 above, we expect that bull trout will respond accordingly and reflect the biodiversity principles of resilience, redundancy, and representation. Specifically, achieving the proposed recovery criteria in each recovery unit would result in geographically widespread and demographically stable local bull trout populations within the range of natural variation, with their essential cold water habitats conserved and connected to allow their diverse life history forms to persist into the foreseeable future; therefore the species would be brought to the point where the protections of the Act are no longer necessary.

In developing this bull trout recovery plan, the recovery criteria and recovery actions are intended to ensure that bull trout will be conserved as an ecologically viable species for the foreseeable future, and where possible, maintain its evolutionary potential. In this context, recovery must include the adequate conservation of genetic diversity, life history features, and broad geographical representation of bull trout populations in six recovery units that comprise the threatened coterminous United States population of bull trout. When identified threats have been sufficiently removed and bull trout populations are secure in an ecologically or evolutionarily significant portion of its range, the protections of the Act would no longer be warranted. With these goals in mind, the recovery plan acknowledges that, despite our best conservation efforts identified in this recovery plan, it is possible that some existing bull trout core areas will become extirpated within the foreseeable future due to various factors including the effects of small populations, isolation, and climate change. Further, the recovery plan also recognizes that a small number of such extirpations could occur without preventing recovery if threats are successfully managed in most core areas.

G. Distinct Population Segment(s) and the Coterminous United States Population

In the future we may consider, in coordination with our partners and consistent with applicable law at the time, whether pursuing the potential reclassification of the listed coterminous United States population of bull trout into multiple distinct population segments (DPSs) is warranted, and/or whether it is a possible approach to delisting bull trout. Section 3 of the Act defines "species" to include "any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature". In 1996, the Service and National Marine Fisheries Service published a joint policy guiding the recognition of DPSs of vertebrate species (61 FR 4722-4725). Under this policy, we consider two factors to determine whether the population segment is a valid DPS and thus eligible for listing, reclassification, or delisting: (1) discreteness of the population segment in relation to the remainder of the taxon, and (2) the significance of the population segment to the taxon to which it belongs. If a population meets both tests, it can be designated a DPS. The population segment's conservation status would then be evaluated according to the standards in section 4 of the Act for listing, delisting, or reclassification (*i.e.*, a determination would be made whether the DPS is endangered or threatened).

As previously described, our initial analyses for listing bull trout under the Act divided the species into five DPSs (Columbia River, Klamath River, Jarbidge River, Saint Mary-Belly River, and Coastal-Puget Sound). Collectively, these five DPSs covered the range of the species within the United States, excluding populations in Canada and Alaska. Two of these DPSs (Columbia River and Klamath River) were listed separately under the Act as threatened in 1998 (USFWS 1998a). The Jarbidge River DPS was emergency listed as endangered in 1998 (USFWS 1998b), and later listed with the Coastal Puget Sound and Saint Mary-Belly River as threatened in 1999 (USFWS 1999b). Subsequently, all five DPSs were combined into a single DPS, covering the species' range in the coterminous United States, and listed as threatened on November 1, 1999 (USFWS 1999a). This listing rule provided efficiency because all five DPSs were considered "threatened," and adhered to contemporary DPS guidance to "use sparingly" such designations as directed by Congress. The coterminous United States listing rule recognized the five DPSs as useful subdivisions for purposes of section 7 consultation under the Act, and they continued to be used in the organization of the 2002 and 2004 draft recovery plans (USFWS 2002b, 2004b).

Since that time, new data and reanalysis have suggested that the coterminous United States listed entity would be more appropriately divided into 6 recovery units, rather than the 27 recovery units identified in the 2002 and 2004 draft recovery plans. We worked with a number of State, Federal, and Tribal partners in 2008 and 2009 to evaluate alternatives for organizing core areas into possible recovery units that might also be consistent with the "discreteness" and "significance" criteria in the DPS policy. Ten alternatives were evaluated that explored from 2 to 69 potential recovery units, based on mitochondrial and microsatellite DNA analysis, and on biogeographical considerations, including geological establishment of major watersheds, isolation of portions of watersheds above major waterfalls, co-occurrence with other fish species, and occurrence in different ecological zones (Ardren *et al*. 2011). The six recovery units identified in this plan reflect this most recent information and analysis, and were first described in the 2010 proposed critical habitat rule (USFWS 2010a). They include: (1) Coastal Recovery Unit; (2) Klamath Recovery Unit; (3) Mid-Columbia Recovery Unit; (4) Upper Snake Recovery Unit; (5) Columbia Headwaters Recovery Unit; and (6) Saint Mary Recovery Unit.

The six units delineated have a pattern of significant genetic divergence at the microsatellite level; are isolated from other populations (strongly for the Coastal, Klamath, St.

Mary, and Columbia Headwaters, limited for the Mid-Columbia and Upper Snake); and show life history differences (primarily for the Coastal and Klamath, limited for the others). Loss of any unit may create a significant gap in the range (loss from major drainage basin or major portion of Columbia basin), loss of unique ecological setting (especially for Klamath and St. Mary, more limited for the others) and marked difference (low potential for shared evolutionary future among Klamath, St. Mary, and Columbia Headwaters; and evolutionarily significant genetic divergence among Coastal, Klamath, and St. Mary).

It is possible that each of the six recovery units may meet the definition of a DPS under our 1996 Policy Regarding Recognition of Distinct Population Segments. All six recovery units operate as biologically distinct entities and each face different suites of site-specific threats. For that reason, recovering and delisting bull trout simultaneously across all six recovery units range-wide may not be necessary. However, because none of these recovery units has been designated as a DPS through a formal federal rule-making process, the DPS discussion in this recovery plan does not constitute designation of any recovery unit as a DPS. Thus, bull trout remain listed as a single DPS in the coterminous United States.

We have identified recovery criteria in this recovery plan to be applied at the recovery unit scale to facilitate independent management and achievement of recovery goals which when achieved may lead to considering whether it is possible to delist at the recovery unit (*i.e.*, DPS scale). Any future and formal determination of DPS status would still require publication of a proposed and final rule in the *Federal Register*, with full consideration of current biological data, applicability of the DPS policy, appropriateness of threatened and/or endangered status for each DPS, and legal sufficiency of the rule.

H. Recovery Actions

Recovery of bull trout will entail effectively managing threats to ensure the long-term persistence of populations and their habitats, ensuring the security of multiple interacting groups of bull trout, and providing habitat conditions and access to them that allow for the expression of various life history forms within each of six recovery units. Specifically, recovery actions described in the following categories, and when implemented and effective, should:

- Protect, restore, and maintain suitable habitat conditions for bull trout.
- Minimize demographic threats to bull trout by restoring connectivity or populations where appropriate to promote diverse life history strategies and conserve genetic diversity.

- Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.
- Work with partners to 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, and considering the effects of climate change.

The following recovery action categories have been developed in cooperation with Federal, State, Tribal, local, and other partners to be implemented in core areas for each of the six recovery units. Six comprehensive RUIPs with implementation schedules that include core area-specific recovery actions for each recovery unit are included in the recovery plan. RUIPs may be updated individually in the future independently of the Recovery Plan as appropriate to reflect new information relevant to recovery actions within a recovery unit.

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

Habitat restoration should be done where necessary to maintain and improve water quality, conserve suitable cold water habitat, and restore impaired instream and associated riparian habitats. These recovery efforts will be focused on those locations in each recovery unit that provide the greatest resilience against difficult-to-manage threats such as climate change.

Habitat maintenance and restoration may involve implementing appropriate grazing and forest management practices, mitigating the effects of past forest harvest and forest road system construction, urban and rural development planning to consider development effects to bull trout, and considering the effects from future climate change on land management activities. Land managers with potential to implement these restoration activities include Federal agencies (particularly U.S. Forest Service and Bureau of Land Management), State agencies, Tribes, and private landowners.

Core area-specific measures to protect, restore, and maintain suitable habitat conditions for bull trout are included in each of the six RUIPs.

2. Minimize demographic threats to bull trout by restoring connectivity or populations where appropriate to promote diverse life history strategies and conserve genetic diversity.

Promoting and restoring connectivity, both within core areas and with riverine or coastal FMO habitat, should encourage the full expression of known migratory life history strategies (fluvial, adfluvial, anadromous), and allow appropriate genetic interaction and demographic exchanges among core areas. Recovery actions that address migratory connectivity may include culvert removal, fish ladder installation, management of dams to provide seasonally appropriate instream flows or avoid entrainment or dewatering, decommissioning dams where appropriate and feasible, and removal of falls or natural barriers. Connectivity management or inter-population transfers should be considered where needed to meet recovery goals under the guidance of a genetic management plan to maintain genetic diversity and regionally appropriate genetic composition.

Core area-specific measures to address demographic threats to bull trout by restoring connectivity or populations are included in each of the six RUIPs.

3. **Prevent and reduce negative effects of non-native fishes and other non-native taxa on bull trout.**

In many core areas, non-native fishes including lake trout (predation and competition), brown trout (competition), brook trout (competition and hybridization), and northern pike (predation and competition) are impacting bull trout.

Management options to address non-native fish effects vary among the six recovery units and may include angler bounties or liberalized fishing regulations, targeted electrofishing or netting, application of piscicides, or creation of passage barriers. However, the feasibility of controlling non-native fishes varies widely, depending on the specific species present, physical and biological characteristics of the watershed, availability of funding for control actions, and the public involvement and perception of control activities. Non-native fish control actions should be carefully planned with attention to site-specific conditions and public outreach.

Core area-specific measures to address effects of nonnative fishes on bull trout are included in each of the six RUIPs.

4. **Work with partners to 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 actions, and considering the effects of climate change.**

Effective monitoring programs are needed to determine whether recovery actions for bull trout are successful and effective, and to help determine where and when recovery criteria have been achieved. Monitoring may include assessing distribution, population status, life history, migratory movements, and genetic characteristics of bull trout in each recovery unit. In addition to evaluating monitoring efforts, management practices such as those for water diversion screening, grazing, timber harvest, and riparian management should be evaluated for their effectiveness in reducing impacts on bull trout.

Future climate change impacts on bull trout will require development of a decision framework to help inform where climate change effects are most likely to impact bull trout. The identification of core areas and watersheds that are most likely to maintain habitats suitable for bull trout over the foreseeable future under probable climate change scenarios will also help guide the allocation of bull trout conservation resources to improve the likelihood of success. Given projected losses of lower-elevation bull trout habitat over the 21^{st} century, it will be increasingly important to identify these viable cold-water habitats and work with their land managers (particularly National Forests) to incorporate bull trout conservation measures in management plans (D. Isaak *in litt.* 2014).

Interspecific interactions (particularly with brook trout, brown trout, and lake trout) should be further studied under a variety of environmental conditions to identify appropriate and cost-effective management methods and assess under what circumstances bull trout may be able to coexist with minimal negative effects.

Structured decision making processes (e.g., Structured Decision Making (SDM), Bayesian Modelling, etc.) can provide a framework for local working groups to identify assumptions and adaptively respond to new monitoring data and outcomes of recovery actions. It is also important to develop a decision framework to assess climate change effects to bull trout and allocate conservation resources and funding to ensure that future bull trout conservation efforts are allocated to those areas with the anticipated future coldest water temperatures that offer the greatest long-term benefit to bull trout conservation. As part of any potential delisting process the Service will need to review information and data regarding the status of the species, including any relevant demographic data.

Significant research and monitoring projects that have been identified as important to bull trout recovery in each recovery unit are included in each of the six RUIPs.

III. Implementation Framework – Recovery Unit Implementation Plans

The bull trout recovery plan describes the principal actions needed to advance the recovery of bull trout in the six recovery units within the coterminous United States. These conservation actions are included in individual **recovery unit implementation plans (RUIPs)** for each recovery unit that provide site-specific detail at the core area scale. The RUIPs describe and prioritize core area specific recovery actions. These recovery actions have generally been developed through an interagency collaboration of interested and knowledgeable Federal, Tribal, State, private and other parties. In many parts of the range, local interagency bull trout working groups had previously identified recovery actions necessary for local bull trout core area conservation, and are already implementing conservation actions. Many of these conservation actions are included in the RUIPs.

Each RUIP includes an **implementation schedule** that outlines core area specific recovery actions and estimated costs for bull trout recovery. An implementation schedule is a *guide* for meeting the recovery goals, objectives, and criteria discussed in Parts I and II of this plan. The implementation schedule indicates the listing factor being addressed by each recovery action, recovery action descriptions, responsible parties, and estimated costs. The initiation and completion of recovery actions for bull trout is subject to the availability of funds, as well as other constraints affecting the parties involved. There is often synergy between recovery actions needed for bull trout with those required for federally listed salmon and steelhead. Much of the overall estimated cost of recovery actions, based on the recovery unit-specific estimates identified in the RUIP implementation schedules, is/can be accomplished with ongoing or planned recovery actions for salmon/steelhead. The total cost of recovery is only an estimate and may change substantially as efforts to recover the species continue. Detailed cost breakdowns for each recovery unit, with expected annual costs for the first 5 years of recovery implementation, are provided in the implementation schedules of the six RUIPs.

While we have the statutory responsibility for developing and implementing this recovery plan for bull trout, recovery of bull trout across the coterminous United States will require the involvement of Federal, Tribal, State, private, and local interests. The continued expertise and contributions of these, and additional agencies and interested parties, is needed to implement the recovery actions identified in this plan. Each recovery action described in the implementation schedule for each recovery unit lists the primary agency or responsible party, having the authority for implementing recovery actions, along with other groups, such as Tribal, State, private, and other organizations, that also may wish to be involved in bull trout recovery implementation. The listing of a responsible party does not require, nor imply a requirement, that the identified party has agreed to implement the recovery action(s) or to secure the funding for implementing the action(s). When more than one party is listed, the most logical lead agency (based on authorities, mandates, and capabilities) are identified in bold type.

To enhance the effectiveness of this recovery plan, we intend to adopt the RUIPs as flexible plans able to be updated and revised as needed, independently of revising the recovery plan. Each RUIP should be updated regularly (ideally every 5 years) to reflect current information on threats and distribution and lessons learned from recovery implementation.

Each RUIP includes the following components:

Introduction: A brief description of the recovery unit in the overall context of bull trout recovery. This includes a list of core areas in the recovery unit, description of overall population status and significance of the various threats in each core area, and a summary of current status of conservation actions. If additional maps are needed for clarification of recovery actions, beyond those presented here in the recovery plan, they are included in this section. Watersheds in the recovery unit that are expected to most effectively maintain cold water temperatures in the face of climate change may be identified and prioritized for management actions. Any core areas where expression of migratory life history is not considered an important element of bull trout conservation (e.g. due to potential for connectivity to result in negative effects from invasive non-native species) are identified.

Stepdown Narrative. A list of individual recovery actions needed within the recovery unit (specific numbered step-down actions under the general recovery actions 1 [management of habitat], 2 [management of demographic threats], 3 [non-native fish management], and 4 [research and monitoring] identified in section II.H above). For each action a brief narrative discussion should describe any appropriate details of methods, rationale, scope, and implementation considerations

Implementation Schedule. The RUIPs also include a recovery unit-specific implementation schedule, describing the responsible parties and cost estimate breakdown for recovery actions.

Each recovery unit specific implementation schedule includes the following components:

- Action Priority: Assigned # 1, 2, or 3 based on the following definitions;

  Priority 1 – An action that must be taken to prevent extinction or prevent the species from declining irreversibly in the foreseeable future;

  Priority 2 – An action that must be taken to prevent a significant decline in species population or habitat quality;

  Priority 3 - All other actions necessary to meet the recovery objectives.
- Action Number: Number of action from stepdown narrative.
- Action Description: Brief descriptive title of recovery action.
- Threat Factor: Listing factor (A through E) or threat category addressed by the action.
- Core Area: Designated core area(s) where the recovery action should be targeted.
- Action Duration: Indicates the number of years estimated to complete the action, or other codes defined as follows:

  Continual (C) – An action that will be implemented on a routine basis once begun.

  Ongoing (O) – An action that is currently being implemented and will continue until no longer necessary.

  To be Determined (TBD) – The action duration is not known at this time or implementation of the action is dependent on the outcome of other recovery actions.
- Responsible Parties: Agencies and others with responsibility or authority to implement proposed recovery actions.
- Estimated Costs: Estimated costs assigned to each action identified in the implementation schedule, both for the first 5 years after release of the recovery plan and for the total estimated cost of recovery (based on time to recovery, for Continual or Ongoing actions).
- Time to Recovery: Estimated time before this recovery unit could meet recovery criteria, if recovery actions are successfully implemented.

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V. APPENDICES

APPENDIX A. Glossary of Terms

Adfluvial bull trout. Bull trout that migrate from tributary streams to a lake or reservoir to mature (one of three commonly recognized bull trout life histories). Adfluvial bull trout return to a tributary to spawn.

Alevin. A newly-hatched trout or salmon still attached to the yolk sac.

Allacustrine. A fish that rears in lakes and spawns in outlet tributaries of lakes.

Alluvial. Pertaining to or composed of silts and clays (usually) deposited by a stream or flowing water. Alluvial deposits may occur after a flood event.

Anadromous (fish). A fish that is born in fresh water, migrates to the ocean to grow and live as an adult, and then returns to fresh water to spawn (reproduce).

Bayesian Modelling. A branch of mathematical probability theory that allows scientists to model uncertainty about natural resource issues and possible outcomes of interest by modifying *a priori* probabilities in response to observational evidence.

Char. A fish belonging to the genus *Salvelinus* and related to both the trout and salmon. The bull trout, Dolly Varden, and the Mackinaw (or lake trout) are all members of the char family. Char live in the icy waters (both fresh and marine) of North America and Europe.

Complex Core Area. A core area that contains multiple interacting bull trout local populations. Complex core areas contribute significantly to the viability of a recovery unit.

Core area. The combination of core habitat (*i.e.*, habitat that could supply all elements for the long-term security of bull trout) and a core population (a group of one or more local bull trout populations that exist within core habitat) constitutes the basic unit on which to gauge recovery within a recovery unit. Core areas require both habitat and bull trout to function, and the number (replication) and characteristics of local populations inhabiting a core area provide a relative indication of the core area's likelihood to persist. A core area represents the closest approximation of a biologically functioning unit for bull trout. Core areas are presumed to reflect the metapopulation structure of bull trout (see metapopulation).

Core habitat. Habitat that encompasses spawning and rearing (SR) habitat (resident populations), with the addition of foraging, migrating, and overwintering (FMO) habitat if the population includes migratory fish. Core habitat is defined as habitat that contains, or if restored would contain, all of the essential physical elements to provide for the security of and allow for the full expression of life history forms of one or more local populations of bull trout. Core habitat may include currently unoccupied habitat if that habitat contains essential elements for bull trout to persist or is deemed critical to recovery.

Core population. A group of one or more bull trout local populations that exist within core habitat.

Demographically stable. Term applied to how a 'recovered' bull trout population can be described in terms of size, age structure, and density. Implies that bull trout populations, at the local population, core area or recovery unit scale, interact with their surrounding environment so that their population scale status is stable or increasing based on measurements and calculations of population size, density, and age structure (*i.e.*, ecologically viable).

Distinct Population Segment (DPS). A listable entity under the Endangered Species Act that meets tests of discreteness and significance according to Service policy.

Embeddedness. The degree to which large particles (boulders, gravel) are surrounded or covered by fine sediment, usually measured in classes according to percentage covered.

Effective population size. The number of breeding individuals that would give rise to the same amount of random genetic drift as the actual population, if ideal conditions held.

Entrainment. Process by which aquatic organisms are pulled through a diversion, turbine, spillway, or other device.

Extirpation. The elimination of a species from a particular local area.

Fish ladder. A device to help fish swim around a dam.

Floodplain. Adjacent to stream channels, areas that are typified by flat ground and are periodically submerged by floodwater.

Fluvial bull trout. Bull trout that migrate from tributary streams to larger rivers to mature (one of three bull trout life histories). Fluvial bull trout migrate to tributaries to spawn.

Foraging, migrating, and overwintering habitat (FMO habitat). Relatively large streams and mainstem rivers, including lakes or reservoirs, estuaries, and nearshore environments, where subadult and adult migratory bull trout forage, migrate, mature, or overwinter. This habitat is typically downstream from spawning and rearing habitat and contains all the physical elements to meet critical overwintering, spawning migration, and subadult and adult rearing needs.

Foreseeable Future. The Act does not define the term "foreseeable future". However, in a general sense, the foreseeable future is the period of time over which events can be reasonably be anticipated. For a threatened species, such as bull trout, the Service interprets the foreseeable future as the extent of time over which we can reasonably rely on predictions about the future in making determinations about the future conservation status of the species. For the bull trout 5-year review (USFWS 2008a) a manager panel defined a reasonable timeframe for the foreseeable future as 4 to 10 bull trout generations (approximately 28 to 70 years).

Geographic Region. Comprised of neighboring core areas that share similar bull trout genetic, geographic (hydrographic), and/or habitat characteristics. Conserving bull trout in Geographic Regions allows for the maintenance of broad representation of genetic diversity; neighboring core areas to benefit from potential source populations in the event of local extirpations and provides a broad array of options among neighboring core areas to contribute recovery under uncertain environmental change.

Headwaters. The source of a stream. Headwater streams are the small swales, creeks, and streams that are the origin of most rivers. These small streams join together to form larger streams and rivers or run directly into larger streams and lakes.

Hybridization. Any crossing of individuals of different genetic composition, typically different species, that results in hybrid offspring.

Lacustrine. Relating to lake habitat.

Legacy effects. Impacts from past activities (usually a land use) that continue to affect a stream or watershed in the present day.

Local population. A group of bull trout that spawn within a particular stream or portion of a stream system. Multiple local populations may exist within a core area. A local population is considered to be the smallest group of fish that is known to represent an interacting reproductive unit. For most waters where specific information is lacking, a local population may be represented by a single headwater tributary or complex of headwater tributaries. Gene flow may occur between local populations (*e.g.*, those within a core population), but is assumed to be infrequent compared with that among individuals within a local population.

Manage Threats. Threats to bull trout are addressed (*i.e.*, managed) so that ecologically viable populations of bull trout that have: (1) stable or increasing trends, (2) a distribution within the recovery unit that promotes a mosaic pattern in representative habitats across the recovery unit, (3) diverse life history strategies within populations, and (4) connectivity between populations and core areas to the maximum extent possible.

Metapopulation. A population structure where a group of semi-isolated local populations of bull trout are interconnected and that probably share genetic material. Core areas represent the functional equivalent of a metapopulation structure for bull trout, and the local populations within these core areas are interconnected by occasional dispersal between them and therefore share some genetic characteristics.

Migratory corridor (bull trout). Stream reaches used by bull trout to move between habitats. A section of river or stream used by fish to access upstream spawning areas or downstream lake environments.

Migratory life history form (bull trout). Bull trout that migrate from spawning and rearing habitat to lakes, reservoirs, or larger rivers to grow and mature.

Nonnative species. Species not indigenous to an area, such as brook trout in the western United States. Also referred to as exotic or invasive species.

Piscicide. A chemical substance poisonous to fish.

Primary Threat. Threat factors known or likely *(i.e.*, non-speculative) to negatively impact bull trout populations at the core area level, and accordingly require management actions to assure bull trout persistence to a degree necessary that bull trout will not be at risk of extirpation within that core area in the foreseeable future.

Recovery unit (general). A population unit of a listed entity that is geographically or otherwise identifiable and is essential to the recovery of the entire listed entity. Recovery units are individually necessary to conserve genetic robustness, demographic robustness, important life history stages, or some other feature necessary for long-term sustainability of the entire listed entity. Recovery criteria for the listed entity should address each identified recovery unit, and every recovery unit must be recovered, before the species can be delisted.

Recovery unit (bull trout). Bull trout recovery units are the major units for managing recovery efforts. Detailed description of recovery implementation for each recovery unit is provided in a separate recovery unit implementation plan (RUIP). Most recovery units consist of one or more major river basins. Several factors have been considered in identifying recovery units (*e.g.*, biological and genetic factors, common threats, political and watershed boundaries, ongoing conservation efforts, and other logistical concerns. Recovery units may include portions of mainstem rivers (*e.g.*, Columbia and Snake rivers) when biological evidence warrants inclusion. Biologically, bull trout recovery units are considered groupings of bull trout for which gene flow was historically or is currently possible.

Redd. A nest constructed by female fish of salmonid species in streambed gravels where eggs are deposited and fertilization occurs. Redds can usually be distinguished in the streambed gravel by a cleared depression, and an associated mound of gravel directly downstream.

Research Needs Area. Those geographic locations (e.g., watershed) where bull trout are known to occur historically, but the current status and historical use of the area are uncertain. These areas may have been historically occupied or had a few contemporary or historical observations to suggest at least some current or potential level of use and there was uncertainty with respect to their role in recovery. Generally, this is an area that may be necessary for recovery where there is some viable information about bull trout use and has a possibility of importance to recovery however, the use is undetermined.

Resident life history form. Bull trout that do not migrate, but that reside in tributary streams their entire lives (one of three bull trout life cycles).

Salmonid. Fish of the family Salmonidae, including trout, salmon, chars, grayling, and whitefish. In general usage, the term most often refers to salmon, trout, and chars.

Simple Core Area. We define a Simple Core Area as a core area that contains one bull trout local population. Simple core areas are almost always small in scope, with a population size that is necessarily restricted by the size of the habitat. Typically, simple cores are ecologically if not physically isolated from other core areas by natural, not anthropogenic factors (e.g., natural barriers, thermal gradients, or large spatial separation from other core areas) that have been operable for thousands of years.

Source population. Strong local populations within a metapopulation that contribute emigrating individuals to other local populations and reduce the risk of local extinctions (see stronghold).

Spawning and rearing habitat (SR habitat). Stream reaches and the associated watershed areas that provide all habitat components necessary for spawning and juvenile rearing for a local bull trout population. Spawning and rearing habitat generally supports multiple year classes of juveniles of resident or migratory fish and may also support subadults and adults from local populations of resident bull trout.

Spillway. That part of a dam that allows high water to flow (spill) over the dam.

Stochastic. The term is used to describe natural events or processes that are subject to random or unpredictable variation. Examples include environmental conditions such as rainfall, runoff, and storms, or life-cycle events, such as survival or fecundity rates.

Stronghold. A watershed, multiple watersheds, basin or other defined spatial units (e.g., core areas) where bull trout populations are strong and diverse, and the habitat has high intrinsic potential to support bull trout or suite of species. Important characteristics of bull trout strongholds include intact and well-connected habitat, presence of robust migratory populations, presence of the native fish fauna, resilient to perturbations, and retains the genetic and phenotypic diversity of the species. Strongholds can act as source populations.

Structured Decision Making (SDM). SDM is an organized approach to identifying and evaluating creative options and making choices in complex natural resource decision situations.

Take. Activities that harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or attempt to engage in any such conduct to a species listed under the Endangered Species Act.

Water right. Any vested or appropriation right under which a person may lawfully divert and use water. It is a real property right appurtenant to and severable from the land on or in connection with which the water is used; such water right passes as an appurtenance with a conveyance of the land by deed, lease, mortgage, will, or inheritance.

Watershed. The area of land from which rainfall (and/or snow melt) drains into a stream or other water body. Watersheds are also sometimes referred to as drainage basins or drainage areas. Ridges of higher ground generally form the boundaries between watersheds. At these boundaries, rain falling on one side flows toward the low point of one watershed, while rain falling on the other side of the boundary flows toward the low point of a different watershed.

Year class (cohort). Fish in a stock born in the same year. For example, the 1987 year class of bull trout includes all bull trout born in 1987, which would be age 1 in 1988. Occasionally, a stock produces a very small or very large year class, which can be pivotal in determining stock abundance in later years.

APPENDIX B. Bull Trout Recovery Unit Maps and Description

These maps delineate core areas, major water bodies, and additional foraging/migration/overwintering (FMO) habitat outside core areas within each of the six recovery units that comprise the coterminous United States population of bull trout.

Map A. Coastal Recovery Unit

Map B. Klamath Recovery Unit

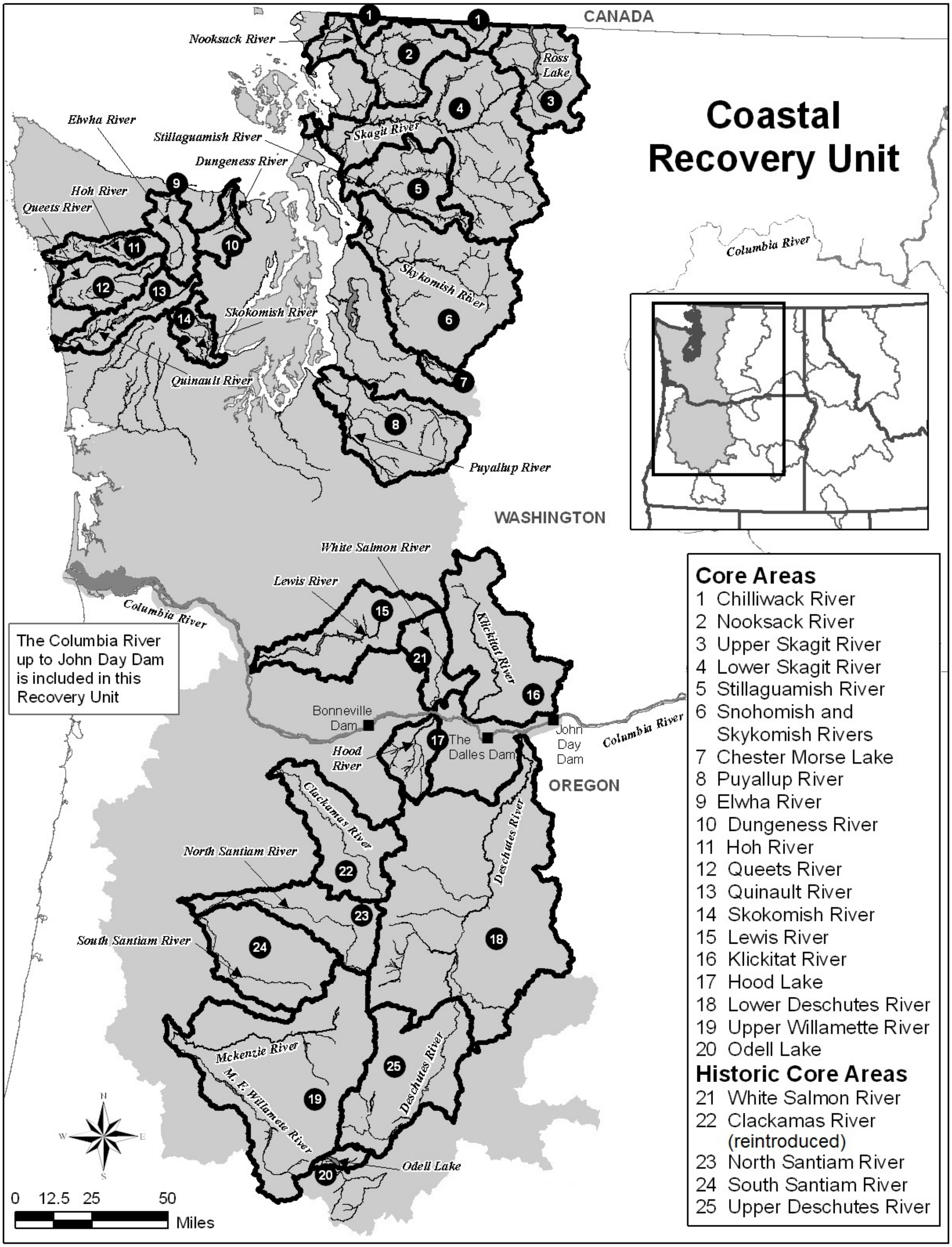
Map C. Mid-Columbia Recovery Unit

Map D. Upper Snake Recovery Unit

Map E. Columbia Headwaters Recovery Unit

Map F. Saint Mary Recovery Unit

Map A


Coastal Recovery Unit
CANADA
WASHINGTON
OREGON
Nooksack River
Ross Lake
Skagit River
Elwha River
Stillaguamish River
Dungeness River
Hoh River
Queets River
Skokomish River
Quinault River
Skykomish River
Puyallup River
Columbia River
White Salmon River
Lewis River
Klickitat River
The Columbia River up to John Day Dam is included in this Recovery Unit
Bonneville Dam
The Dalles Dam
John Day Dam
Hood River
Clackamus River
Deschutes River
North Santiam River
South Santiam River
Mckenzie River
M. F. Willamette River
Odell Lake
0 12.5 25 50
Miles
Core Areas
1 Chilliwack River
2 Nooksack River
3 Upper Skagit River
4 Lower Skagit River
5 Stillaguamish River
6 Snohomish and Skykomish Rivers
7 Chester Morse Lake
8 Puyallup River
9 Elwha River
10 Dungeness River
11 Hoh River
12 Queets River
13 Quinault River
14 Skokomish River
15 Lewis River
16 Klickitat River
17 Hood Lake
18 Lower Deschutes River
19 Upper Willamette River
20 Odell Lake
Historic Core Areas
21 White Salmon River
22 Clackamas River (reintroduced)
23 North Santiam River
24 South Santiam River
25 Upper Deschutes River

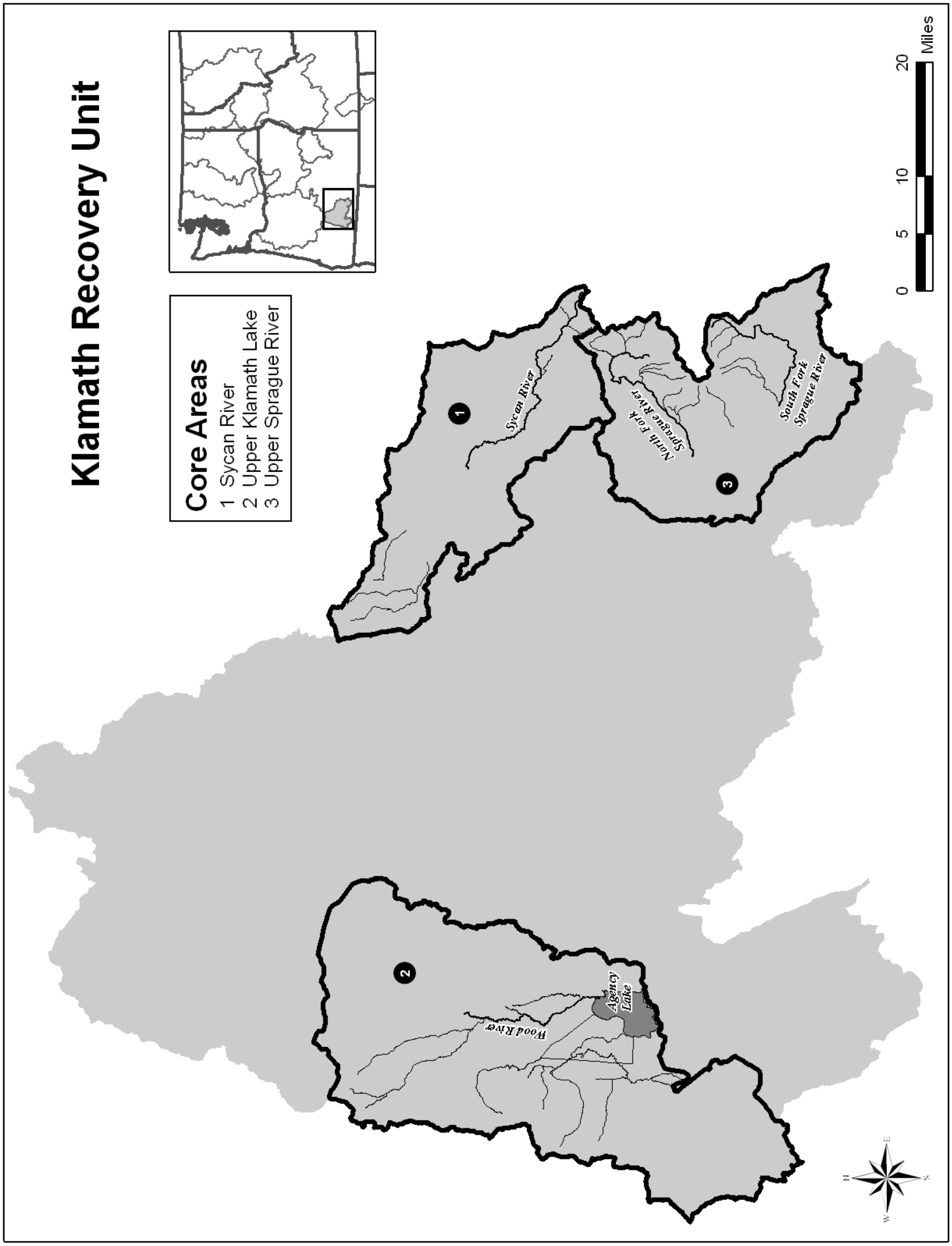
Coastal Recovery Unit (Map A)

The Coastal Recovery Unit is located within western Oregon and Washington. Major drainages include the Olympic Peninsula, Puget Sound, Lower Columbia River basins, Upper Willamette River, Hood River, Lower Deschutes River, Odell Lake, and the Lower Mainstem Columbia River. In the Coastal Recovery Unit, we have designated 21 existing bull trout core areas, including the recently reintroduced Clackamas River population, and identified 4 core areas that could be reestablished. Ten shared FMO habitats are also identified outside of core areas. Core areas within the recovery unit are distributed among three major geographic regions, Puget Sound (includes one core area that is actually part of the lower Fraser River system), Olympic Peninsula, and Lower Columbia River. The only core areas currently supporting anadromous populations of bull trout are located within the Puget Sound and Olympic Peninsula regions. Although bull trout in the Lower Columbia River region share a genetic past with the Puget Sound and Olympic Peninsula regions, it is unclear whether Lower Columbia River core areas supported the anadromous life history to any significant degree in the past, or could in the future. Historically, the Lower Columbia River region is believed to have largely supported the fluvial life history form; however, hydroelectric facilities built within a number of the core areas have isolated or fragmented watersheds and largely replaced the fluvial life history with the adfluvial form.

Two core areas within the Coastal Recovery Unit (Chilliwack River and Upper Skagit River) are functionally transboundary with British Columbia, Canada. The boundaries of these core areas should extend into British Columbia from a functional standpoint, and our developed recovery targets have taken this into consideration.

There are five core areas within the Coastal Recovery Unit that have been identified as current population strongholds. These are the Lower Skagit and Upper Skagit core areas in the Puget Sound region, the Quinault River core area in the Olympic Peninsula region, and the Lewis River and Lower Deschutes River core areas in the Lower Columbia River region. These are the most stable and abundant bull trout populations in the recovery unit.

Map B


Klamath Recovery Unit
Core Areas
1 Sycan River
2 Upper Klamath Lake
3 Upper Sprague River
Sycan River
North Fork Sprague River
South Fork Sprague River
Wood River
Agency Lake
0
5
10
20
Miles

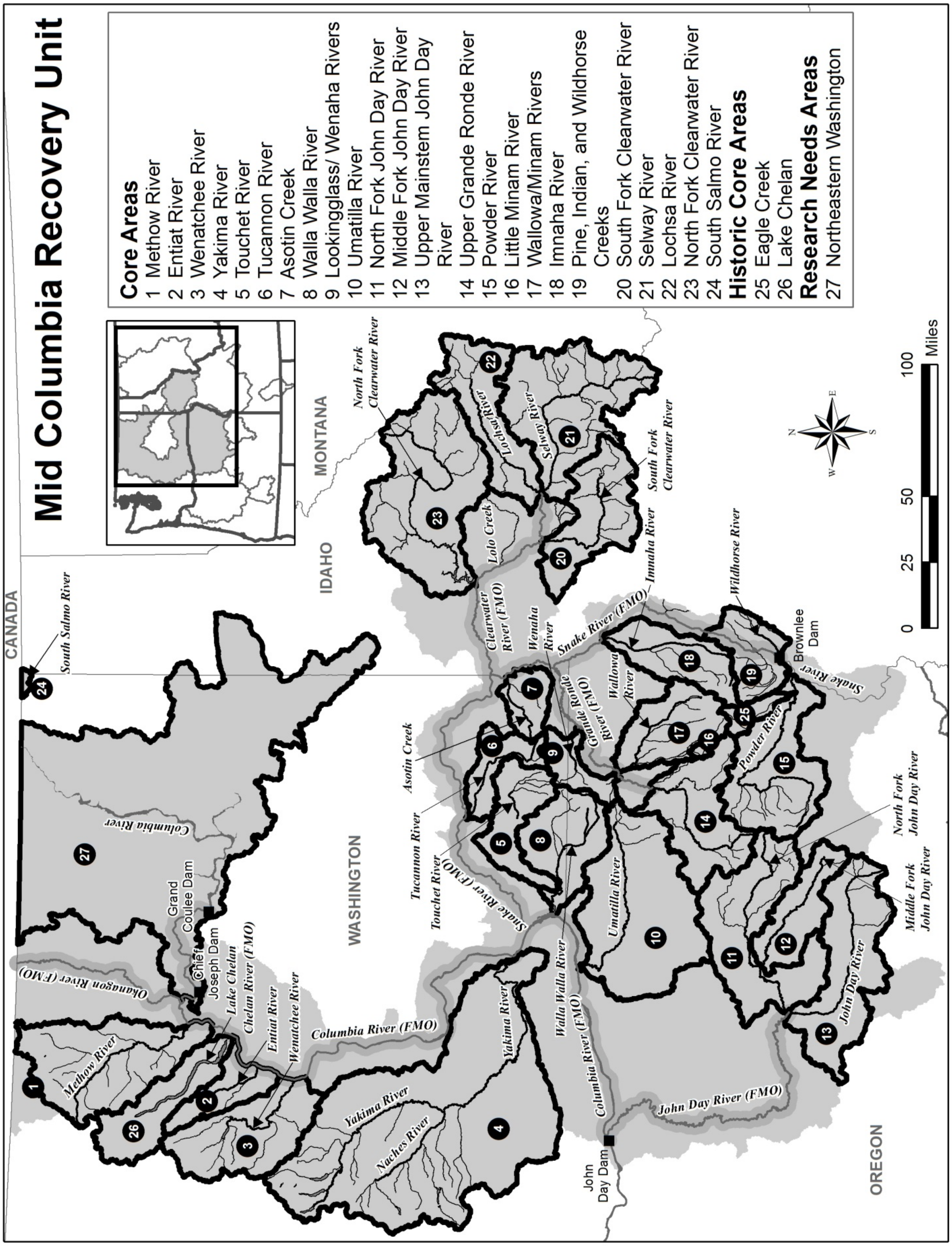
Klamath Recovery Unit (Map B)

In the Klamath Recovery Unit in southern Oregon, we have designated three bull trout core areas. The Upper Klamath Lake core area is comprised of the northern portion of the lake and its immediate major and minor tributaries. The lake is the collection point for most of drainage tributaries, with a surface area of 37,260 hectares (92,000 acres). It is classified as hypereutrophic (*i.e.*, high chemical nutrient levels, excessive algal growth, and low oxygen availability)(NRC 2004). This core area includes waters draining from Crater Lake National Park south of Scott Peak and from the area west of and including the Williamson River below Klamath Marsh. Also included is the west side of the Winema National Forest from Crater Lake National Park south into the Spencer Creek and Varney Creek drainages on the west side of Klamath Lake. This core area includes two existing local bull trout populations: Threemile Creek and Sun Creek. Sun Creek, in Crater Lake National Park, currently supports the largest local population in the Upper Klamath Lake core area. Major tributaries are the Williamson River and Wood River. Numerous small streams that are spring fed and surface water fed originate along the rim of the basin.

The Sycan River core area is comprised of Sycan Marsh and its tributaries and the Sycan River and its tributaries. The Sycan River originates from springs near 2,133 meters (7,000 feet) on the eastern edge of the Klamath River basin. The river flows through high-elevation meadows and forest lands for 74 kilometers (46 miles). It flows through Sycan Marsh for 15 kilometers (9.3 miles), and then flows through a variety of landscapes until it joins the Sprague River. This core area is composed of the waters that drain into the Sycan Marsh, including Long, Calahan, and Coyote creeks on the west side of the marsh. On the east side of the marsh are the upper Sycan River, Chocktoot Creek, Shake Creek, and their tributaries. The only local population in the Sycan River core area is Long Creek. Bull trout, including a fluvial life history form, have been found distributed throughout the most of the length of Long Creek.

The Upper Sprague River core area is comprised of drainages of the North Fork and South Fork of the Sprague River. The origins of the North Fork and South Fork of the Sprague River are from small, mainly spring fed, streams, near 2,926 meters (6,900 feet) elevation on the north and southeast sides of Gearhart Mountain. The upper miles of each creek meander through high-elevation meadow and forest lands before being confined by narrow forested canyons (ODFW 1997). The lower stretches of the North Fork and South Fork of the Sprague River meander through the broad, low-gradient Sprague River valley. The Upper Sprague River core area is comprised of the drainages of the North Fork and South Fork of the Sprague River upstream of their confluence, including Deming, Boulder, Dixon, Brownsworth, and Leonard creeks. Deming Creek is believed to support the largest local population of bull trout in the Upper Sprague River core area. Presence/absence surveys in 1998 revealed several fluvial bull trout in the North Fork Sprague River below the confluence with Boulder Creek. Recent surveys have determined bull trout and all other fishes are absent from Sheepy Creek, where a cascade barrier at its terminus is believed to prevent colonization.

Map C



Mid Columbia Recovery Unit
Core Areas
1 Methow River
2 Entiat River
3 Wenatchee River
4 Yakima River
5 Touchet River
6 Tucannon River
7 Asotin Creek
8 Walla Walla River
9 Lookingglass/ Wenaha Rivers
10 Umatilla River
11 North Fork John Day River
12 Middle Fork John Day River
13 Upper Mainstem John Day River
14 Upper Grande Ronde River
15 Powder River
16 Little Minam River
17 Wallowa/Minam Rivers
18 Imnaha River
19 Pine, Indian, and Wildhorse Creeks
20 South Fork Clearwater River
21 Selway River
22 Lochsa River
23 North Fork Clearwater River
24 South Salmo River
Historic Core Areas
25 Eagle Creek
26 Lake Chelan
Research Needs Areas
27 Northeastern Washington
CANADA
MONTANA
IDAHO
WASHINGTON
OREGON
Grand Coulee Dam
Chief Joseph Dam
John Day Dam
Brownlee Dam
0 25 50 100 Miles

Mid-Columbia Recovery Unit (Map C)

In the Mid-Columbia Recovery Unit, we have designated 27 bull trout core areas, along with 6 FMO habitats. This recovery unit is located within eastern Washington, eastern Oregon, and portions of Idaho. Major drainages include the Yakima River, John Day River, Umatilla River, Walla Walla River, Grande Ronde River, Imnaha River, Powder River, Clearwater River, and small drainages along the Snake River and Columbia River. These core areas include two unoccupied core habitat areas (areas that contain suitable habitat that could potentially support reestablished bull trout populations; *i.e.*, the Chelan and Eagle Creek basins), and one unoccupied research needs area (Northeastern Washington, above Chief Joseph Dam).

The Mid-Columbia Recovery Unit can be divided into four geographic regions: (1) the Lower Mid-Columbia which includes all core areas that flow into the Columbia River below its confluence with the Snake River (*i.e.*, the John Day, Umatilla, and Walla Walla basins); (2) the Upper Mid-Columbia which includes all core areas that flow into the Columbia River above its confluence with the Snake River (*i.e.*, the Yakima and all other basins north to the Canadian border); (3) the Lower Snake which includes all core areas that flow into the Snake River between its confluence with the Columbia River and Hells Canyon Dam (*i.e.*, the Clearwater, Tucannon, Asotin, Grande Ronde, and Imnaha basins); and (4) the Mid-Snake which includes all core areas in the Mid-Columbia Recovery Unit that flow into the Snake River above Hells Canyon Dam (*i.e.*, the Powder basin; Pine, Indian and Wildhorse Creeks).

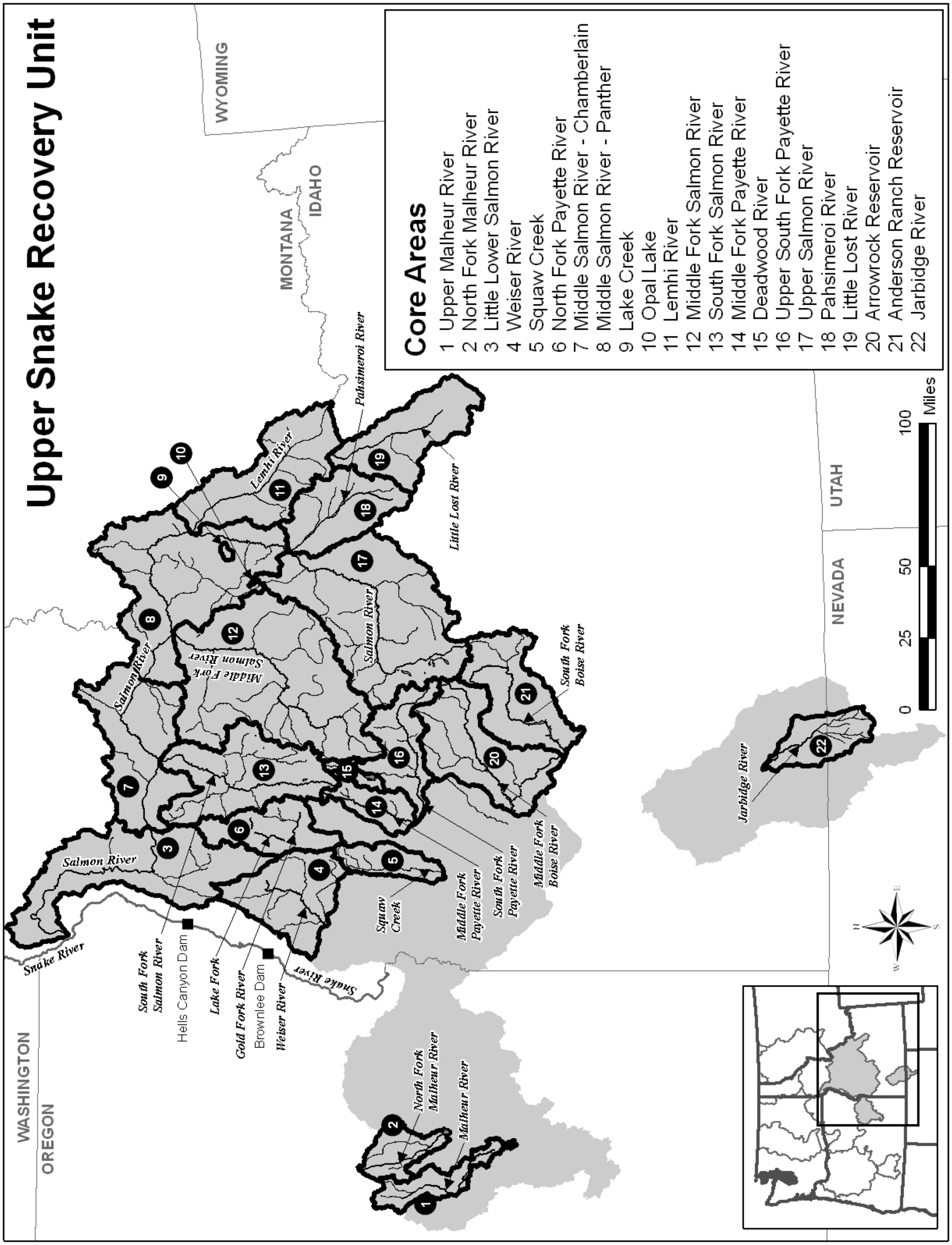
Some changes have been made to core areas since the 2002 Draft Bull Trout Recovery Plan. First, within the Lower Snake geographic region, the Grande Ronde River Core Area has been divided into three separate core areas, along with the Grande Ronde River FMO. These three new core areas include: (1) the Lookingglass Creek – Wenaha River Core Area; (2) the Upper Grande Ronde – Catherine Creek – Indian Creek River Core Area; and (3) the Wallowa River – Minam River Core Area. The decision to split the Grande Ronde into three separate core areas was based on distribution patterns determined from telemetry studies of fish tagged in the Wenaha and Lostine Rivers and Lookingglass Creek, differences in the environmental characteristics among the subdivisions, and the likelihood for genetic exchange and demographic linkage given the size of the Grande Ronde basin. The Little Minam River is still its own core area. Within the Clearwater River basin, the Fish Lake (North Fork Clearwater River) Core Area was absorbed into the North Fork Clearwater River Core Area, and the Fish Lake (Lochsa River) Core Area was absorbed into the Lochsa River Core Area. It was determined that while these two Fish Lake populations are adfluvial, they are not isolated from the other two core areas and represent a continuation of the headwater populations in both the Lochsa River and North Fork Clearwater River core areas. Additionally, the Lower-Middle Clearwater River is no longer a core area, but is now considered FMO habitat because it was determined that Lolo Creek is not a local population, which leaves no local populations in the Lower-Middle Clearwater River. However, the mainstem Clearwater still provides access to the other core areas in the Clearwater basin, providing essential FMO habitat and connectivity.

In the Mid-Snake geographic region, the Eagle Creek basin was removed from the Powder River Core Area and given its own core area status because it is located some distance from the rest of the Powder River bull trout populations and contains somewhat different habitat. However, the Eagle Creek Core Area is currently unoccupied and is best described as core habitat. Within the Upper-Mid Columbia geographic region, the Chelan basin is now considered its own core area; however, like Eagle Creek, it is currently unoccupied and is best described as core habitat. FMO habitat is also now recognized in the Okanogan River, and the area east of the Okanogan River (upstream from Chief Joseph Dam) is recognized as a research needs area. It is also considered a core area in a basic sense, but is unoccupied and more information needs to be collected in this area to determine its potential for supporting bull trout in the future.

In the Upper Mid-Columbia geographic region, the South Salmo River core area has been added because of recent information documenting spawning and rearing and year-round occupancy in the South Fork local population.

In the Lower Snake geographic area, the Granite Creek and Sheep Creek core areas have been removed because it has been recently determined that these watersheds do not support spawning and rearing and year-round occupancy of bull trout.

Map D

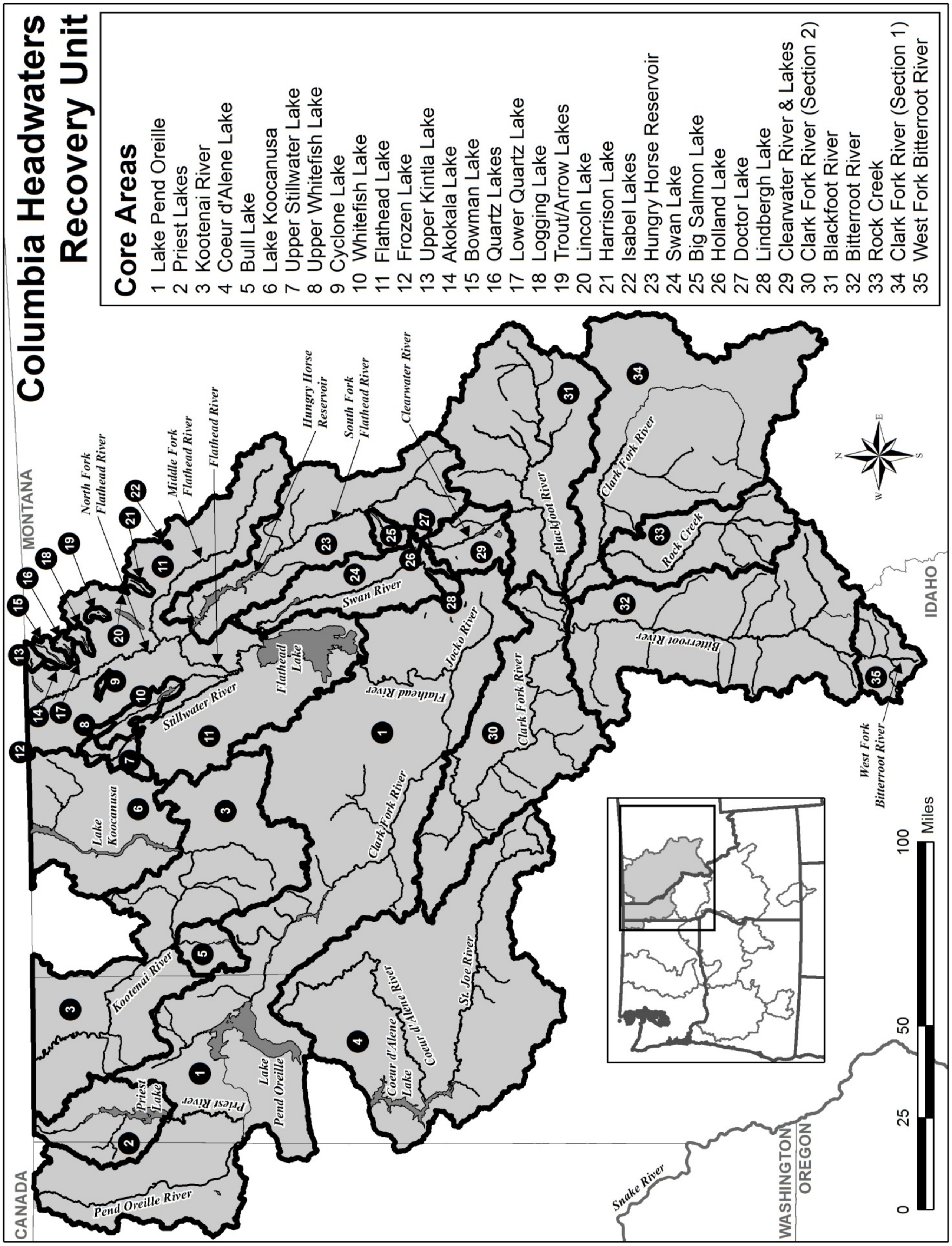

Upper Snake Recovery Unit
Core Areas
1 Upper Malheur River
2 North Fork Malheur River
3 Little Lower Salmon River
4 Weiser River
5 Squaw Creek
6 North Fork Payette River
7 Middle Salmon River - Chamberlain
8 Middle Salmon River - Panther
9 Lake Creek
10 Opal Lake
11 Lemhi River
12 Middle Fork Salmon River
13 South Fork Salmon River
14 Middle Fork Payette River
15 Deadwood River
16 Upper South Fork Payette River
17 Upper Salmon River
18 Pahsimeroi River
19 Little Lost River
20 Arrowrock Reservoir
21 Anderson Ranch Reservoir
22 Jarbidge River
WASHINGTON
OREGON
IDAHO
MONTANA
WYOMING
NEVADA
UTAH
Salmon River
Snake River
South Fork Salmon River
Hells Canyon Dam
Lake Fork
Gold Fork River
Brownlee Dam
Weiser River
North Fork Malheur River
Malheur River
Squaw Creek
Middle Fork Payette River
South Fork Payette River
Middle Fork Boise River
South Fork Boise River
Middle Fork Salmon River
Lemhi River
Pahsimeroi River
Little Lost River
Jarbidge River
0 25 50 100 Miles

Upper Snake Recovery Unit (Map D)

The Upper Snake Recovery Unit occurs within Idaho, Nevada, and Oregon. Major drainages include: the Salmon River, Malheur River, Jarbidge River, Little Lost River, Boise River, Payette River, and the Weiser River. In the Upper Snake Recovery Unit, we have designated 22 bull trout core areas. The only core areas currently supporting adfluvial populations of bull trout are located in the Upper Salmon River, Deadwood River, Anderson Ranch, Arrowrock, Opal Lake, and Lake Creek core areas. All remaining core areas contain resident populations and most have fluvial populations. Large intact habitat exists primarily in the Salmon drainage as this is the only drainage in the Upper Snake Recovery Unit that still flows directly into the Snake River; most other drainages no longer have direct connectivity due to irrigation uses or instream barriers. Bull trout in the Salmon basin share a genetic past with bull trout in the Upper Snake Recovery Unit. Historically, the Upper Snake Recovery Unit is believed to have largely supported the fluvial life history form; however, many core areas are now isolated or have become fragmented watersheds and replaced the fluvial life history with the resident or adfluvial form. The Weiser River, Squaw Creek, and North Fork Payette River core areas only contain resident populations of bull trout.

Some changes to core areas have occurred since the 2002 draft recovery plan. The Lucky Peak core area that was identified in 2002 has been determined to be a population sink with limited reproduction. Based on a review of information, it has been determined through genetic testing that these individuals are identical to individuals from Arrowrock and the current population in the Lucky Peak core area is sustained artificially through entrainment. Based on genetic information, the Malheur Core Area was divided into two separate core areas, the Upper Malheur Core Area and the North Fork Malheur Core Area.

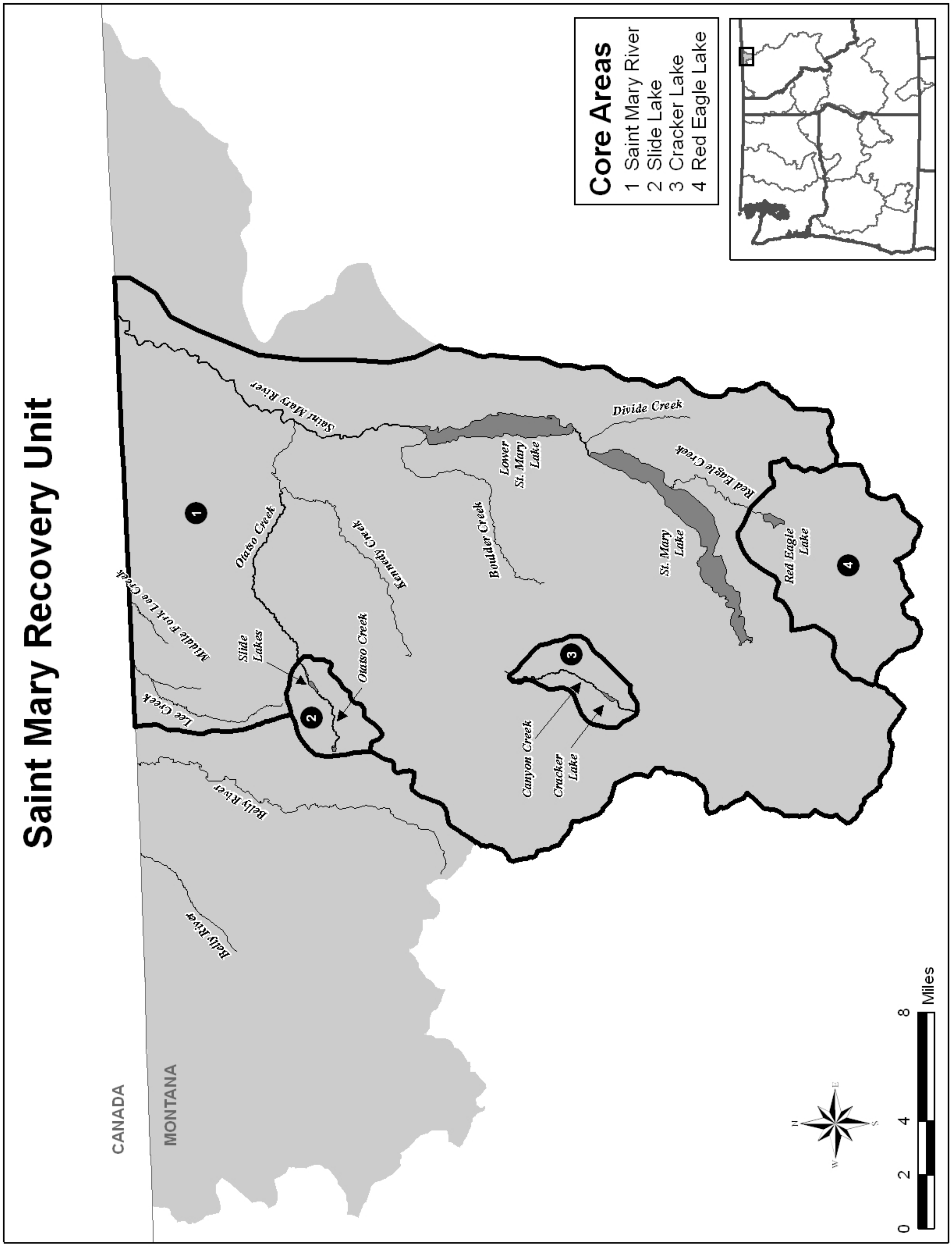
Map E


Columbia Headwaters
Recovery Unit
Core Areas
1 Lake Pend Oreille
2 Priest Lakes
3 Kootenai River
4 Coeur d'Alene Lake
5 Bull Lake
6 Lake Koocanusa
7 Upper Stillwater Lake
8 Upper Whitefish Lake
9 Cyclone Lake
10 Whitefish Lake
11 Flathead Lake
12 Frozen Lake
13 Upper Kintla Lake
14 Akokala Lake
15 Bowman Lake
16 Quartz Lakes
17 Lower Quartz Lake
18 Logging Lake
19 Trout/Arrow Lakes
20 Lincoln Lake
21 Harrison Lake
22 Isabel Lakes
23 Hungry Horse Reservoir
24 Swan Lake
25 Big Salmon Lake
26 Holland Lake
27 Doctor Lake
28 Lindbergh Lake
29 Clearwater River & Lakes
30 Clark Fork River (Section 2)
31 Blackfoot River
32 Bitterroot River
33 Rock Creek
34 Clark Fork River (Section 1)
35 West Fork Bitterroot River
CANADA
MONTANA
IDAHO
WASHINGTON
OREGON
North Fork Flathead River
Middle Fork Flathead River
Flathead River
Hungry Horse Reservoir
South Fork Flathead River
Clearwater River
Swan River
Stillwater River
Flathead Lake
Flathead River
Jocko River
Clark Fork River
Blackfoot River
Rock Creek
Bitterroot River
Lake Koocanusa
Kootenai River
Priest Lake
Priest River
Lake Pend Oreille
Pend Oreille River
Coeur d'Alene Lake
Coeur d'Alene River
St. Joe River
Snake River
West Fork Bitterroot River
0
25
50
100
Miles

Columbia Headwaters Recovery Unit (Map E)

The Columbia Headwaters Recovery Unit occurs within western Montana, northern Idaho, and the northeastern corner of Washington. Major drainages include the Coeur d'Alene Lake Basin, Kootenai River Basin, and the Clark Fork River Basin. In this plan for the Columbia Headwaters Recovery Unit, we have slightly reorganized the 2002 structure, based on latest available science and fish passage improvements that have rejoined previously fragmented habitats. We have now identified 35 bull trout core areas (compared to 47 in 2002) for this recovery unit. Fifteen of the 35 are referred to as "complex" core areas as they represent larger interconnected habitats, each containing multiple spawning streams considered to host separate and largely genetically identifiable local populations. As such, the 15 complex core areas contain the majority of individual bull trout and the bulk of the designated critical habitat (USFWS 2010a, 2010b).

However, somewhat unique to this recovery unit is the presence of 20 smaller core areas that are each represented by a single local population. For the most part, these "simple" core areas are found in remote glaciated headwater basins, typically in Glacier National Park or federally designated wilderness areas. Many are upstream of waterfalls or other natural barriers to fish migration and have persisted for thousands of years despite their small populations and isolated existence. As such, they meet the criteria for core area designation and continue to be valued for their uniqueness, despite limitations of size and scope. Throughout this recovery plan, we often separate our analyses to distinguish between complex and simple core areas with respect to recovery criteria and targets as well as threats.


Saint Mary Recovery Unit
Core Areas
1 Saint Mary River
2 Slide Lake
3 Cracker Lake
4 Red Eagle Lake
CANADA
MONTANA
Saint Mary River
Divide Creek
Lower St. Mary Lake
Red Eagle Creek
Otatso Creek
Kennedy Creek
Boulder Creek
St. Mary Lake
Red Eagle Lake
Middle Fork Lee Creek
Slide Lakes
Otatso Creek
Lee Creek
Canyon Creek
Cracker Lake
Belly River
Belly River
0 2 4 8
Miles

Saint Mary Recovery Unit (Map F)

This recovery unit contains the Saint Mary, Belly, and Waterton River basins from their headwaters to the international boundary with Canada at the 49th parallel. For all of these river basins, the majority of the watershed area is in Canada; the United States portion includes headwater spawning habitat and the upper reaches of FMO habitat in the mainstem of Saint Mary River, Belly River, and in Waterton Lake.

Within the Belly River, spawning is known to occur just south of the international boundary; however, no other spawning areas are known within the United States. In the Waterton Basin, natural fish barriers occur just above Waterton Lake, limiting bull trout distribution. Therefore, although part of the geographically defined recovery unit, neither Belly nor Waterton drainages are considered core areas for the purposes of the recovery plan. The United States portions of both drainages are wholly within remote areas of Glacier National Park and thus, subject to few human-caused threats. Furthermore, management options exist only on the Canadian side of the boundary.

Across the International Boundary in Alberta, Canada, the Saint Mary River bull trout population is considered at "high risk," while the Belly River is rated as "at risk" (Alberta Sustainable Resource Development and Alberta Conservation Association 2009).

APPENDIX C. Future Bull Trout Status Review or Delisting Process

The bull trout recovery criteria provided in Section II.F of the recovery plan represent our best assessment of the conditions that would result in a determination that listing under the Act is no longer required. For bull trout, these conditions will be met when conservation actions have been implemented to ameliorate the primary threats to the species (resulting in geographically widespread and demographically stable local bull trout populations within the range of natural variation, with their essential cold water habitats conserved and connected to allow their diverse life history forms to persist into the foreseeable future).

In accordance with our responsibilities under section 4(c)(2) of the Act, the Service will conduct a status review of the coterminous United States population of bull trout at least once every five years (5-year review) to evaluate the status of the listed population and gauge progress towards delisting. Additionally, the Service may initiate an assessment, or status review of whether recovery has been achieved and delisting is warranted when the primary threats identified for core areas in the six recovery units are effectively managed at the thresholds identified in the recovery plan (*i.e.*, 75 percent for the Coastal, Mid-Columbia, and Upper Snake Recovery Units; 75 percent for simple and complex core areas in the Columbia Headwaters Recovery Unit; and 100 percent for the Klamath and St. Mary Recovery Units).

All future status review or delisting evaluations for bull trout will evaluate the best available scientific and commercial information to ensure that the recovery pathway for bull trout in a "recovered" recovery unit achieves representation (*i.e.*, existing occupancy within most core areas were maintained and existing life history forms that are present in these core areas were mostly preserved); redundancy (*i.e.*, a mosaic of healthy populations are distributed across the landscape within the recovery unit); and resilience (*i.e.*, core areas that contain migratory life history expressions were prioritized for conservation, and "at risk" core areas have been improved). The status reviews will take into account the following:

- Achieving recovery criteria (threat assessment process to evaluate the status of threats across the range of bull trout in terms of the five listing factors);
- Demonstration of demographically stable populations of bull trout; and
- Adequacy of existing regulatory mechanisms to provide adequate protection for bull trout in the foreseeable future (approximately the next 50 years).

To objectively evaluate the status of threats affecting bull trout across the range of the species, the Service has created a structured assessment tool that incorporates the best available data and scientific expert opinion participation. The results from this assessment tool will be integral to evaluate the status of bull trout at the range-wide and recovery unit scales based on the analysis of threat management effectiveness at the core area level.

The Threats Assessment Tool developed for bull trout includes the following components (along with the participating or responsible participants), and is fully described below.

- **Assessment Workshop Process.** Convene a workshop or series of workshops to assess the status (threat severity, threat management effectiveness, bull trout demography) of each core area within the recovery unit. Each workshop will include broad representation of fisheries biologists knowledgeable about bull trout issues within the recovery unit, including but not limited to biologists from U.S. Geological Survey, U.S. Fish and Wildlife Service - Fisheries and Ecological Services field offices, Federal land managers (U.S. Forest Service, National Park Service, Bureau of Land Management), State land management agencies, State fish and game agencies, Tribal fisheries programs, and universities.

- **Threats Assessment Decision Matrix.** Participating experts involved in the Assessment Workshop Process described above will be asked to evaluate all identified primary threats for each respective core area with respect to two independent metrics: threat severity and management effectiveness. These two metrics are combined into a decision matrix that will be used to assess whether current management or conservation actions effectively address the threat.

- **Assessment of Threats Effectively Managed.** After the individual threats have been assessed in the Threats Assessment Decision Matrix, the Service will make a determination of whether threats are being effectively managed for the core area being evaluated. This assessment may include a collective evaluation of all threats within a core area to ensure that interactions and possible cumulative effects of even minor threats are considered.

- **Evaluation of Recovery Unit Status.** After determining whether threats are effectively managed for each respective core area, a tally will be produced for the entire recovery unit that shows all core areas in a recovery unit and the number of local populations in each core area. For each recovery unit, the recovery criteria identified in the bull trout recovery plan will be assessed based on the number of core areas where primary threats have been effectively managed or are non-existent. Additional information that will help assess the overall status of bull trout within a recovery unit and inform whether recovery criteria have been achieved include: evidence of demographically stable populations of bull trout; and an evaluation of the adequacy of existing regulatory mechanisms to provide adequate protection for bull trout in the foreseeable future (approximately the next 50 years).

If the Service, following the Threat Assessment Tool process, determines that the threats to bull trout have been effectively managed and sufficiently reduced, then we may consider initiating the status review process. In the case of bull trout, each of the recovery units may meet the definition of a distinct population segment (DPS) under our Policy Regarding Recognition of Distinct Population Segments (61 FR 4722, Feb. 7, 1996). Consequently we may consider, consistent with applicable law, whether it is possible to delist at the recovery unit (*i.e.*, DPS) scale, if a status review indicates that delisting criteria have been met within a recovery unit. Any proposal to delist bull trout would be published in the *Federal Register*. After analyzing the comments received on the proposed rulemaking, the Service would decide whether to complete the proposed delisting action or leave the protections of the Act in place. Our final decision would be announced in the *Federal Register*. The comments received and our responses to them would be addressed in the final rule.

APPENDIX D. Summary of the Comments Received on the Revised Draft Recovery Plan for the Coterminous United States Population of Bull Trout (*Salvelinus confluentus*): Two Comment Periods: September 4 through December 3, 2014; and June 4 through July 20, 2015.

Background

On September 4, 2014 (79 FR 52741), we released the Revised Draft Recovery Plan for the Coterminous United States Population of Bull Trout for a 90-day comment period for Federal agencies, Native American Tribes, State and local governments, and members of the public. The public comment period ended on December 3, 2014. Four peer reviewers provided comments on the revised draft plan.

Subsequently, from June 4 through July 20, 2015 (80 FR 31916), we made available for public comment our proposed modifications to the recovery criteria, as well as six draft recovery unit implementation plans (RUIPs), supplemental recovery planning documents that describe more detailed, site-specific conservation actions and implementation schedules for each of the six recovery units (Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Upper Snake, and St. Mary).

This section provides a summary of general information about the comments received, including the numbers of comments (letters) from various sources.

	Sept 4 through Dec 3, 2014	June 4 through July 20, 2015
Federal Agencies	(4)	(6)
State Agencies	(5)	(4)
Native American Tribes	(6)	(3)
Utilities/Commissions/Counties	(9)	(13)
Conservation/Other Organizations	(20)	(13)
Individuals	(26)	(5)
Peer Reviewers	(4)	(NA)

In general, comments received during the September 4 through December 3, 2014, comment period were centered around: (1) recovery unit boundaries and delineations, with several suggested boundary changes or splits in recovery units; (2) lack of support for the proposed 75 percent threshold for effective threat management for four of the six recovery units, which many maintained does not conserve all remaining bull trout populations; (3) concern that the revised recovery plan 'abandons' demographic targets proposed in earlier draft recovery plans for bull trout; and (4) the role of monitoring in bull trout recovery.

We have considered information we received from public comments and peer reviewers in our preparation of the final recovery plan. Updated information has been incorporated into the final recovery plan and the six final RUIPs as appropriate, and substantive issues and comments, together with our responses, are summarized in appendices. Comments relating to overall recovery strategy and criteria are addressed in this appendix to the final recovery plan, while those comments specific to individual recovery units are addressed in appendices to each RUIP. We welcome continuing public comment on this recovery plan, and we will consider all substantive comments on an ongoing basis to inform the implementation of recovery activities and future updates to the recovery plan.

The response to comments on the revised draft recovery plan for bull trout are organized as follows: General Comments, Peer Review Comments, Summary of Native American Tribal Comments, and Summary of Five State Fish and Wildlife Agency Comments.

General Comments

1. *Comment:* Suggestion that the revised bull trout recovery plan failed to follow "... the Service's long-standing Interim Recovery Planning Guidance".

Response: The comment refers to the joint National Marine Fisheries Service and U.S. Fish and Wildlife Service's Interim Endangered and Threatened Species Recovery Planning Guidance (NMFS and USFWS 2010), which was first proposed in 2004 and revised/updated in 2006, 2007 and 2010. Our recovery planning guidance recommends that recovery criteria be SMART: Specific, Measurable, Achievable, Realistic, and Time-referenced. Current recovery criteria for bull trout were developed with these practical directives in mind, and are based in a sound scientific rationale, reflecting biodiversity principles of resilience (ecological quality and ability to persist), redundancy (maintaining multiple replicates of populations/habitats to insure against catastrophic loss), and representation (conserving the full range of natural variation) (Shaffer and Stein 2000, Tear *et al*. 2005). Moreover, the recovery criteria emphasize conservation actions whose effects can be monitored and measured to assure that recovery has occurred or to inform adaptive management. We also considered seven principles of conservation specific to bull trout in developing recovery criteria: (1) conserve the opportunity for diverse life history expression; (2) conserve the opportunity for genetic diversity; (3) ensure bull trout are distributed across representative habitats; (4) ensure sufficient connectivity among populations; (5) ensure sufficient habitat to support population viability (e.g., abundance, trend indices); (6) address threats, including climate change; and (7) ensure sufficient redundancy in conserving population units. These recovery principles take into account both threats and the physical or biological needs of the species throughout its range and focus on the range-wide recovery needs. At the same time, the seven principles and our approach recognize that given the diverse threats to the long-term viability of bull trout throughout its range, the pathways to recovery of the species cannot be "one-size fits all". To that end, the recovery plan addresses these questions through a framework of six recovery units within which recovery can be tailored to the needs of geographically distinct subpopulations of bull trout.

Addressing threats in recovery criteria (threat-based criteria) is a requirement under the Interim Recovery Planning Guidance. This principle guided our recovery approach for bull trout with a goal to: (1) conserve bull trout so that they are geographically widespread across representative habitats and demographically stable, within six recovery units that comprise the coterminous United States population of bull trout; (2) effectively manage and ameliorate the primary threats in each of the six recovery units at the core area scale such that bull trout will persist in the foreseeable future; (3) build upon the numerous and ongoing conservation actions implemented on behalf of bull trout since their listing in 1999, and improve our understanding of how various threat factors potentially affect the species; (4) use that information to work cooperatively with our partners to design, fund, prioritize, implement and monitor effective conservation actions in those areas that offer the greatest long-term benefit to sustain bull trout and where recovery can be achieved; and (5) apply adaptive management principles to implementing the bull trout recovery program to incorporate new information into management.

In summary, we developed recovery criteria that focus on the identification and effective management of known, primary threat factors to bull trout in currently occupied core areas in each of six recovery units (Specific, Measurable, Achievable); established recovery criteria thresholds that acknowledge, despite our best conservation efforts, some extant bull trout core area habitats will likely change (and may be lost) over time (Realistic); and identified and focused recovery actions in those areas where success is likely, to meet our goal of ensuring the conservation of genetic diversity, life history features, and broad geographical representation of remaining bull trout populations (Realistic, Time-referenced).

2. *Comment:* The revised bull trout recovery plan failed to account for critical habitat in recovery planning.

Response: Critical habitat was designated for the coterminous United States population of bull trout on October 18, 2010 (USFWS 2010a). Areas designated as critical habitat included occupied habitat with the features essential to the conservation of the species, as well as a few currently unoccupied areas also considered essential to bull trout. In total, our 2010 critical habitat rule identified 32 critical habitat units (CHUs) within 6 biologically based recovery units, representing 19,729 river miles (31,751 km) and 488,252 surface acres (197,589 hectares) of bull trout habitat, primarily consisting of occupied core areas or groups of core areas that are in close geographic proximity.

In designating critical habitat, we considered the conservation relationship between critical habitat and past and present bull trout recovery planning processes. It is important to note that, while recovery plans formulate the recovery strategy for a species, unlike critical habitat designations they are not regulatory documents. There are no specific protections, prohibitions, or requirements afforded a species based solely on a recovery plan. Furthermore, although critical habitat designation can contribute to the overall recovery strategy of a species, it does not, by itself, achieve recovery plan goals. Information used in the 2010 designation of critical habitat for bull trout has informed, and contributed to, the overall recovery strategy described in the bull trout recovery plan, especially as it relates to sub-dividing the coterminous United States population of bull trout into the six recovery units described in the bull trout recovery plan (replacing the 27 recovery units proposed in the earlier 2002 and 2004 draft recovery plans). Conserving the six recovery units is considered essential to conserving the currently listed coterminous population as a whole.

While core areas are the primary focus of the recovery plan because of the importance of adequate spawning and rearing habitat, in a few recovery units areas currently designated as critical habitat exist outside of or adjacent to core areas. Most of these areas are bull trout FMO habitat shared among bull trout originating from multiple core areas (shared FMO habitat). These habitats primarily comprise relatively large streams and mainstem rivers, including lakes and reservoirs, and estuaries where sub adult and adult migrating bull trout can forage, migrate, mature and overwinter. They are typically downstream from core area spawning and rearing habitats and may contain all the physical elements to meet critical overwintering and migration needs for subadults and adults. The recovery criteria identified in the revised draft recovery plan specifically state that, for "recovery units where shared FMO habitat outside of core areas has been identified... connectivity and habitat in shared FMO areas should be maintained in a condition sufficient for regular bull trout use and successful dispersal among the connecting core areas". The specific recovery actions that are needed in particular shared FMO areas are being identified through the RUIPs.

3. *Comment:* Some commenters recommend that bull trout recovery strategies should be based on the fact that bull trout mostly occur in habitats that are altered from natural conditions and management options should recognize "today's and tomorrow's environment".

Response: Our approach to bull trout recovery and conservation is intended to ensure adequate conservation of genetic diversity, life history features, and broad geographical representation of remaining bull trout populations. Although bull trout are believed to have undergone a significant reduction in their historical range prior to the time of their listing in 1999, the species continues to be found in suitable habitats and remains geographically widespread across numerous major river basins in five western states. Additionally, in several currently occupied core areas bull trout population status remains stable or strong. As described in this recovery plan, recovery of bull trout: (1) will continue to build upon the numerous and ongoing conservation actions implemented on behalf of bull trout since their listing in 1999; (2) will be focused on the identification of and effective management of known threat factors to bull trout in areas where bull trout currently occur; and (3) will use the available scientific information to work cooperatively with our partners to design, fund and implement effective conservation actions in areas that offer the greatest long-term benefit to sustain bull trout and where recovery can be achieved.

This approach to achieving recovery for bull trout acknowledges the current status of the species in both altered and natural habitats, as well as likely future trends. In a few core areas habitat alterations have likely resulted in increased bull trout populations relative to historical conditions or have created barriers to nonnative fish invasion, and should be maintained. In many watersheds management should be prioritized in cold water habitats that are most likely to be resistant to habitat loss from climatic warming. Our recovery strategy is focused on achieving demographically stable bull trout populations in areas where they currently occur. The recovery of bull trout is not dependent upon recovery throughout its "historic" range.

4. *Comment:* Several comments suggested that bull trout recovery efforts are consistent and compatible with existing salmon, steelhead and other multi-species recovery plans. It is important to work closely with existing aquatic species partnerships and utilize the existing "infrastructure" already in place in several areas within the range of bull trout.

Response: Since the listing of bull trout, numerous conservation measures have been and continue to be implemented across its range in the coterminous United States These conservation measures on behalf of bull trout are being undertaken by a wide variety of local and regional partnerships, including State fish and game agencies, State and Federal land management and water resource agencies, Tribal governments, power companies, watershed working groups, water users, ranchers, and landowners. In areas where the range of bull trout overlaps with listed salmon and other listed aquatic species, many of these bull trout conservation measures are closely interrelated with work already being done for recovery of salmon and steelhead, which are limited by many of the same threats. For example, there are numerous examples of interagency partnerships implementing or planning fish habitat restoration projects in the Coastal, Mid-Columbia, and Upper Snake Recovery Units targeted at bull trout and/or listed salmon or steelhead conservation. While we have the statutory responsibility for developing and implementing this recovery plan for bull trout, recovery of bull trout across the coterminous United States will require the involvement of Federal, Tribal, State, private, and local parties.

This recovery plan takes into account the expertise and contributions of numerous individuals and agencies, and describes the principal actions needed to advance the recovery of bull trout found in the six RUIPs. The recovery actions described in the RUIPs were developed primarily through an interagency collaboration of interested and knowledgeable Federal, Tribal, State, private and other parties. In many parts of the range, local interagency salmon or multi-species working groups have previously identified recovery actions necessary for listed species, including bull trout conservation, and have already been implementing conservation actions for the past several years. The RUIPs were developed building upon these existing partnership efforts and information.

5. *Comment:* Concerns about the process and timeline for the assessment of management of threats as described in Appendix E: Proposed Threat Assessment Tool (TAT) for effective threat management. Specifically, a final recovery plan for bull trout would benefit from completing the threat assessment process prior to compiling the RUIPs. Additionally, several commenters had concerns that the TAT does not include adequate State and other partner involvement in future assessments and excludes workshop participants from final decision making.

Response: In the revised draft recovery plan, the Service made available for public and peer review a proposed assessment tool that will be useful to an evaluation of the status of bull trout at the range wide, recovery unit and core area scales that is based on an analysis of effective management of primary threats in bull trout core areas. The proposed assessment tool was developed to establish a structured, consistent, and objective approach to evaluate the status of threats across the range of bull trout that is reliant on the best available information and data. The assessment tool includes the following components: Description of an Assessment Workshop Process designed to utilize an interagency assessment of the status of bull trout (threat severity, threat management effectiveness, bull trout demography) in each core area in a recovery unit. The Workshop Process intends to seek broad representation of fisheries biologists representing agencies, Tribes, and other interested parties, knowledgeable about bull trout issues within the recovery unit being assessed. Our objective is to provide a decision framework that characterizes bull trout status objectively as possible through interagency partner involvement, and to establish a framework through a decision matrix to assess threat severity and management effectiveness for each identified primary threat as described for each core area in the RUIPs.

Applying a threat assessment process prior to completing the final recovery plan for bull trout may have provided useful information to inform development of the RUIPs. However, the Service maintained that it was important to first develop and propose a structured, consistent, and objective threat assessment process that can guide future assessments to evaluate the status of threats across the range of bull trout, and then solicit public, peer and agency review and feedback prior to implementation. The formal Threat Assessment Process included with this recovery plan will be useful in recovery criteria evaluation and status assessments conducted as part of future 5-year reviews and five-factor threats analysis in any future delisting evaluation(s).

We acknowledge the concern that partners may be excluded from future decision making. While the Service bears the final responsibility under the Act for making determinations of listing status, we welcome a full range of input on this decision from interested parties. In future status review assessments and listing determinations, the Service will consider the best available information in the context of the requirements of the Act to assess the status of threats in terms of the five listing factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) Overutilization for commercial, recreational, scientific or educational purposes; (C) Disease or predation; (D) The inadequacy of existing regulatory mechanisms; and (E) Other natural or manmade factors affecting its continued existence. For example, under the proposed TAT process Service managers will meet to determine whether threats have been effectively managed in each core area based on the best available information (recommended matrix cell assignments, survey and monitoring data on bull trout population and threats, and supporting rationales) that has been provided to the Service by experts (Federal, State, Tribal and others) during the recovery unit workshops. We acknowledge that opinions on bull trout status may vary greatly, and will seek to make the most appropriate assessment while considering available data and identifying underlying assumptions. The outcome of these assessments will determine the Service's recommendation for the listing status of bull trout under the Act.

6. *Comment:* There is no crosswalk between threats and the physical and biological features essential to bull trout conservation. The recovery plan should include habitat-based standards, guidelines or goals to achieve recovery.

Response: The Recovery Strategy section (pages 23-28 of the recovery plan) summarizes the causal interrelationships between the biological requirements of bull trout, habitat characteristics, threats, and the management actions necessary for recovery. The primary constituent elements of bull trout critical habitat correspond closely with the biological requirements described in this section, and impairment of these requirements results in threats that need to be addressed through management actions.

The purpose of the Act is in part "to provide a means whereby the ecosystems upon which [listed species] depend may be conserved," and to bring species to the point where the protections of the Act are no longer necessary. Our primary strategy for achieving recovery of bull trout is to effectively manage threats in order to protect, restore, and maintain suitable habitat conditions for the species that promote its diverse life history strategies and conserve genetic diversity. The primary threats identified in the final recovery plan have been identified as problems or factors that are affecting bull trout local populations and their suitable habitats in a core area at present or in the foreseeable future. Because the relevant threats can vary greatly among core areas, in the RUIPs we are specifically identifying such threats and the particular recovery actions necessary to address them at the core area level. Thus in core areas where habitat impairment is a significant threat to bull trout, the RUIPs recommend management actions to restore habitat. Successful implementation of these actions is likely to benefit bull trout. Thus, we expect that successful management of primary threats will result in corresponding improvements in demographic parameters. However, the RUIPs also identify survey and monitoring needs by core area, and if survey data do not indicate that the bull trout population is demographically stable and self-sustaining, the threats may be reassessed through additional research and adaptive management. We will ultimately evaluate whether such threats are being successfully managed, by assessing the efficacy of habitat restoration actions in conjunction with relevant survey and monitoring data on a core area scale.

Bull Trout Recovery Plan Content

7. *Comment:* Some comments suggested that the Service further define what a primary threat is. The current definition is ambiguous and is subject to varying interpretations when applied at different geographic scales. Others suggested replacing the term "primary threat" with the simple term "threat".

Response: In the revised draft recovery plan, the term Primary Threat was defined as: *Threat factors known or demonstrated (i.e., non-speculative) to impact or affect bull trout survival, growth, reproduction, distribution, migration etc., and their suitable cold water habitat.* In response to the numerous comments and concerns regarding the proposed definition of a primary threat, the Service has revised the term to emphasize the appropriate geographic scale (core area) and timescale (foreseeable future). Primary threats are now defined as: *Primary threats are those factors known or likely (i.e., non-speculative) to negatively impact bull trout populations at the core area level, and accordingly require management actions to assure bull trout persistence to a degree necessary that bull trout will not be at risk of extirpation within that core area in the foreseeable future.*

8. *Comment:* New information was provided to the Service suggesting that bull trout-occupied habitat within the South Salmo River drainage in northeast Washington should be included in the recovery plan as a new core area within the Mid-Columbia Recovery Unit.

Response: The referenced South Salmo River drainage was previously discussed as a potential core area, pending additional survey work, in the 2002 draft recovery plan for bull trout that was never finalized. The South Salmo River core area was inadvertently not included in the 2014 revised draft recovery plan and we are now including this core area as the 24^{th} core area within the Mid-Columbia Recovery Unit.

The Salmo River basin is a transboundary system flowing from the Selkirk Mountains of British Columbia and northern Idaho and Washington in the United States. The Salmo River drains into the Pend Oreille River approximately 3 miles downstream of the international border. Major tributaries of the Salmo River include Apex, Clearwater, Hall, Barrett, Ymir, Porcupine, Hidden, Boulder Mill, Erie, and Sheep creeks, and the South Fork of the Salmo River (South Fork). Of all the major Salmo River tributaries, only the South Fork originates in the United States. The headwaters of the South Fork originate in northern Idaho, with the entire United States portion located within the Salmo Priest Wilderness Area. Several small tributaries drain into the South Fork, including Watch and Lead Creeks. The core area contains four local populations in the upper South Salmo mainstem, Clearwater Creek, Sheep Creek, Stagleap

Creek, and the South Fork. Bull trout in the Salmo River watershed exhibit primarily a fluvial migratory life history with FMO habitat occurring from approximately river mile 27 (km 44) to the confluence with Pend Oreille River. In Canada, the South Salmo River is identified as one of the most threatened populations in British Columbia, with an estimated number of redds per year between 38 and 109 (1998 to 2009) and an estimated population size between fewer than 50 to as many as 250 adults.

9. *Comment:* Suggestion to include in a final recovery plan a section describing the role of artificial propagation and transplantation in bull trout recovery.

Response: In watersheds where bull trout populations have been severely reduced or extirpated and connectivity impairment is likely to prevent natural recolonization, active reintroduction or supplementation of bull trout from appropriate source populations may help reestablish viable local populations to improve core area status. The recovery plan includes a discussion on the role of artificial propagation and translocation in bull trout recovery, and the RUIPs identify where propagation or translocation efforts may be useful to aid recovery efforts. Such efforts may involve direct translocation from more vigorous populations or captive breeding of bull trout in controlled propagation facilities. Such translocation programs should consider appropriate precautions against introduction of fish pathogens to new watersheds.

Recovery Unit Delineation

10. *Comment:* Several commenters questioned the proposed recovery unit boundaries and suggested the six recovery unit structure for the coterminous United States population of bull trout is not consistent with the Service's Distinct Population Segment (DPS) policy. Some commenters suggested the Service has demonstrated a conflict of interest in its rationale provided for the recovery unit delineations, specifically that "... it appears that the Service has interpreted internal science in development of Recovery Units that are indirectly tied to future delisting". Others suggested the recovery unit delineations should be revised to consider existing land and resource management boundaries of agencies that will implement threats-based management and to encompass smaller geographic areas that are consistent with existing jurisdictional boundaries in resident (non-anadromous) fish management.

Specific recovery unit boundary changes proposed include:

- Split the Coastal Recovery Unit into two recovery units: Washington Coast and Lower Columbia Recovery Units. The commenter expressed the belief that the rule-set used to designate the six recovery units was applied inconsistently with respect to establishing the Coastal Recovery Unit. Specifically, the use of genetic data was not consistently evaluated across all areas when "... spatial configuration, ecological setting, and management authority..." may have influenced appropriate recovery unit boundaries. Additional support for splitting the Coastal Recovery Unit based on spatial separation, different ecological settings and different expressions of life history was also provided.

- Split off the two Malheur River core areas from the Upper Snake Recovery Unit and create a separate Malheur River Recovery Unit. Recommendation "... based on biological uniqueness, biodiversity principles and Service DPS policy…". Specific examples included information that fluvial bull trout in the Malheur River drainage mature at an earlier age than individuals in other areas; the two core areas are comprised of all three possible life history forms: resident, fluvial, and adfluvial fish (Representation); there is a high potential for the establishment of new populations in currently unoccupied habitats (Redundancy); and the probability of persistence would likely increase (Resilience). Additionally, the recovery plan should consider existing land and resource management boundaries of the agencies asked to manage bull trout habitats and encompass smaller geographic areas that are consistent with existing State jurisdictional boundaries in resident fish management.

- Reassign the Clearwater River core areas from the Mid-Columbia Recovery Unit to the Upper Snake River Recovery Unit. Suggestions that political boundaries may have influenced the placement of the Clearwater core areas rather than genetic or other biogeographical considerations.

Response: Since the early 2000s, new data and reanalysis have suggested that the coterminous United States listed entity would be more appropriately divided into 6 recovery units, rather than the 27 recovery units identified in the 2002 and 2004 draft recovery plans. We worked with a number of State, Federal, and Tribal partners in 2008 and 2009 to evaluate alternatives for organizing core areas into possible recovery units that would also be consistent with the "discreteness" and "significance" criteria in the DPS policy. Ten alternatives were evaluated that explored from 2 to 69 potential recovery units, based on mitochondrial and microsatellite DNA analysis, and on biogeographical considerations, including geological establishment of major watersheds, isolation of portions of watersheds above major waterfalls, co-occurrence with other fish species, and occurrence in different ecological zones (Ardren *et al*. 2011). The six recovery units identified in this plan reflect this most recent information and analysis, and were first described in the 2010 proposed critical habitat rule (USFWS 2010a). They include: (1) Coastal Recovery Unit, (2) Klamath Recovery Unit, (3) Mid-Columbia

Recovery Unit, (4) Upper Snake Recovery Unit, (5) Columbia Headwaters Recovery Unit, and (6) Saint Mary Recovery Unit.

In this analysis of alternatives, we concluded that the six unit alternative could meet the discreteness criterion for a DPS because the six units had a pattern of significant genetic divergence at the microsatellite level; were isolated from other populations (strongly for the Coastal, Klamath, St. Mary, and Columbia Headwaters, limited for the Mid-Columbia and Upper Snake); and showed life history differences (primarily for the Coastal and Klamath, limited for the others). We also concluded that this alternative could meet the significance criterion for a DPS on the basis that loss of any unit would create a significant gap in the range (loss from major drainage basin or major portion of Columbia basin), and possibly on the basis of ecological setting (unique species assemblage for Klamath and St. Mary, more limited for the others) and marked difference (low potential for shared evolutionary future among Klamath, St. Mary, and Columbia Headwaters; and evolutionarily significant genetic divergence among Coastal, Klamath, and St. Mary).

The seven unit alternative that we analyzed differed from the six unit alternative in splitting the Coastal Recovery Unit between the Washington Coast (including both Puget Sound and Olympic Peninsula watersheds) and Lower Columbia regions. We concluded that this alternative also could meet the discreteness and significance criteria for a DPS. Differences in the discreteness analysis included the degree of isolation from other populations and life history differences (both strong for Washington Coast and limited for Lower Columbia watershed). We concluded that this alternative met the significance criterion on the basis that loss of any unit would create a significant gap in the range (loss from major drainage basin or major portion of Columbia basin); however, it was noted that this argument might be weak for the Lower Columbia. Other differences in the significance analysis included differences in ecological setting (unique species assemblage for Washington Coast) and marked difference (evolutionarily significant genetic divergence with low potential for shared evolutionary future for Washington Coast, but not for Lower Columbia).

Thus, our original analysis found that both the six unit and seven unit alternatives could legitimately meet the criteria in the DPS policy. Recovery unit delineation considered multiple factors, including genetics, life history strategies, ecological setting, and geographical connectivity. On review of the commenters' requests to split the Coastal Recovery Unit, while their rationale supports the seven unit structure under the DPS policy, we maintain that no substantial new information was provided that was not considered in the original analysis. Nonetheless, for effective management we do support the use of bull trout working groups at the level of recovery subunits organized along the lines of the Washington Coast and Lower Columbia regions. Additionally, if such a portion of the Coastal Recovery Unit appears to be meeting recovery targets, we would also consider application of tools such as HCPs or an expanded 4(d) rule to reduce regulatory burdens in the region or in other recovery units.

The Upper Snake and Mid-Columbia Recovery Units comprise a complex array of life history types, ecological zones, management jurisdictions, connectivity patterns, and genetic characteristics. We determined the specific boundaries between the Upper Snake and Mid-Columbia recovery units following Ardren *et al*. (2011), who analyzed bull trout population differentiation at 15 microsatellite loci. In this analysis (see their Figures 6 and 7D), three sites in the Clearwater River watershed clustered with nearby populations in northeast Oregon within the Mid-Columbia Recovery Unit, while two sites in the Malheur River watershed clustered with populations in central Idaho and Nevada within the Upper Snake Recovery Unit. We continue to maintain that this is a reasonable basis of delineation between these two recovery units.

We understand the concern that the isolated Malheur River bull trout populations (two core areas) in Oregon could be delisted based on recovery of the majority of the Upper Snake Recovery Unit in Idaho. However, given that several other recovery units cross State boundaries and the Malheur River population groups related genetically with the Upper Snake basin populations in Idaho and Nevada, we do not support delineation of a separate recovery unit for the Malheur River watershed based on its genetic distinctiveness within Oregon. In this context, we note that in our original analysis of alternatives we found that the 69-unit alternative could meet the discreteness criterion in the DPS policy (based on patterns of genetic divergence at the microsatellite level), but did not meet the significance criterion. The Malheur River watershed constitutes a relatively small proportion of the Columbia watershed (approximately 2 percent by area) and we maintain that it would be difficult to support a separate Malheur River DPS under our policy.

11. *Comment:* Some commenters question whether the Service’s proposed intention to possibly reclassify the coterminous DPS into six separate recovery units is consistent with our joint NMFS and FWS’s 2010 Interim Endangered and Threatened Species Recovery Planning Guidance.

Response: Our Interim Recovery Planning Guidance defines a recovery unit as “a special unit of the listed entity that is geographically or otherwise identifiable and is essential to the recovery of the entire listed entity”. The recovery units that we have defined meet this definition by representing suitable cold water habitats across the species’ range of genetic diversity, adaptation to diverse geographic and environmental conditions, and expression of the full range of life history strategies. The six recovery units are individually necessary to conserve and ensure the long-term sustainability of the listed entity as presently defined (bull trout within the coterminous United States). Any designation of distinct population segments would be made on a separate basis (assessing discreteness and significance) as described in our DPS policy (USFWS 1996). We have not made a formal determination through a listing rule that the current listed entity should be separated into multiple DPSs; however, because bull trout are wide-ranging and occur in environmentally diverse watersheds that are often isolated from one another, there may be plausible arguments for making such a determination. Thus, when we identified the current six recovery units, we also explicitly considered the DPS policy in defining unit boundaries, so that possible future modifications would be less likely to require boundary changes. However, any formal determination of DPS status would still require publication of a proposed and final rule, with full consideration of current biological data, applicability of the DPS policy, appropriateness of threatened and/or endangered status for each DPS, and legal sufficiency of the rule.

Recovery Strategy

12. *Comment:* Suggestion that the recovery plan proposes use of a threats assessment tool that "... appears to bias results toward conclusions of successful rather than unsuccessful management effectiveness..." that may result in delisting where it is not biologically justified. Suggested changes included providing more specific criteria (e.g., population demographic data, etc.) for the Service's assessment of whether threats are being effectively managed since the proposed Matrix falls short of the objective and measurable criteria that the Act requires of recovery plans; and fails to account for "cumulative threats" or even threat management interactions.

Response: The bull trout recovery plan includes a Threat Assessment Tool (Appendix E) that will be integral to an evaluation of the conservation status of bull trout at the range-wide and recovery unit scales. The recovery plan describes recovery of bull trout as dependent upon effectively managing and ameliorating the primary threats affecting the species in each recovery unit at the core area level such that bull trout are geographically widespread and demographically stable across representative habitats within the six recovery units. Therefore to objectively evaluate the status of bull trout (through effective threat management) across the range of bull trout, the Threat Assessment Tool will be applied at the core area level. Core area assessments can inform the process of recovery plan implementation by highlighting and prioritizing management actions that maximize conservation benefits for bull trout. This approach also provides a basis for managers to forecast the influence of individual management actions on status at the aggregated recovery unit level. These core area assessments will also serve as the primary metric to assess the species status in future 5-year reviews and five-factor threats analyses, including any future delisting evaluations.

The Threats Assessment Tool includes the following components (potential participants identified in parentheses):

- Assessment Workshop Process (Service, State, Federal, Tribal, and others)
- Proposed Threats Assessment Decision Matrix (Service, State, Federal, Tribal, and others)
- Assessment of Threats Effectively Managed (Service)
- Evaluation of Recovery Unit Status (Service)

In summary, ecologically viable populations of bull trout are necessary to produce stable core areas which in turn will result in viable recovery units. These recovery principles take into account the threats and physical or biological needs of bull trout throughout its range and focus on the range-wide recovery needs through conservation at the recovery unit scale. This approach to achieving recovery should ensure adequate conservation of genetic diversity, life history features, and broad geographical representation (*i.e.*, adequate spatial distribution) of bull trout populations in the six recovery units that comprise the coterminous population of bull trout.

13. *Comment:* Suggestion to develop or encourage consistent monitoring approaches and metrics (e.g., population demographic data) for assessing effective threat management. In addition, possible threat management interactions should be considered when assessing effective threat management.

Response: Effective monitoring programs are needed to reliably assess whether recovery actions for bull trout are successful and to help determine where and when recovery criteria have been achieved. Bull trout monitoring and evaluation protocols to support and evaluate recovery will need to be both reliable and cost effective, with a focus on assessing bull trout status (*i.e.*, distribution, population status, life history, migratory movements, and genetic characteristics), in combination with direct indicators of threats such as physical habitat conditions (reflecting effectiveness of management practices such as water diversion screening, grazing, timber harvest, and riparian management) and occurrence of nonnative species.

Across the range of bull trout, Federal, State and Tribal entities are monitoring bull trout and their habitats using a wide variety of monitoring protocols and sampling techniques. In developing the RUIPs included in the recovery plan, we asked the RUIP working groups to evaluate the existing monitoring programs as to their utility in providing information that will inform future effective threat management. For each recovery unit, these working groups should identify deficiencies in existing monitoring programs and include in the RUIPs additional monitoring protocols needed to monitor bull trout populations and or their habitat to ensure adequate monitoring information at the appropriate spatial scale across each recovery unit. However, the Service is not requiring that a single, uniform monitoring program be established across the range of bull trout.

The Service's 2008 Monitoring and Evaluation Guidance draft document (USFWS 2008b) describes and evaluates various bull trout monitoring protocols and procedures, and is a useful guide for those responsible for bull trout monitoring programs. The current generation of bull trout habitat models, combined with spatial data on habitat, stream temperature, and presence of nonnative species, provides valuable tools for targeting monitoring efforts to efficiently identify occupied habitat patches and track population trends in response to habitat change (USGS 2011; Isaak *et al*. 2009, 2014; Isaak *in litt*. 2014). Environmental DNA assays (Wilcox *et al.* 2013, 2014) are another promising new method for inexpensively assessing habitat patches for occupancy by bull trout and other species. Appropriate use of these resources is being considered by RUIP working groups in the development and future implementation of recovery unit level monitoring programs.

In addition, the recovery plan describes an approach that applies adaptive management principles to account for new information regarding threat management interactions and future climate effects to adjust and focus bull trout recovery actions in each recovery unit.

Recovery Criteria

14. *Comment:* Numerous commenters did not support the 75 percent threshold for the number of core areas with threats effectively managed for four of the six recovery units. They believed the threshold is too low and could lead to a determination that recovery is achieved while not conserving all remaining bull trout populations. There were specific comments to revise the proposed 75 percent threshold to a 100 percent threshold for a number of core areas within each recovery unit with threats effectively managed and the maximum number of local populations within the range of natural variation. Additionally, at least one commenter expressed that: "its (the 75 percent threshold) broad application across geographically large recovery areas assumes local bull trout populations and core areas have equal value ..." and may allow the potential loss of bull trout 'representation and redundancy'. Other commenters suggested that the 75 percent threshold may be too high in those areas where insufficient resources or unproven threat management techniques may be lacking.

Response: Recovery criteria are the values by which it can be determined that an objective has been reached. In the case of bull trout, the 'objective' is to manage threats and ensure sufficient distribution and abundance to improve the status of bull trout throughout their extant range in the coterminous United States so that protection under the Act is no longer necessary. Additionally, recovery criteria must be "SMART": specific, measurable, achievable, realistic and time-referenced, and address threats in terms of each of the five listing factors.

The Service takes seriously its obligations under the Act to prevent the extinction of species as well as to help species avoid experiencing the risk of extinction. At the same time, the Service recognizes that the protections of the Act must be applied only when a species is truly on the verge of extinction or could be at risk of extinction in the foreseeable future because the protections of the Act impose economic, social, and cultural limitations that can sometimes be onerous. As we strive to balance prevention of extinction or the risk of extinction to bull trout with our obligation to not unnecessarily impose the limitations on society that protections under the Act carry, the Service has established a recovery standard (criteria) for bull trout. The current recovery criteria for bull trout were developed based on the practical directives of being SMART (specific, measurable, achievable, realistic and time-referenced) and in consideration of the differences between portions of its range where bull trout are stable and likely to persist and portions of its range where the risk of extirpation is higher.

To that end, the four recovery units where the 75 percent threshold for effective threat management (primary threats managed in 75 percent of core areas representing 75 percent or more of local populations within each recovery unit) was established are regions (recovery units) where, since listing, bull trout continue to persist and something less than addressing 100 percent of threats to the species can be expected to assure long-term persistence, viability and even an improved status for the species. These four recovery units (*i.e.*, Coastal, Mid-Columbia, Upper Snake, and Columbia Headwaters) where the 75 percent threshold was established generally span large geographic areas comprised of several major river watersheds with multiple extant core areas (range: 21 to 35) and numerous local populations (range: 92 to 208). The threshold for these recovery units was established to ensure sufficient bull trout distribution, representation, resilience, and redundancy across each recovery unit as demonstrated by demographically stable or increasing populations, with the understanding that there may be some loss of bull trout local populations or even existing core areas in the future. Because of the size and landscape diversity of these four recovery units, the Service is confident that a minimum threshold of 75 percent is sufficient to achieve recovery.

For the Columbia Headwaters Recovery Unit, we did make a change in how the 75 percent threshold for effective management would be applied. The Columbia Headwaters Recovery Unit is distinguished from other recovery units in that a high percentage of the core areas within the recovery unit (20 of 35) are simple core areas comprising a single local population. Most of these simple core areas occur in remote glaciated headwaters and represent unique environments and diversity in genetics and life history strategies. In response to concerns that the 75 percent threshold could allow many of these simple core areas to become extirpated, or alternatively allow many complex core areas in major watersheds comprising a large portion of the recovery unit to remain unrecovered, the Service has decided to apply the 75 percent threshold separately to both the simple and complex core areas within this recovery unit. This would mean that for recovery criteria to be met in the Columbia Headwaters Recovery Unit, effective threat management would need to be achieved for 15 of 20 simple core areas and 12 of 15 complex core areas.

In the two recovery units where the 100 percent threshold is applied (the Klamath and St. Mary Recovery Units), the status of bull trout since listing continues to point to the need for a higher level of recovery effort before an expectation of recovery can be met. In the Klamath Recovery Unit, because 9 of 17 known local populations have already been extirpated and the remainder are significantly imperiled and require active management of threats, we maintain that effective threat management is necessary in 100 percent of core areas, and the geographic range of bull trout within this recovery unit will need to be expanded through reestablishment of extirpated local populations before recovery criteria can be met. Recovery of bull trout in the St. Mary Recovery Unit is critically dependent on successfully addressing threats in the St. Mary River complex core area, while the other three core areas in this recovery unit each comprise a single isolated local population with only minor threats. Because a 75 percent threshold would not adequately reflect the importance of the St. Mary River core area, we have set the threshold to 100 percent in this recovery unit.

It should be emphasized that although bull trout are believed to have undergone a significant reduction in their historical range prior to the time of their listing in 1999, the species continues to be found in suitable habitats and is geographically widespread across numerous major river basins in five western states. The Act does not require a species, in this case bull trout, to be recovered throughout its historical range or even in any set proportion of the currently suitable habitat. Instead, the Act requires that we recover listed species such that they no longer meet the definitions of a "threatened species" or "endangered species".

In developing this bull trout recovery plan, the recovery criteria and recovery actions are intended to ensure that bull trout will be conserved as an ecologically viable species for the foreseeable future, and where possible, maintain its evolutionary potential. In this context, recovery must include the adequate conservation of genetic diversity, life history features, and broad geographical representation of bull trout populations in six recovery units that comprise the threatened coterminous United States population of bull trout. When identified threats have been sufficiently removed and bull trout populations are secure in an ecologically or evolutionarily significant portion of its range, the protections of the Act would no longer be warranted. With these goals in mind, the plan acknowledges that, despite our best conservation efforts identified in this recovery plan, it is possible that some existing bull trout core areas will become extirpated within the foreseeable future due to various factors; including the effects of small populations, isolation, and climate change. Further, the plan also recognizes that a small number of such extirpations might occur without preventing recovery if threats are successfully managed in most core areas.

In summary, although the recovery plan recognizes that all 109 existing bull trout core areas contribute to the overall conservation of the species and identifies recovery actions to address specific threat factors affecting bull trout in these same 109 core areas, meeting the 75 percent threshold for effective threat management in any of the 4 referenced recovery units is the minimum established value at which the Service may initiate an assessment of whether recovery has been achieved. It is important to note that to achieve viable (recovered) recovery units, identified threats affecting the species in core areas must be effectively managed to produce demographically stable bull trout populations. In any delisting evaluation, the Service will consider all available information to ensure that bull trout in a 'recovered' recovery unit achieve representation (*i.e.*, existing occupancy within most core areas was maintained and existing life history forms that are present in these core areas were mostly preserved); redundancy (*i.e.*, a mosaic of healthy populations are distributed across the landscape within the recovery unit); and resilience (*i.e.*, core areas that contain several local populations or more than one life history expression were prioritized for conservation, and "at risk" core areas have been improved).

15. *Comment:* If the proposed recovery criteria are not revised, modify the recovery criteria to account for the importance of complex core areas. Specifically, separate recovery criteria should be established for simple and complex core areas to maximize the opportunity for conservation and recognition of the significance of complex core areas in contributing to the viability of a recovery unit.

Response: In developing this recovery plan, we established recovery criteria and recovery actions that are intended to ensure adequate conservation of genetic diversity, life history features, and broad geographical representation of bull trout populations in six recovery units that comprise the threatened coterminous United States population of bull trout based on the existing distribution of bull trout. Therefore, the recovery plan recognizes that all 109 existing bull trout core areas contribute to the overall conservation of the species and identifies recovery actions to address primary threat factors affecting bull trout in these same 109 core areas. We have modified the recovery criteria for the Columbia Headwaters Recovery Unit to consider complex and simple core areas separately, as summarized above. However, the recovery plan does not distinguish conservation importance or prioritize conservation actions differently for ‘complex’ and ‘simple’ core areas. For example, simple core areas are ecologically if not physically isolated from other core areas and are comprised of a single local bull trout population. While this can increase the risk of extirpation for bull trout in simple core areas due to immediate threat factors, simple core areas may also represent extremes of the species’ range and may contain unique genetic or life history adaptations worthy of conservation. Complex core areas, on the other hand, contain multiple local bull trout populations and are typically situated in larger patches of habitat and often occupied by more than one life history form; therefore they can have a higher likelihood of persistence. The relative importance of bull trout in any core area is assessed through the RUIP process for each of the six recovery units.

We do acknowledge, however, that despite our best conservation efforts identified in this recovery plan, it is possible that some existing bull trout core areas may become extirpated within the foreseeable future due to various factors, including the effects of small populations, isolation, and climate change.

16. *Comment:* The revised draft recovery plan provides no rationale for ‘abandoning’ ‘critically important demographic recovery targets’ proposed in the 2002 and 2004 draft recovery plans for bull trout. Specifically, there are significant risks associated with measuring recovery based on effective management of threats alone... and that some measure of the species status (abundance, distribution, population trends) is required so that demographic threats (inbreeding, loss of genetic variation) can be avoided. There is a need to “... supplement the Draft Plan’s reliance on qualitative measures of the success of threats-based management”. The RUIPs should incorporate current numerical population abundance levels where possible, with clearly defined recovery goal targets. Explain why demographics are no longer needed as recovery criteria.

Response: In the previous 2002 and 2004 draft recovery plans, adult abundance levels (demographics) were proposed as recovery targets for each identified bull trout core area, considering theoretical estimates of effective population size, historical census information, and the professional judgment of recovery unit team members. The proposed abundance targets for bull trout core areas were derived using best professional judgment by informal recovery unit teams which in most cases considered best estimates of productive capacity for identified local populations and potential local populations in each core area. For many core areas, there appeared to be a high degree of subjectivity when identifying proposed bull trout abundance targets for each core area and a general lack of consistency in applying recovery population targets between core areas.

The current recovery plan integrates, and benefits from, new information regarding life history, ecology, conservation actions, climate change effects, etc., learned since bull trout were listed as threatened in 1999. We recognize that bull trout continue to be found in suitable habitats and generally remain geographically widespread across 109 core areas in numerous major river basins in 5 states; and the recovery plan identifies conservation needs for these 109 core areas where bull trout continue to persist. However, we acknowledge that despite our best future conservation efforts identified in this plan, it is possible that some existing bull trout core areas may become extirpated within the foreseeable future; due to various factors including existing small population size, climate change, and isolation. Moreover, the availability of survey data for accurate population estimates is problematic in some regions, and in certain core areas the geographic limitations on available habitat may inherently constrain the ability of bull trout populations to achieve the demographic targets proposed in the earlier draft recovery plans. Therefore, we reconsidered our earlier recovery approach and developed a recovery plan that focuses on the identification and effective management of known threat factors to bull trout in currently occupied core areas in each of six recovery units to establish 'demographically stable' populations. The recovery plan establishes recovery criteria thresholds that acknowledge, despite our best conservation efforts, some extant bull trout core area habitats will likely change (and may be lost) over time coincident with recovery. We identify and focus recovery actions in core areas where success is likely to meet our goal of ensuring the conservation of genetic diversity, life history features, and broad geographical representation of remaining bull trout populations. The recovery plan does identify a number of core areas where small population size is a significant threat factor that needs to be addressed since population levels are particularly low considering the spatial extent of existing habitat. Achieving a demographically stable population in these core areas would most likely require an increasing population trend and a measured increase in population size.

In summary, the recovery plan foresees that achieving effective threat management in each recovery unit will result in geographically widespread and demographically stable local bull trout populations within the range of natural variation (not necessarily at some theoretical level of effective population size), with their essential cold water habitats connected to allow their diverse life history forms to persist into the foreseeable future. A 'demographically stable' population would therefore be expected to vary in size, magnitude, and distribution between core areas based upon differences in core area habitat availability, and other indicators of carry capacity. Demographic data that can include empirical data on the magnitude and trends in bull trout population counts or indices, is just one of several evaluation metrics, such as current or historical spatial distribution, connectivity, and extent of populations; expression of life history strategies; occurrence, magnitude, scope, trends, and severity of threats; and significant conservation measures that are ongoing or have been completed to address primary threats, that will be useful to evaluate the status of bull trout in any future status review process.

17. *Comment:* There were comments suggesting "significant variation" in how the RUIPs were drafted, specifically that a single definition of primary threat was not consistently applied across the six recovery units. As a result, some commenters suggested that primary threats and related conservation actions were characterized inconsistently between RUIPs when primary threats were assigned to core areas.

Response: Our primary strategy for achieving recovery of bull trout is to effectively manage threats at the core area scale in each of six recovery units in order to protect, restore, and maintain suitable habitat conditions for the species that promote its diverse life history strategies and conserve genetic diversity. The bull trout recovery plan includes six individual RUIPs intended to identify the primary threats affecting bull trout and describe and prioritize core area specific ongoing and future recovery actions. The primary threat description and recovery actions were mostly developed through an interagency collaboration of interested and knowledgeable Federal, Tribal, State, private and other parties. The process was designed to acknowledge and build upon the numerous and ongoing conservation actions already being implemented throughout much of the range of bull trout since the time of listing, utilizing local biological expertise and existing and new information, including decision support tools (*i.e.*, Structured Decision Making, climate change considerations) to describe the primary threats affecting bull trout and in developing and prioritizing conservation actions in each recovery unit.

We understand the desire for consistency, especially regarding the description of primary threats across the wide geographic range of the six bull trout recovery units, on the part of some commenters. We did establish a common definition of primary threat so that recovery actions would focus on known or demonstrated threat factors across the coterminous range of bull trout at the core area scale. Early on during the RUIP development process, in response to some interagency partner concerns that the application of primary threat designations was ambiguous and subject to varying interpretations when applied at different geographic scales, the primary threat definition was further revised to emphasize the appropriate geographic scale (core area) and timescale (foreseeable future). Ultimately, the Service has relied on the expertise and guidance of the bull trout biologists assigned to oversee the RUIP development process in applying their local expertise and familiarity as to what is necessary to achieve recovery in each recovery unit. The process recognized that the specific circumstances and relative emphasis of factors affecting bull trout and the suite of possible recovery actions varies widely across the different recovery units. Additionally, the process acknowledged and attempted to reconcile inherent differences among experts in applying their professional opinion when discussing all scientific information used in developing the RUIPs. Any attempt to apply a common and strict rule set overseeing the RUIP development process consistently across all six recovery units, risked leaving out or overlooking important primary threats in any one recovery unit and instead relied on best professional judgement in crafting recovery unit specific RUIPs.

Summary of Peer Review Comments

All four peer reviewers provided additional supporting information and referenced documents regarding pertinent recent research on bull trout. Two peer reviewers appreciated the description of climate change impacts on bull trout and their habitats, and suggested including some specific estimates of rates of change in aquatic habitats where such information exists. Much of the information provided by peer reviewers has been incorporated and referenced in the final recovery plan where appropriate.

1. *Comment:* Uncertainty associated with the ability and accountability in determining effective threat management. There were expressed concerns on how threats will be ranked or prioritized, and whether the Service has adequately described the process for determining effective threat management, with additional concerns that 'professional judgment' will replace statistical information.

Response: The bull trout recovery plan includes a Threat Assessment Tool (TAT) that will be integral to an evaluation of the conservation status of bull trout at the range-wide and recovery unit scales. The recovery plan describes recovery of bull trout as dependent upon effectively managing and ameliorating the primary threats affecting the species in each recovery unit at the core area level such that bull trout are geographically widespread and demographically stable across representative habitats within the six recovery units. The TAT establishes a structured, consistent, and objective approach to determining whether the identified primary threats to bull trout are being effectively managed at the core area level. The framework for making these determinations will include a simple, but consistently applied, decision matrix to assess threat severity and management effectiveness for each identified primary threat in the core area.

Assessment of this decision matrix will be informed by existing empirical data on magnitude and trends in bull trout population counts or indices; current or historical spatial distribution, connectivity, and extent of populations; expression of life history strategies; occurrence, magnitude, scope, trends, and severity of threats; and significant conservation measures that are ongoing or have been completed to address primary threats. These data will be interpreted with the best professional judgment of biologists familiar with bull trout populations in the core areas under review because statistical information is or would be lacking across much of the range of bull trout. We are confident that this structured approach will provide uniform and useful information that will allow Service managers to forecast the influence of individual management actions on the status of bull trout at the core area and recovery unit level.

In summary, ecologically viable populations of bull trout are necessary to produce stable core areas which in turn will result in viable recovery units. These recovery principles take into account the threats and physical or biological needs of bull trout throughout its range and focus on the range-wide recovery needs through conservation at the recovery unit scale. This approach to achieving recovery should ensure adequate conservation of genetic diversity, life history features, and broad geographical representation (*i.e.*, adequate spatial distribution) of bull trout populations in the six recovery units that comprise the coterminous population of bull trout.

2. *Comment:* Comments related to climate change and climate resilience. Specifically, will climate resilience be used to prioritize conservation actions (*i.e.*, focus conservation in those areas where cold water necessary for bull trout is expected to occur)? If so, how?

Response: As stated in the recovery plan, climate change effects were not considered as factors affecting bull trout at the time of listing in 1999. Since that time, several climate change assessments or studies have been published or are currently underway assessing the possible effects of climate change on bull trout and their habitats. The results of these efforts will allow us to better understand how climate change may influence bull trout and help to identify suitable conservation actions to ensure bull trout persist in the foreseeable future in the face of climate change. For example, recent publications have cited information showing estimates of both summer flow decreases and stream temperature increases due to climate change in several areas where bull trout currently reside (e.g., Leppi *et al*. 2012; Luce *et al*. 2013; Sawaske and Freyberg 2014). Both of these metrics demonstrate that discernible long-term trends are having direct negative impacts on availability of suitable habitat for bull trout.

Therefore, it is important to develop a decision framework to assess climate change effects to bull trout and allocate conservation resources and funding to ensure that future bull trout conservation efforts are allocated to those areas with the anticipated future coldest water temperatures that offer the greatest long-term benefit to bull trout conservation. Recent tools and regional databases that may be useful for informing and prioritizing the bull trout conservation and monitoring actions described in the RUIPs include: NorWeST Regional Database and Modeled Stream Temperatures (Isaak *et al.* 2014) (stream temperature data used to develop accurate and consistent data on aquatic habitat spatial distribution and responses to climate that may help predict future bull trout occupancy); Bayesian Belief Network decision support tools (Peterson *et al*. 2013) (developed to provide spatially-explicit information about the likelihood of fish population, including bull trout, persistence under different climate scenarios); and the numerous recent scientific publications describing historical trends in precipitation and stream flow observed across the Pacific Northwest. We expect that these, and other, tools will be useful in developing and applying conservation actions identified in the RUIPs, and will be used by State, Federal, Tribal and other agencies responsible for implementing actions in support of bull trout conservation and recovery.

3. *Comment:* Suggestions that a "clear, concise monitoring plan" be developed to monitor bull trout recovery. One peer reviewer provided information describing some of the new technologies that may provide "broad-scale, high-resolution, cost-effective monitoring of bull trout populations through space and time". Periodic distributional monitoring was suggested as being useful to track bull trout occurrence across many habitats through time and may help describe if, how and where bull trout distribution may be shifting.

Response: As previously discussed in the response to public comments above (see response # 13 above), the Service maintains that effective monitoring programs are needed to reliably inform whether recovery actions for bull trout are successful and to help determine where and when recovery criteria have been achieved. Bull trout monitoring and evaluation protocols to support (evaluate) recovery will need to be both reliable and cost effective, with a focus on assessing bull trout status (*i.e.*, distribution, population status, life history, migratory movements, and genetic characteristics), and possibly the physical habitat conditions (*i.e.*, management practices such as those for water diversion screening, grazing, timber harvest, and riparian management). In addition, monitoring protocols should also provide information that is useful to the local management needs of the agencies collecting such information as well as providing information that can be incorporated into the Service's proposed effective threat management process and inform whether core area bull trout populations have achieved demographic stability.

Across the range of bull trout, Federal, State and Tribal entities are monitoring bull trout and their habitats using a wide variety of monitoring protocols and sampling techniques. In developing the RUIPs included in the final recovery plan, we asked the RUIP working groups to evaluate the existing monitoring programs as to their utility in providing information that will inform future effective threat management. For each recovery unit, these working groups should identify deficiencies in existing monitoring programs and include in the RUIPs additional monitoring protocols needed to monitor bull trout populations and or their habitat to ensure adequate monitoring information at the appropriate spatial scale across each recovery unit. However, the Service is not requiring that a single, uniform monitoring program be established across the range of bull trout.

Summary of Native American Tribal Comments:

1. *Comment*: Require RUIPs to contain demographic targets, and provide guidance for developing those targets. There is a need to "... supplement the Draft Plan's reliance on qualitative measures of the success of threats-based management".

Response: The recovery plan integrates, and benefits from, new information regarding life history, ecology, conservation actions, climate change effects, etc., learned since bull trout were listed as threatened in 1999. We recognize that bull trout continue to be found in suitable habitats and generally remain geographically widespread across 109 core areas in numerous major river basins in 5 states; and identifies conservation needs for these 109 core areas where bull trout continue to persist. We also maintain that despite our best future conservation efforts identified in this recovery plan, it is possible that some existing bull trout core areas may become extirpated within the foreseeable future due to various factors, including the effects of small populations, isolation, and climate change. Moreover, the availability of survey data for accurate population estimates is problematic in some regions, and in certain core areas the geographic limitations on available habitat may inherently constrain the ability of bull trout populations to achieve the demographic targets proposed in the earlier draft recovery plans. Therefore, we reconsidered our earlier recovery approach and developed a recovery plan that focuses on the identification and effective management of known threat factors to bull trout in currently occupied core areas in each of six recovery units; establishes recovery criteria thresholds that acknowledge some extant bull trout core area habitats will likely change (and may be lost) over time; and identifies and focuses recovery actions in core areas where success is likely to meet our goal of ensuring the conservation of genetic diversity, life history features, and broad geographical representation of remaining bull trout populations. We do identify a number of core areas where small population size is a significant threat factor that needs to be addressed, because population levels are particularly low considering the spatial extent of existing habitat.

In summary, we maintain that effectively managing primary threat factors in each recovery unit will result in geographically widespread and demographically stable local bull trout populations within the range of natural variation (not necessarily at some theoretical level of effective population size), within their essential cold water habitats connected to allow their diverse life history forms to persist into the foreseeable future.

2. *Comment:* Revise proposed recovery criteria in the Mid-Columbia, Upper Snake, and Columbia Headwaters Recovery Units to be more stringent. Specifically, revise the proposed 75

percent threshold to a 100 percent threshold for number of core areas with threats effectively managed and the maximum number of local populations within the range of natural variation. The five Tribes also suggested a less than 100 percent effective threat management threshold as another alternative to consider: "Recovery is achieved when 85% of the primary threats are effectively managed in 100% of the core areas".

Response: As previously stated in our response (#14) above, recovery criteria are the values by which it can be determined that an objective has been reached. In the case of bull trout, the 'objective' is to manage threats and ensure sufficient distribution and abundance to improve the status of bull trout throughout their extant range in the coterminous United States so that protection under the Act is no longer necessary. Additionally, recovery criteria must be "SMART": specific, measurable, achievable, realistic and time-referenced, and address threats in terms of each of the five listing factors.

The Service takes very seriously its obligations under the Act to prevent the extinction of species as well as to help species avoid experiencing the risk of extinction. At the same time, the Service recognizes that the protections of the Act must be applied only when a species is truly on the verge of extinction or could be at risk of extinction in the foreseeable future because the protections of the Act impose economic, social, and cultural limitations that can sometimes be onerous. As we strive to balance prevention of extinction or the risk of extinction to bull trout with our obligation to not unnecessarily impose the limitations on society that protections under the Act carry, the Service has established a recovery standard (criteria) for bull trout. The current recovery criteria for bull trout were developed based on the practical directives of being SMART (specific, measurable, achievable, realistic, and time-referenced) and in consideration of the differences between portions of its range where trout are stable and likely to persist and portions of its range where the risk of extinction bull is higher.

To that end, the four recovery units where the 75 percent threshold for effective threat management (primary threats managed in 75 percent of core areas representing 75 percent or more of local populations within each recovery unit) was established are regions (recovery units) where, since listing, bull trout continue to persist and something less than addressing 100 percent of threats to the species can be expected to assure long-term persistence, viability and even an improved status for the species. These four recovery units (*i.e.*, Coastal, Mid-Columbia, Upper Snake, and Columbia Headwaters) where the 75 percent threshold was established generally span large geographic areas comprised of several major river watersheds with multiple extant core areas (range: 21 to 35) and numerous local populations (range: 92 to 208). The threshold for these recovery units was established to ensure sufficient bull trout distribution, representation, resilience, and redundancy across each recovery unit as demonstrated by demographically stable or increasing populations, with the understanding that there may be some loss of bull trout local populations or even existing core areas in the future. Because of the size and landscape diversity of these four recovery units, the Service is confident that a minimum threshold of 75 percent is sufficient to achieve recovery.

For the Columbia Headwaters Recovery Unit, we did make a change in how the 75 percent threshold for effective management would be applied. The Columbia Headwaters Recovery Unit is distinguished from other recovery units in that a high percentage of the core areas within the recovery unit (20 of 35) are simple core areas comprising a single local population. Most of these simple core areas occur in remote glaciated headwaters and represent unique environments and diversity in genetics and life history strategies. In response to concerns that the 75 percent threshold could allow many of these simple core areas to become extirpated, or alternatively allow many complex core areas in major watersheds comprising a large portion of the recovery unit to remain unrecovered, the Service has decided to apply the 75 percent threshold separately to both the simple and complex core areas within this recovery unit. This would mean that for recovery criteria to be met in the Columbia Headwaters Recovery Unit, effective threat management would need to be achieved for 15 of 20 simple core areas and 12 of 15 complex core areas.

In the two recovery units where the 100 percent threshold is applied (the Klamath and St. Mary Recovery Units), the status of bull trout since listing continues to point to the need for a higher level of recovery effort before an expectation of recovery can be met. In the Klamath Recovery Unit, because 9 of 17 known local populations have already been extirpated and the remainder are significantly imperiled and require active management of threats, we maintain that effective threat management is necessary in 100 percent of core areas, and the geographic range of bull trout within this recovery unit will need to be expanded through reestablishment of extirpated local populations before recovery criteria can be met. Recovery of bull trout in the St. Mary Recovery Unit is critically dependent on successfully addressing threats in the St. Mary River complex core area, while the other three core areas in this recovery unit each comprise a single isolated local population with only minor threats; because a 75 percent threshold would not adequately reflect the importance of the St. Mary River core area, we have set the threshold to 100 percent in this recovery unit.

It should be emphasized that although bull trout are believed to have undergone a significant reduction in their historical range prior to the time of their listing in 1999, the species continues to be found in suitable habitats and is geographically widespread across numerous major river basins in five western states. The Act does not require a species, in this case bull trout, to be recovered throughout its historical range or even in any set proportion of the currently suitable habitat. Instead, the Act requires that we recover listed species such that they no longer meet the definitions of a “threatened species” or “endangered species”.

In developing this bull trout recovery plan, the recovery criteria and recovery actions are intended to ensure that bull trout will be conserved as an ecologically viable species for the foreseeable future, and where possible, maintain its evolutionary potential. In this context, recovery must include the adequate conservation of genetic diversity, life history features, and broad geographical representation of bull trout populations in six recovery units that comprise the threatened coterminous United States population of bull trout. When identified threats have been sufficiently removed and bull trout populations are secure in an ecologically or evolutionarily significant portion of its range, the protections of the Act would no longer be warranted. With these goals in mind, the plan acknowledges that, despite our best conservation efforts, it is possible that some existing bull trout core areas will become extirpated within the foreseeable future due to various factors; including the effects of small populations, isolation, and climate change. Further, the plan also recognizes that a small number of such extirpations might occur without preventing recovery if threats are successfully managed in most core areas.

In summary, although the recovery plan recognizes that all 109 existing bull trout core areas contribute to the overall conservation of the species and identifies recovery actions to address specific threat factors affecting bull trout in these same 109 core areas, meeting the 75 percent threshold for effective threat management in any of the 4 referenced recovery units is the minimum established value at which the Service may initiate an assessment of whether recovery has been achieved. It is important to note that to achieve viable (recovered) recovery units, identified threats affecting the species in core areas must be effectively managed to produce demographically stable bull trout populations. In any delisting evaluation, the Service will consider all available information to ensure that bull trout in a 'recovered' recovery unit achieve representation (*i.e.*, existing occupancy within most core areas were maintained and existing life history forms that are present in these core areas were mostly preserved); redundancy (*i.e.*, a mosaic of healthy populations are distributed across the landscape within the recovery unit); and resilience (*i.e.*, core areas that contain several local populations or more than one life history expression were prioritized for conservation, and "at risk" core areas have been improved).

3. *Comment:* If the proposed recovery criteria are not revised, modify the recovery criteria to account for the importance of complex core areas. Specifically, separate recovery criteria should be established for simple and complex core areas to maximize the opportunity for conservation and recognition of the significance of complex core areas in contributing to the viability of a recovery unit.

Response: In developing this bull trout recovery plan, we established recovery criteria and recovery actions that are intended to ensure adequate conservation of genetic diversity, life history features, and broad geographical representation of bull trout populations in six recovery units that comprise the threatened coterminous United States population of bull trout based on the existing distribution of bull trout. Therefore, the recovery plan recognizes that all 109 existing bull trout core areas contribute to the overall conservation of the species and identifies recovery actions to address primary threat factors affecting bull trout in these same 109 core areas. We have modified the recovery criteria for the Columbia Headwaters Recovery Unit to consider complex and simple core areas separately, as summarized above. However, the recovery plan does not distinguish conservation importance or prioritize conservation actions differently for 'complex' and 'simple' core areas. For example, simple core areas are ecologically if not physically isolated from other core areas and are comprised of a single local bull trout population. While this can increase the risk of extirpation for bull trout in simple core areas due to immediate threat factors, simple core areas may also represent extremes of the species' range and may contain unique genetic or life history adaptations worthy of conservation. Complex core areas, on the other hand, contain multiple local bull trout populations and are typically situated in larger patches of habitat and often occupied by more than one life history form; therefore they can have a higher likelihood of persistence. The relative importance of bull trout in any core area will be assessed through the RUIP process for each of the six recovery units.

We do acknowledge, however, that despite our best conservation efforts identified in this plan, it is possible that some existing bull trout core areas may become extirpated within the foreseeable future due to various factors, including the effects of small populations, isolation, and climate change; and that a small number of such extirpations could occur without preventing recovery if threats are successfully managed in most core areas.

4. *Comment:* Revise the Threats Assessment Decision Matrix to offer more protection for complex core areas and ensure access to critical habitat. Belief that there is an inherent bias in the proposed matrix favoring simple core areas because effective threat management will be evaluated in part on the percentage of affected local populations. The matrix should be revised "... to ensure that threats area identified and managed to retain and expand complexity" and "... to ensure that it does not undercut the Service's 2010 critical habitat designation. Additionally, develop more specific criteria for the Service's assessment of whether threats are being effectively managed. The proposed matrix falls short of the objective and measureable criteria that the Act requires of recovery plans; and fails to account for "cumulative threats".

Response: The Service in any future status review or delisting evaluation will evaluate the best available scientific and commercial information to ensure that bull trout in a 'recovered' recovery unit achieve representation (*i.e.*, existing occupancy within most core areas were maintained and existing life history forms that are present in these core areas were mostly preserved); redundancy (*i.e.*, a mosaic of healthy populations are distributed across the landscape within the recovery unit); and resilience (*i.e.*, core areas that contain several local populations or more than one life history expressions were prioritized for conservation, and "at risk" core areas have been improved). The recovery plan recognizes that all 109 existing bull trout core areas contribute to the overall conservation of the species and identifies recovery actions to address specific threat factors affecting bull trout in these same 109 core areas, and does not distinguish between simple and complex core areas. We maintain that the Threat Assessment Decision Matrix will be equally useful in evaluating whether threats are being effectively managed regardless of the total number of local populations in a core area because it allows a collective evaluation of all threats within a core area to ensure that interactions and possible cumulative effects of even minor threats are considered. Additionally, if the combination of threat severity and management effectiveness for any individual threat indicates that the threat is not effectively managed to be consistent with bull trout survival and persistence, then the entire core area will be identified as such.

In summary, the Service will focus on three primary areas when evaluating the status of bull trout in a recovery unit: utilizing all and best available information in the context of the requirements of the Act to assess the status of threats in terms of the five listing factors; demonstration of demographically stable populations of bull trout across both simple and complex core areas; and evaluation of the adequacy of existing regulatory mechanisms to provide adequate protection for bull trout in the foreseeable future (approximately the next 50 years).

5. *Comment*: Replace the term "primary threat" with "threat".

Response: The term primary threat is used in the revised recovery plan to assist bull trout managers distinguish threat factors known (*i.e.*, non-speculative) or likely to negatively impact bull trout populations at the core area level from suggested or hypothetical generic threat factors, many of which were identified as threat factors in previous draft recovery plans but have not been shown to negatively impact bull trout populations.

It should be noted that in response to the numerous comments and concerns regarding the proposed definition of a primary threat, the Service has further revised the term to emphasize the appropriate geographic scale (core area) and timescale (foreseeable future). Primary threats are now defined as: *Primary threats are those factors known or likely (i.e., non-speculative) to negatively impact bull trout populations at the core area level, and accordingly require* *management actions to assure bull trout persistence to a degree necessary that bull trout will not be at risk of extirpation within that core area in the foreseeable future.*

6. *Comment*: Specific comments related to language in the revised draft recovery plan related to the 'primary strategy', recovery goal, and recovery actions sections. Primary recommendations to include and expand recovery of bull trout to "... across the species' native range...".

Response: A major goal of the recovery plan is to ensure that bull trout are geographically widespread across representative habitats and demographically stable. Bull trout will be recovered when they no longer meet the definition of threatened under the Act ("likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range") as determined by a threats analysis addressing the five listing factors. Thus bull trout populations will need to be secure with threats being successfully addressed across a broad geographic range; however, successfully meeting this standard does not necessarily require that viable bull trout populations be present in every locality where the species historically occurred. In the recovery plan we do identify appropriate recovery actions that should be implemented in each of the 109 core areas with extant bull trout populations; assessing whether overall recovery goals have been met for the species will be done by evaluating the core areas within each recovery unit for whether implementation of these actions has resulted in threats being successfully managed.

7. *Comment*: Suggestion to include in a final recovery plan a section describing the role of artificial propagation and transplantation in bull trout recovery.

Response: As previously discussed under General Comment # 9, the recovery plan includes a discussion on the role of artificial propagation and translocation in bull trout recovery, and the RUIPs identify where propagation or translocation efforts may be useful to aid recovery efforts. Such efforts may involve direct translocation from more vigorous populations or captive breeding of bull trout in controlled propagation facilities. Such translocation programs should consider appropriate precautions against introduction of fish pathogens to new watersheds.

8. *Comment*: The Service has demonstrated a conflict of interest in its utilization of the scientific rationale provided for recovery unit delineation, specifically that "... it appears that the Service has interpreted internal science in development of Recovery Units that are indirectly tied

to future delisting. Please re-evaluate the RU boundaries with external scientific evidence prior to the release of a final Plan". Others suggested the recovery unit boundaries in the revised draft recovery plan should be revised to consider existing land and resource management boundaries of agencies that will implement threats-based management and to encompass smaller geographic areas that are consistent with existing jurisdictional boundaries in resident (non-anadromous) fish management. The recovery units are too large to practicably reach delisting.

Response: Since the original listing decision in 1998, new data and reanalysis have suggested that the coterminous United States listed entity would be more appropriately divided into 6 recovery units, rather than the 27 recovery units identified in the 2002 and 2004 draft recovery plans. We worked with a number of State, Federal, and Tribal partners in 2008 and 2009 to evaluate alternatives for organizing core areas into possible recovery units that might also be consistent with the "discreteness" and "significance" criteria in the DPS policy. Ten alternatives were evaluated that explored from 2 to 69 potential recovery units, based on mitochondrial and microsatellite DNA analysis, and on biogeographical considerations, including geological establishment of major watersheds, isolation of portions of watersheds above major waterfalls, co-occurrence with other fish species, and occurrence in different ecological zones (Ardren *et al*. 2011). The six recovery units identified in this plan reflect this most recent information and analysis, and were first described in the 2010 proposed critical habitat rule (USFWS 2010a). They include: (1) Coastal Recovery Unit, (2) Klamath Recovery Unit, (3) Mid-Columbia Recovery Unit, (4) Upper Snake Recovery Unit, (5) Columbia Headwaters Recovery Unit, and (6) Saint Mary Recovery Unit.

In this analysis of alternatives, we concluded that the six unit alternative could meet the discreteness criterion for a DPS because the six units had a pattern of significant genetic divergence at the microsatellite level; were isolated from other populations (strongly for the Coastal, Klamath, St. Mary, and Columbia Headwaters, limited for the Mid-Columbia and Upper Snake); and showed life history differences (primarily for the Coastal and Klamath, limited for the others). We also concluded that this alternative could meet the significance criterion for a DPS on the basis that loss of any unit would create a significant gap in the range (loss from major drainage basin or major portion of Columbia basin), and possibly on the basis of ecological setting (unique species assemblage for Klamath and St. Mary, more limited for the others) and marked difference (low potential for shared evolutionary future among Klamath, St. Mary, and Columbia Headwaters; and evolutionarily significant genetic divergence among Coastal, Klamath, and St. Mary).

The seven unit alternative that we analyzed differed from the six unit alternative in splitting the Coastal Recovery Unit between the Washington Coast (including both Puget Sound and Olympic Peninsula watersheds) and Lower Columbia regions. We concluded that this alternative also could meet the discreteness and significance criteria for a DPS. Differences in the discreteness analysis included the degree of isolation from other populations and life history differences (both strong for Washington Coast limited for Lower Columbia watershed). We concluded that this alternative met the significance criterion on the basis that loss of any unit would create a significant gap in the range (loss from major drainage basin or major portion of Columbia basin); however, it was noted that this argument might be weak for the Lower Columbia. Other differences in the significance analysis included differences in ecological setting (unique species assemblage for Washington Coast) and marked difference (evolutionarily significant genetic divergence with low potential for shared evolutionary future for Washington Coast, but not for Lower Columbia). Thus, our original analysis found that both the six unit and seven unit alternatives could legitimately meet the criteria in the DPS policy. Recovery unit delineation considered multiple factors, including genetics, life history strategies, ecological setting, and geographical connectivity.

9. *Comment*: The two Malheur River core areas should be removed from the Upper Snake Recovery Unit based on biological uniqueness, the biodiversity principles and the Service's DPS policy.

Response: The Upper Snake Recovery Unit, which includes the two Malheur River core areas, comprises a complex array of life history types, ecological zones, management jurisdictions, connectivity patterns, and genetic characteristics. We determined the specific boundary for the Upper Snake Recovery Unit, and distinguished from other recovery units, by following Ardren *et al*. (2011), who analyzed bull trout population differentiation at 15 microsatellite loci. In this analysis (see their Figures 6 and 7D), the two sites in the Malheur River watershed clustered with populations in central Idaho and Nevada within the Upper Snake Recovery Unit.

We understand the concern that the isolated Malheur River bull trout populations (two core areas) in Oregon could be delisted based on recovery of the majority of the Upper Snake Recovery Unit in Idaho. However, given that several other recovery units cross state boundaries and the Malheur River population groups genetically with the Upper Snake basin populations in Idaho and Nevada, we do not support delineation of a separate recovery unit for the Malheur River watershed based on its genetic distinctiveness within Oregon. In this context, we note that in our original analysis of alternatives we found that the 69-unit alternative could meet the discreteness criterion in the DPS policy (based on patterns of genetic divergence at the microsatellite level), but did not meet the significance criterion. The Malheur River watershed constitutes a relatively small proportion of the Columbia watershed (approximately 2 percent by area) and we maintain that it would be difficult to support a separate Malheur River DPS under our policy.

10. *Comment*: General concern that if a recovery unit is delisted, then there will be no incentive or mechanisms to continue threat management in core areas. Specific example highlighted ongoing brook trout control efforts that might be curtailed in some Malheur River core areas within the Upper Snake River Recovery Unit after delisting.

Response: If, at some future date, the Upper Snake River Recovery Unit is determined to be a distinct population segment (DPS) and that DPS is proposed for reclassification, yet the primary threats affecting bull trout or their populations are not meeting the goals established by the Burns Paiute Tribe, then the Service, through its Federal trust responsibilities to federally-recognized Tribes, would be obligated to support the Tribe's goals outside of the context of the Act.

Summary of Five State Fish and Wildlife Agency Comments

1. *Comment:* One State agency suggested reconsideration of the inclusion of the Clearwater Drainage core areas in the Mid-Columbia Recovery Unit, and instead reassignment of those core areas to the Upper Snake Recovery Unit.

Response: Since the early 2000s, new data and reanalysis have suggested that the coterminous United States listed entity could be more appropriately divided into 6 recovery units, rather than the 27 recovery units identified in the 2002 and 2004 draft recovery plans. We worked with a number of State, Federal, and Tribal partners in 2008 and 2009 to evaluate alternatives for organizing core areas into possible recovery units that might also be consistent with the "discreteness" and "significance" criteria in the DPS policy. Ten alternatives were evaluated that explored from 2 to 69 potential recovery units, based on mitochondrial and microsatellite DNA analysis, and on biogeographical considerations, including geological establishment of major watersheds, isolation of portions of watersheds above major waterfalls, co-occurrence with other fish species, and occurrence in different ecological zones (Ardren *et al*. 2011). The Service selected the six recovery unit alternative identified in this plan, which we have concluded best reflects the available genetic, biogeographical, and ecological information, and may be consistent with our "discreteness" and "significance" criteria in our DPS policy. The six recovery units were first described in the Service's 2010 proposed critical habitat rule (USFWS 2010), and include: (1) Coastal Recovery Unit; (2) Klamath Recovery Unit; (3) Mid-Columbia Recovery Unit; (4) Upper Snake Recovery Unit; (5) Columbia Headwaters Recovery Unit; and (6) Saint Mary Recovery Unit.

In this analysis of alternatives, we concluded that the six unit alternative could meet the discreteness criterion for a DPS because the six units had a pattern of significant genetic divergence at the microsatellite level; were isolated from other populations (strongly for the Coastal, Klamath, St. Mary, and Columbia Headwaters, limited for the Mid-Columbia and Upper Snake); and showed life history differences (primarily for the Coastal and Klamath, limited for the others). We also concluded that this alternative could meet the significance criterion for a DPS on the basis that loss of any unit would create a significant gap in the range (loss from major drainage basin or major portion of Columbia basin), and possibly on the basis of ecological setting (unique species assemblage for Klamath and St. Mary, more limited for the others) and marked difference (low potential for shared evolutionary future among Klamath, St. Mary, and Columbia Headwaters; and evolutionarily significant genetic divergence among Coastal, Klamath, and St. Mary).

The Upper Snake and Mid-Columbia Recovery Units comprise a complex array of life history types, ecological zones, management jurisdictions, connectivity patterns, and genetic characteristics. We determined the specific boundaries between the Upper Snake and Mid-Columbia recovery units following Ardren *et al*. (2011), who analyzed bull trout population differentiation at 15 microsatellite loci. In this analysis (see their Figures 6 and 7D), three sites in the Clearwater River watershed clustered with nearby populations in northeast Oregon within the Mid-Columbia Recovery Unit, while two sites in the Malheur River watershed clustered with populations in central Idaho and Nevada within the Upper Snake Recovery Unit. We continue to maintain that this is a reasonable basis of delineation between these two recovery units.

2. *Comment:* The recovery plan should be more explicit in describing how bull trout demographic data will be considered in relation to the threats based assessment process. For example, one State agency suggested that the RUIPs should incorporate current numerical population abundance levels where possible, with clearly defined recovery goal targets.

Response: In the previous 2002 and 2004 draft recovery plans, adult abundance levels (demographics) were proposed as recovery targets for each identified bull trout core area, considering theoretical estimates of effective population size, historical census information, and the professional judgment of recovery unit team members. In developing our current recovery plan, we reconsidered our earlier recovery approach and developed a recovery plan that deemphasized specific demographic (population) targets and instead focuses on the identification and effective management of known threat factors to bull trout in currently occupied core areas to achieve ‘demographically stable’ bull trout populations throughout each of six recovery units.

To objectively evaluate the status of threats across the range of bull trout, the recovery plan has created a structured approach (threat assessment tool) that incorporates the best available data. The results from this assessment tool are integral to evaluate the status of bull trout at the range-wide and recovery unit scales based on the analysis of threats at the core area level. Core area assessments can inform the process of recovery plan development and implementation by highlighting and prioritizing management actions that maximize conservation benefits for bull trout. Available demographic data, as well as other empirical data on the magnitude and trends in bull trout population counts or indices; current or historical spatial distribution, connectivity, and extent of populations; expression of life history strategies; occurrence, magnitude, scope, trends, and severity of threats; and significant conservation measures that are ongoing or have been completed to address primary threats. These data will be interpreted with the best professional judgment of biologists familiar with bull trout populations in the core area.

3. *Comment*: One State agency suggested the sole inclusion of "primary threat" to be problematic since the definition is fairly narrow and potentially sets a low bar in a threats based recovery approach. They suggested that all substantive threats be identified and classified as minor/moderate or severe.

Response: The term primary threat is used in the bull trout recovery plan to assist bull trout managers distinguish threat factors known (*i.e.*, non-speculative) or likely to negatively impact bull trout populations at the core area level from suggested or hypothetical generic threat factors, many of which were identified as threat factors in previous draft recovery plans but have not been shown to negatively impact bull trout populations.

It should be noted that in response to the numerous comments and concerns regarding the proposed definition of a primary threat, the Service has further revised the term to emphasize the appropriate geographic scale (core area) and timescale (foreseeable future). Primary threats are now defined as: *Primary threats are those factors known or likely (i.e., non-speculative) to negatively impact bull trout populations at the core area level, and accordingly require management actions to assure bull trout persistence to a degree necessary that bull trout will not be at risk of extirpation within that core area in the foreseeable future.*

4. *Comment:* Concerns regarding the process and timeline for the assessment of threats to bull trout as described in the Threat Assessment Tool proposed in Appendix E of the revised draft recovery plan.

Response: Applying a threat assessment process prior to completing the final recovery plan for bull trout may have provided useful information to inform development of a final recovery plan, including the RUIPs. However, we maintain that it was important to first develop and propose a structured, consistent, and objective threat assessment process that can guide future assessments to evaluate the status of threats across the range of bull trout, and then solicit public, peer and agency review and feedback prior to implementation. The formal Threat Assessment Tool process included with this recovery plan will be useful in recovery criteria evaluation and status assessments conducted as part of future 5-year reviews and five-factor threats analysis in any future delisting evaluation(s).

5. *Comment:* Concerns related to the State agency's perceived lack of involvement in the process for assessing whether threats have been effectively managed. The recovery plan does not adequately define threats or commit to an objective process for determining effective threat management.

Response: We acknowledge the concern that partners may be excluded from future decision making. While the Service bears the final responsibility under the Act for making determinations of listing status, we welcome a full range of input on this decision from interested parties. In future status review assessments and listing determinations, the Service will consider the best available information in the context of the requirements of the Act. For example, under the proposed TAT process Service managers will meet to determine whether threats have been effectively managed in each core area based on the best available information (recommended matrix cell assignments, survey and monitoring data on bull trout population and threats, and supporting rationales) that has been provided to the Service by experts (Federal, State, Tribal and others) during the recovery unit workshops. We acknowledge that opinions on bull trout status may vary greatly, and will seek to make the most appropriate assessment while considering available data and identifying underlying assumptions. The outcome of these assessments will determine the Service's recommendation for the listing status of bull trout under the Act.

6. *Comment:* Appears that the revised draft recovery plan did not consider one State's scientific information related to bull trout distribution and abundance.

Response: New scientific information referenced by the State has been incorporated in the final recovery plan where appropriate. Because these referenced articles also contain information that includes possible bull trout population trend data for several core areas within the State, they helped inform the interagency RUIP development process.

7. *Comment:* Regarding the 75 percent criteria, one State was concerned regarding the lack of clarity on how threat severity or threat management would inform the development of the RUIPs. Another State suggests that the 75 percent threats managed threshold "is unacceptably high" based on the extensive number of non-native threats listed in the Columbia Headwaters RUIP and the lack of resources or proven techniques to address these threats.

Response: As previously described in the response to questions #2 and #3 above, the Service proposed in the revised draft recovery plan a threats assessment tool that will be useful to inform whether threats have been effectively managed in a bull trout core area. Because the proposed threat assessment tool was made available for public review and comment, it would have been premature for the Service to mandate use of the assessment tool in completing the final bull trout recovery plan. We did however, encourage Service staff involved in the RUIP process to consider the use of the draft assessment tool as an aid where feasible in informing the identification of primary threats as part of the RUIP development process.

8. *Comment:* Concerned that the proposed recovery criteria may not be consistent with other recovery plans for other ESA-listed western trout.

Response: Recovery criteria developed for species listed as threatened or endangered represent our best assessment of the conditions that would most likely result in a determination that listing under the Act is no longer required. Recovery criteria are 'specific' or unique to a respective listed species and can be expected to vary between species. While we cannot speak to the adequacy of recovery criteria proposed for other ESA-listed western trout, we developed recovery criteria for bull trout that we maintain are specific to the species and justified in the context of the species ecology; are technically feasible and grounded in good science, and meet the standard of being objective and measurable. For bull trout, these conditions (*i.e.*, recovery criteria) will be met when conservation actions have been implemented to ameliorate the primary threats in suitable habitats. If the primary threats have been effectively managed in each recovery unit, the long-term persistence of bull trout should be ensured in the foreseeable future.

9. *Comment:* Further revisions of definitions for "foreseeable future" and "primary threat". Additionally, some term definitions should be revised to gain better acceptance and more informed decision making process. Specifically, better define the terms: primary threat; persist, persistence, and long-term persistence).

Response: Where appropriate, the Service has revised certain terms in the bull trout recovery plan to make them more understandable and useful to the process. For example, the term "primary threat" is now used in the recovery plan to assist bull trout managers in distinguishing threat factors known (*i.e.*, non-speculative) or likely to negatively impact bull trout populations at the core area level from suggested or hypothetical generic threat factors, many of which were identified as threat factors in previous draft recovery plans but have not been shown to negatively impact bull trout populations. In response to the numerous comments and concerns regarding the proposed definition of a primary threat, the Service has further revised the term to emphasize the appropriate geographic scale (core area) and timescale (foreseeable future). Primary threats are now defined as: *Primary threats are those factors known or likely (i.e., non-speculative) to negatively impact bull trout populations at the core area level, and accordingly require management actions to assure bull trout persistence to a degree necessary that bull trout will not be at risk of extirpation within that core area in the foreseeable future.*

Additionally, the term persistence is applicable to the timescale defined as the foreseeable future. In the revised draft recovery plan we described that the "foreseeable future" for evaluating actions affecting bull trout and their recovery was from 4 to 10 generations, or roughly 28 to 70 years. We adopted this figure based on the foreseeable future timeframe used in a manager panel for the most recent bull trout 5-year review (FWS 2008a). Several commenters suggested this wide range provided insufficient guidance for evaluating effective threat management into the "foreseeable future". In order to provide a "... consistent and meaningful time frame..." for use in the completion of a final recovery plan and developing the RUIPs, we have specified approximately 50 years as the foreseeable future.

10. *Comment:* Threats identified in the revised draft recovery plan are not up to date or ranked, etc.

Response: Threats found in the revised draft recovery plan were derived from information assembled in the Core Area Templates (USFWS 2008) in coordination with various State, Federal, and Tribal partners, and additional assessments developed by the Service in 2010 and 2011. These threats were identified as problems or factors that may affect bull trout local populations in each core area <u>at that time</u> or expected to into the foreseeable future (in consideration of present and future climate change). They included a variety of threats that ranged in severity from serious imminent threats to documented, but relatively minor issues that should nonetheless be evaluated for their potential impact.

Because the threats were derived from information assembled from Core Area Templates and Assessments developed in 2008, 2010 and 2011, we anticipated that much of the information was likely out of date and in need of updating and revision. New information and suggested changes in the list of threats has been incorporated and updated in the final recovery plan through the interagency RUIP development process.

11. *Comment:* One State agency suggested that recovery should recognize that bull trout management needs should focus "... within today's and tomorrow's environment (science based yet reasonable)".

Response: Our approach to bull trout recovery and conservation is intended to ensure adequate conservation of genetic diversity, life history features, and broad geographical representation of remaining bull trout populations. Although bull trout are believed to have undergone a significant reduction in their historical range prior to the time of their listing in 1999, the species continues to be found in suitable habitats and remains geographically widespread across numerous major river basins in five western states. Additionally, in several currently occupied core areas bull trout population status remains stable or strong. As described in this recovery plan, recovery of bull trout: (1) will continue to build upon the numerous and ongoing conservation actions implemented on behalf of bull trout since their listing in 1999; (2) will be focused on the identification of and effective management of known threat factors to bull trout in areas where bull trout currently occur; and (3) using the available scientific information to work cooperatively with our partners to design, fund and implement effective conservation actions in areas that offer the greatest long-term benefit to sustain bull trout and where recovery can be achieved.

This approach to achieving recovery for bull trout acknowledges the current status of the species in both altered and natural habitats, as well as likely future trends. In a few core areas habitat alterations have likely resulted in increased bull trout populations relative to historical conditions or have created barriers to nonnative fish invasion, and should be maintained. In many watersheds management should be prioritized in cold water habitats that are most likely to be resistant to habitat loss from climatic warming. Our recovery strategy is focused on achieving demographically stable bull trout populations in areas where they currently occur. The recovery of bull trout is not dependent upon recovery throughout its historical range.

12. *Comment:* Concerns with the proposed threats based recovery approach and Threats Assessment Tool. Will there be a process to prioritize conservation actions? And are migratory bull trout populations more important from a conservation perspective than resident populations?

Response: In developing this bull trout recovery plan, recovery criteria and recovery actions were established for bull trout that are intended to ensure adequate conservation of genetic diversity, life history features, and broad geographical representation of bull trout populations in six recovery units that comprise the threatened coterminous United States population of bull trout. Therefore, the recovery plan recognizes that all 109 existing bull trout core areas contribute to the overall conservation of the species and identifies recovery actions to address primary threat factors affecting bull trout in these same 109 core areas. Although the recovery plan does not distinguish conservation importance or prioritize conservation actions for 'complex' and 'simple' core areas, we also acknowledge that despite our best conservation efforts identified in this plan, it is possible that some existing bull trout core areas may become extirpated within the foreseeable future due to various factors; including the effects of small populations, isolation, and climate change, coincident with recovery.

13. *Comment:* Due to the uncertainty of terminology, it is difficult to comment and respond to the RUIP process and fully evaluate whether the proposed recovery criteria and threats determination process are viable.

Response: Where applicable, the Service has revised or better defined specific terms to help inform completion of the recovery plan. The Service is committed to working with our partners to ensure that we have the best recovery plan available for bull trout while meeting our legal obligations in completing the recovery plan.

14. *Comment:* One State agency suggested that for most core areas bull trout demographic information can and should be used to determine tangible conservation and recovery objectives, and ultimately recovery criteria.

Response: We agree. One demonstration of effective threat management is a demographically stable bull trout population as measured at the core area scale. Therefore, demographic data, as well as other empirical data on the magnitude and trends in bull trout population counts or indices; current or historical spatial distribution, connectivity, and extent of populations, will be useful and help inform the effectiveness of primary threat management where such information is available. Because such information is not available in all core areas across the species' range, each RUIP will identify additional monitoring and evaluation needs.

15. *Comment:* One State agency does not believe that bull trout in Montana are currently threatened or endangered with extirpation in the foreseeable future (35 or 50 years), but acknowledged that in some core areas further management efforts may be needed.

Response: As described in the recovery plan our most recent 5-year status review for bull trout was completed on April 8, 2008, and concluded that listing the species as "threatened" remained warranted range-wide in the coterminous United States. In our most recent recovery report to Congress (USFWS 2012) we reported that bull trout were generally "stable" overall range-wide (species status neither improved nor declined during the reporting year), with some core area populations decreasing, some stable, and some increasing. Since the listing of bull trout, there has been very little change in the general distribution of bull trout in the coterminous United States, and we are not aware that any known, occupied bull trout core areas have been extirpated. We concur that in some parts of their extant range, bull trout experience few or no threats and harbor healthy populations throughout most or all available habitat; some bull trout core areas experience limited but major threats and have strong populations throughout most habitat; and some continue to experience severe and systemic threats and harbor relatively small populations that have been reduced to a limited portion of available habitat.

In summary, today bull trout remain listed as a threatened species throughout its coterminous range in the United States. The Service is committed to completing the recovery plan so that future conservation actions will be focused in those areas where success is likely.

16. *Comment:* One State agency was generally supportive of the 'managed threats', 'core area', and possible 'recovery unit DPS delisting' approaches in the draft recovery plan.

Response: Thank you for your comments.

17. *Comment:* One State agency was generally supportive of the thematic changes from previous draft recovery plans for bull trout, including:

- Inclusion of adaptive recovery principles and tools that may play a role in threat assessments and measuring recovery;
- Recognition that recovery does not mean restoration everywhere or throughout their native range;
- Support the concept of recovery units as possible DPSs.

Response: Although bull trout are believed to have undergone a significant reduction in their historical range prior to the time of their listing in 1999, the species continues to be found in suitable habitats and is geographically widespread across numerous major river basins in five western states.

This recovery plan incorporates and builds upon all the new information found in numerous reports and studies regarding bull trout since the draft 2002 and 2004 recovery plans and outlines a strategy that: (1) conserves bull trout so that they are geographically widespread across representative habitats and demographically stable in six recovery units; (2) effectively manage and ameliorate the primary threats in each of six recovery units at the core area scale; (3) builds upon the numerous and ongoing conservation actions implemented on behalf of bull trout since their listing in 1999, and improves our understanding of how various threat factors potentially affect the species; (4) used that information to work cooperatively with our partners to design, fund, prioritize, and implement effective conservation actions in those areas that offer the greatest long-term benefit to sustain bull trout and where recovery can be achieved; and (5) applies adaptive management principles to implementing the bull trout recovery program to account for new information.

18. Comment: One State agency expressed concerns that the recovery pathway was not fully developed in the revised draft recovery plan (acknowledges that this will likely be accomplished through the RUIP process).

Response: The recovery plan describes recovery of bull trout as dependent upon effectively managing and ameliorating the primary threats affecting the species in each recovery unit at the core area level such that bull trout are geographically widespread and demographically stable across representative habitats within the six recovery units.

The Service may initiate an assessment, or status review, of whether recovery has been achieved and delisting is warranted when the primary threats identified for core areas in the six recovery units are effectively managed at the thresholds identified in the recovery plan (*i.e.*, 75 percent for the Coastal, Mid-Columbia, Upper Snake and Columbia Headwaters; and 100 percent for the Klamath and St. Mary Recovery Units).

In any future status review or delisting evaluation, the Service will evaluate the best available scientific and commercial information to ensure that the recovery pathway for bull trout in a ‘recovered’ recovery unit achieves representation (*i.e.*, existing occupancy within most core areas were maintained and existing life history forms that are present in these core areas were mostly preserved); redundancy (*i.e.*, a mosaic of healthy populations are distributed across the landscape within the recovery unit); and resilience (*i.e.*, core areas that contain migratory life history expressions were prioritized for conservation, and "at risk" core areas have been improved). The Service will focus on three primary areas: utilizing all and best available information in the context of the requirements of the Act to assess the status of threats across the range of bull trout in terms of the five listing factors; demonstration of demographically stable populations of bull trout; and evaluation of the adequacy of existing regulatory mechanisms to provide adequate protection for bull trout in the foreseeable future (approximately the next 50 years).

19. *Comment:* Two State agencies submitted a proposal to reconfigure the Coastal Recovery Unit into two recovery units. Specifically, to split the Coastal Recovery Unit into two recovery units: Washington Coast and Lower Columbia Recovery Units. Belief that the rule-set used to designate the six recovery units was applied inconsistently with respect to establishing the Coastal Recovery Unit. Specifically, the use of genetic data was not consistently evaluated across all areas when "... spatial configuration, ecological setting, and management authority..." may have influenced appropriate recovery unit boundaries. Additional support for splitting the Coastal Recovery Unit based on spatial separation, different ecological settings and different expressions of life history also provided.

Response: Since the original listing decision in 1998, new data and reanalysis have suggested that the coterminous United States listed entity would be more appropriately divided into 6 recovery units, rather than the 27 recovery units identified in the 2002 and 2004 draft recovery plans. We worked with a number of State, Federal, and Tribal partners in 2008 and 2009 to evaluate alternatives for organizing core areas into possible recovery units that might also be consistent with the "discreteness" and "significance" criteria in the DPS policy. Ten alternatives were evaluated that explored from 2 to 69 potential recovery units, based on mitochondrial and microsatellite DNA analysis, and on biogeographical considerations, including geological establishment of major watersheds, isolation of portions of watersheds above major waterfalls, co-occurrence with other fish species, and occurrence in different ecological zones (Ardren *et al*. 2011). The six recovery units identified in this plan reflect this most recent information and analysis, and were first described in the 2010 proposed critical habitat rule (USFWS 2010a). They include: (1) Coastal Recovery Unit, (2) Klamath Recovery Unit, (3) Mid-Columbia Recovery Unit, (4) Upper Snake Recovery Unit, (5) Columbia Headwaters Recovery Unit, and (6) Saint Mary Recovery Unit.

In this analysis of alternatives, we concluded that the six unit alternative could meet the discreteness criterion for a DPS because the six units had a pattern of significant genetic divergence at the microsatellite level; were isolated from other populations (strongly for the Coastal, Klamath, St. Mary, and Columbia Headwaters, limited for the Mid-Columbia and Upper Snake); and showed life history differences (primarily for the Coastal and Klamath, limited for the others). We also concluded that this alternative could meet the significance criterion for a DPS on the basis that loss of any unit would create a significant gap in the range (loss from major drainage basin or major portion of Columbia basin), and possibly on the basis of ecological setting (unique species assemblage for Klamath and St. Mary, more limited for the others) and marked difference (low potential for shared evolutionary future among Klamath, St. Mary, and Columbia Headwaters; and evolutionarily significant genetic divergence among Coastal, Klamath, and St. Mary).

The seven unit alternative that we analyzed differed from the six unit alternative in splitting the Coastal Recovery Unit between the Washington Coast (including both Puget Sound and Olympic Peninsula watersheds) and Lower Columbia regions. We concluded that this alternative also could meet the discreteness and significance criteria for a DPS. Differences in the discreteness analysis included the degree of isolation from other populations and life history differences (both strong for Washington Coast, limited for Lower Columbia watershed). We concluded that this alternative could meet the significance criterion on the basis that loss of any unit would create a significant gap in the range (loss from major drainage basin or major portion of Columbia basin); however, it was noted that this argument might be weak for the Lower Columbia. Other differences in the significance analysis included differences in ecological setting (unique species assemblage for Washington Coast) and marked difference (evolutionarily significant genetic divergence with low potential for shared evolutionary future for Washington Coast, but not for Lower Columbia).

Thus, our original analysis found that both the six unit and seven unit alternatives could legitimately meet the criteria in the DPS policy. Recovery unit delineation considered multiple factors, including genetics, life history strategies, ecological setting, and geographical connectivity. On review of the commenters' requests to split the Coastal Recovery Unit, while their rationale supports the seven unit structure under the DPS policy, we did not find that substantial new information was provided that was not considered in the original analysis. Nonetheless, for effective management we do support the use of bull trout working groups at the level of recovery subunits organized along the lines of the Washington Coast and Lower Columbia regions. Additionally, if such a portion of the Coastal Recovery Unit appears to be meeting recovery targets, we would also consider application of tools such as HCPs or an expanded 4(d) rule to reduce regulatory burdens in the region or other recovery units too.

20. *Comment:* One State agency expressed concerns with proposed recovery criteria dependent upon effective management alone, and that some measure of status will be needed (demographics).

Response: One demonstration of effective threat management is a demographically stable population as measured at the core area scale. Therefore, demographic data, as well as other empirical data on the magnitude and trends in bull trout population counts or indices; current or historical spatial distribution, connectivity, and extent of populations, will be useful and help inform the effectiveness of primary threat management where such information is available. Because such information is not available in all core areas across the species' range, each RUIP will identify additional monitoring and evaluation needs.

21. *Comment:* One State agency suggested that the Bull Trout Recovery Plan include a Service staff directory for the entire range of the species.

Response: FWS field offices with primary responsibility for bull trout recovery plan development and recovery implementation include:

Oregon Fish and Wildlife Office (Oregon except for Klamath Recovery Unit; current lead biologist Chris Allen)

Klamath Falls Fish and Wildlife Office (Klamath Recovery Unit; current lead biologist Nolan Banish)

Washington Fish and Wildlife Office (Washington; current lead biologists Jeff Chan, Erin Britton-Kuttel [eastern Washington], Judy Neibauer [central Washington])

Montana Fish and Wildlife Office (Montana; current lead biologist Wade Fredenberg)

Idaho Fish and Wildlife Office (Idaho; current lead biologists Benjamin Matibag [southern Idaho], Scott Deeds [northern Idaho])

Numerous biologists in our Fisheries and Ecological Services programs support bull trout recovery through section 7 consultation, HCP development, policy review, research, and monitoring. Although inevitably incomplete, a list of Service staff and other partners who have contributed to bull trout recovery is available at this link.

22.	Comment: Similar to other comments, one State agency expressed concerns that the lack of metrics (abundance and distribution) in recovery criteria seems inconsistent with our recovery policy.

Response: This comment was addressed previously in General Comment # 1 (page 2). In summary, the comment refers to the joint National Marine Fisheries Service and U.S. Fish and Wildlife Service's Interim Endangered and Threatened Species Recovery Planning Guidance (NMFS and USFWS 2010), which was first proposed in 2004 and revised/updated in 2006, 2007 and 2010. Our recovery planning guidance recommends that recovery criteria be SMART: Specific, Measurable, Achievable, Realistic, and Time-referenced. Current recovery criteria for bull trout were developed with these practical directives in mind, and are based in a sound scientific rationale, reflecting biodiversity principles of resilience (ecological quality and ability to persist), redundancy (maintaining multiple replicates of populations/habitats to insure against catastrophic loss), and representation (conserving the full range of natural variation) (Shaffer and Stein 2000, Tear *et al*. 2005). Moreover, the recovery criteria shift the emphasis on recovery from predetermined, but subjective, outcomes to conservation actions whose effects can be monitored and measured to assure that recovery has occurred to or inform adaptive management. We also considered seven principles of conservation specific to bull trout in developing recovery criteria: (1) conserve the opportunity for diverse life history expression; (2) conserve the opportunity for genetic diversity; (3) ensure bull trout are distributed across representative habitats; (4) ensure sufficient connectivity among populations; (5) ensure sufficient habitat to support population viability (e.g., abundance, trend indices); (6) address threats, including climate change; and (7) ensure sufficient redundancy in conserving population units. These recovery principles take into account threats to and physical or biological needs of the species throughout its range and focus on the range-wide recovery needs. At the same time, the seven principles and our approach recognize that the nature of threats to, the long-term viability of and the pathways to recovery for bull trout cannot be "one-size fits all" across its entire range. To that end, the recovery plan addresses these questions through a framework of six recovery units within which recovery can be tailored to the needs of geographically distinct subpopulations of bull trout.

Addressing threats in recovery criteria (threats-based criteria) is a requirement under the Interim Recovery Planning Guidance. This principle guided our recovery approach for bull trout with a goal to: (1) conserve bull trout so that they are geographically widespread across representative habitats and demographically stable, within six recovery units that comprise the coterminous United States population of bull trout; (2) effectively manage and ameliorate the primary threats in each of the six recovery units at the core area scale such that bull trout will persist in the foreseeable future; (3) build upon the numerous and ongoing conservation actions implemented on behalf of bull trout since their listing in 1999, and improve our understanding of how various threat factors potentially affect the species; (4) use that information to work cooperatively with our partners to design, fund, prioritize, implement and monitor effective conservation actions in those areas that offer the greatest long-term benefit to sustain bull trout and where recovery can be achieved; and (5) apply adaptive management principles to implementing the bull trout recovery program to account for new information.

In summary, we developed recovery criteria that focus on the identification and effective management of known, primary threat factors to bull trout in currently occupied core areas in each of six recovery units (Specific, Measurable, Achievable); establishes recovery criteria thresholds that acknowledge, despite our best conservation efforts identified in this plan, some extant bull trout core area habitats will likely change (and may be lost) over time (Realistic); and identifies and focuses recovery actions in those areas where success is likely to meet our goal of ensuring the conservation of genetic diversity, life history features, and broad geographical representation of remaining bull trout populations (Realistic, Time-referenced).

23. Defining recovery units: The States believe more documentation is needed to describe more clearly why the proposed recovery unit boundaries were chosen. The recovery plan needs to especially include more biogeographic justification for several recovery units.

Response: As previously described above, new data and reanalysis since 2000 have suggested that the coterminous United States listed entity could be more appropriately divided into 6 recovery units, rather than the 27 recovery units identified in the 2002 and 2004 draft recovery plans. We worked with a number of State, Federal, and Tribal partners in 2008 and 2009 to evaluate alternatives for organizing core areas into possible recovery units that would also be consistent with the "discreteness" and "significance" criteria in the DPS policy. Ten alternatives were evaluated that explored from 2 to 69 potential recovery units, based on mitochondrial and microsatellite DNA analysis, and on biogeographical considerations, including geological establishment of major watersheds, isolation of portions of watersheds above major waterfalls, co-occurrence with other fish species, and occurrence in different ecological zones (Ardren *et al*. 2011). The Service selected the six recovery unit alternative identified in this plan that we maintain best reflects the available genetic, biogeographical, and ecological information, and is consistent with our "discreteness" and "significance" criteria in our DPS policy. The six recovery units were first described in the Service's 2010 proposed critical habitat rule (USFWS 2010), and include: (1) Coastal Recovery Unit, (2) Klamath Recovery Unit, (3) Mid-Columbia Recovery Unit, (4) Upper Snake Recovery Unit, (5) Columbia Headwaters Recovery Unit, and (6) Saint Mary Recovery Unit.

24. *Comment:* Comments suggesting that reintroduction and supplementation tools be included where appropriate to aid in recovery.

Response: As previously discussed under General Comment # 9, the recovery plan includes a discussion on the role of artificial propagation and translocation in bull trout recovery, and the RUIPs will identify where propagation or translocation efforts may be useful to aid recovery efforts. Such efforts may involve direct translocation from more vigorous populations or captive breeding of bull trout in controlled propagation facilities. Such translocation programs should consider appropriate precautions against introduction of fish pathogens to new watersheds.

25. Comment: Proposed recovery unit list of threats: concerned that the proposed list of threats was too broad and not necessarily applicable or representative of current threat factors affecting bull trout in each core area.

Response: Threats found in the revised draft recovery plan were derived from information assembled in the Core Area Templates (USFWS 2008) in coordination with various State, Federal, and Tribal partners, and additional assessments developed by the Service in 2010 and 2011. These threats were identified as problems or factors that may affect bull trout local populations in each core area at that time or expected to into the foreseeable future (in consideration of present and future climate change). They included a variety of threats that ranged in severity from serious imminent threats to documented, but relatively minor issues that should nonetheless be evaluated for their potential impact.

Because the threats were derived from information assembled from Core Area Templates and Assessments developed in 2008, 2010 and 2011, we anticipated that much of the information was likely out of date and in need of updating and revision. New information and suggested changes in the list of threats has been incorporated and updated in the final recovery plan through the interagency RUIP development process.

26. *Comment:* Climate Change: future climate change effects should be considered in developing conservation actions and appropriating conservation resources. One State agency suggested a more programmatic approach to address climate change in the final recovery plan.

Response: Climate change effects were not considered as factors affecting bull trout at the time of listing in 1999. Since that time, several climate change assessments or studies have been published or are currently underway assessing the possible effects of climate change on bull trout and their habitats. The results of these efforts will allow us to better understand how climate change may influence bull trout and help to identify suitable conservation actions to ensure bull trout persist in the foreseeable future in the face of climate change. For example, recent publications have cited information showing estimates of both summer flow decreases and stream temperature increases due to climate change in several areas where bull trout currently reside (e.g., Leppi *et al*. 2012; Luce *et al*. 2013; Sawaske and Freyberg 2014). Both of these metrics demonstrate that discernible long-term trends are having direct negative impacts on availability of suitable habitat for bull trout.

Therefore, it is important to develop a decision framework to assess climate change effects to bull trout and allocate conservation resources and funding to ensure that future bull trout conservation efforts are allocated to those areas with the anticipated future coldest water temperatures that offer the greatest long-term benefit to bull trout conservation. Recent tools and regional databases that may be useful for informing and prioritizing the bull trout conservation and monitoring actions described in the RUIPs include: NorWeST Regional Database and Modeled Stream Temperatures (Isaak *et al.* 2014) (stream temperature data used to develop accurate and consistent data on aquatic habitat spatial distribution and responses to climate that may help predict future bull trout occupancy); Bayesian Belief Network decision support tools (Peterson *et al*. 2013) (developed to provide spatially-explicit information about the likelihood of fish population, including bull trout, persistence under different climate scenarios); and the numerous recent scientific publications describing historical trends in precipitation and stream flow observed across the Pacific Northwest. We expect that these, and other, tools will be useful in developing and applying conservation actions identified in the bull trout recovery plan's RUIPs, and will be used by State, Federal, Tribal and other agencies responsible for implementing actions in support of bull trout conservation and recovery.

APPENDIX E. Assessment Tool for Describing Effective Management of Threats in Bull Trout Core Areas and Six Recovery Units that Comprise the Coterminous Population of Bull Trout.

EXECUTIVE SUMMARY

The primary recovery strategy for recovery of bull trout in the coterminous United States is to: (1) conserve bull trout so that they are geographically widespread across representative habitats and demographically stable; (2) managing and ameliorating the primary threats in each of six recovery units at the core area scale such that bull trout will persist well into the future; (3) work cooperatively with partners to develop and implement bull trout recovery actions in each of the six recovery units; and (4) apply adaptive management principles to implementing the bull trout recovery program to account for new information. Recovery criteria described in the recovery plan represent our best assessment of the conditions that would most likely result in a determination that listing under the Act is no longer required.

To objectively evaluate the status of threats affecting bull trout across the range of the species, the Service has created a structured assessment tool that incorporates the best available data and scientific expert opinion participation. The results from this assessment tool will be integral to evaluate the status of bull trout at the range-wide and recovery unit scales based on the analysis of threat management effectiveness at the core area level. These core area assessments should also serve as a primary metric to assess the species' status in 5-year reviews and five-factor threats analyses that are initiated in the future, including any delisting evaluations. Additional 'metrics' that will be important in future status reviews include evidence of demographically stable populations of bull trout; and an evaluation of the adequacy of existing regulatory mechanisms to provide adequate protection for bull trout in the foreseeable future (approximately the next 50 years).

In summary, when future status reviews or delisting evaluations are initiated, the Service will evaluate the best available scientific and commercial information to ensure that the recovery pathway for bull trout in a 'recovered' recovery unit achieve representation (*i.e.*, existing occupancy within most core areas were maintained and existing life history forms that are present in these core areas were mostly preserved); redundancy (*i.e.*, a mosaic of healthy populations are distributed across the landscape within the recovery unit); and resilience (*i.e.*, core areas that contain migratory life history expressions were prioritized for conservation, and "at risk" core areas have been improved). Such reviews will focus on three primary areas: threat assessment process to evaluate the status of threats across the range of bull trout; demonstration of demographically stable populations of bull trout; and evaluation of the adequacy of existing regulatory mechanisms to provide adequate protection for bull trout in the foreseeable future (approximately the next 50 years).

BACKGROUND

Our recovery planning guidance (NMFS and USFWS 2010) calls for the design of recovery criteria to address the five statutory listing factors in section 4(a)(1) of the Act, in order to measure whether threats to the species have been ameliorated. Thus, recovery criteria should be applicable to a five-factor threats analysis in a subsequent delisting rule. Because bull trout are geographically widespread and vary substantially within each recovery unit in the nature of the threats that populations face, it is necessary to use an appropriate geographic scale to assess whether management is effectively ameliorating threats. Because threats to bull trout are generally expressed at a metapopulation level and management actions can be effectively planned at that scale, we will explicitly assess threats at the core area scale, in terms of the statutory listing factors, and aggregate these core area assessments to the recovery unit level to determine whether recovery criteria are being met.

Overview of the Threat Assessment Process

To objectively evaluate the status of threats across the range of bull trout, the Service has created a structured assessment approach that incorporates the best available data and scientific expert opinion participation. The results from this assessment tool will be integral to evaluate the status of bull trout at the range-wide and recovery unit scales based on the analysis of threats at the core area level. These core area assessments should also serve as a primary metric to assess the species' status in 5-year reviews and five-factor threats analyses that are initiated in the future, including any delisting evaluations.. Core area assessments can also inform the process of recovery implementation by highlighting and prioritizing management actions that maximize conservation benefits for bull trout.

The Threats Assessment Tool developed for bull trout includes the following components (along with the participating or responsible participants), and is fully described below.

- Assessment Workshop Process (Service, Federal, State, Tribal, and others)
- Threats Assessment Decision Matrix (Service, Federal, State, Tribal, and others)
- Assessment of Threats Effectively Managed (Service)
- Evaluation of Recovery Unit Status (Service)

Assessment Workshop Process

When evaluating the status of bull trout at the recovery unit scale, we plan to convene a workshop or series of workshops to assess the status (threat severity, threat management effectiveness, bull trout demography) of each core area within the recovery unit. Each workshop will include broad representation of fisheries biologists knowledgeable about bull trout issues within the recovery unit, including but not limited to biologists from U.S. Geological Survey, U.S. Fish and Wildlife Service - Fisheries and Ecological Services field offices, Federal land managers (U.S. Forest Service, National Park Service, Bureau of Land Management), State land management agencies, State fish and game agencies, Tribal fisheries programs, and universities. Our objective is to provide a decision framework that characterizes bull trout status as objectively as possible, with acknowledgment that there are inherent differences among experts in data interpretation and professional opinion. In the workshops we will seek to determine the range of professional opinion on the status of each core area (without seeking group consensus), soliciting an open discussion of current survey and management information and eliciting the rationale and assumptions involved in the status determination and any differences of opinion.

Our goal is to establish a structured, consistent, and objective approach to determining whether the identified primary threats to bull trout are being effectively managed at the core area level. The framework for making these determinations will include a simple, but consistently applied, decision matrix (described below) to assess threat severity and management effectiveness for each identified primary threat in the core area.

Assessment of this decision matrix will be informed by existing empirical data on magnitude and trends in bull trout population counts or indices; current or historical spatial distribution, connectivity, and extent of populations; expression of life history strategies; occurrence, magnitude, scope, trends, and severity of threats; and significant conservation measures that are ongoing or have been completed to address primary threats. These data will be interpreted with the best professional judgment of biologists familiar with bull trout populations in the core area. Data sources may include but are not limited to:

- Available bull trout survey and monitoring data (e.g., redd counts, telemetry, creel counts) collected by State, Federal, Tribal, university programs, or other researchers, providing information on population size or indices, historical trends, distribution, and movements for bull trout, forage fish, or non-native predators/competitors in the core area.

- Information from section 7 consultations regarding management actions within the core area, including characterization of habitat impacts, population trends, and baseline within local populations (e.g., analyses under the consultation matrix template [USFWS 1999]).

This information may be compiled using data on bull trout effects from Service databases or other information in Service files.

- Compilation of ongoing and completed conservation actions since the time of listing which address identified primary and other threats within the core area.

- Threat monitoring information, including land management agency assessment of stream habitat conditions, trends, and high priority actions (e.g., USFS 2013), and water quality assessments (impaired waters identified under Clean Water Act 303(d), and total maximum daily load determinations).

- Calculation of an integrated conservation metric for each core area, based on methodology of the NatureServe Conservation Status Assessment Tool created by the International Union for Conservation of Nature (Faber-Langendoen *et al.* 2012). This metric combines available information on bull trout habitat extent, population size, trends, and threats to provide a generalized ordinal representation of current core area conservation status.

- Available analyses for core area stream temperature data collected and modeled through the NorWeST (USFS 2014, Isaak *et al*. 2015), and Bull Trout Vulnerability Assessment (Dunham 2015) processes. This information includes modeled probabilities of bull trout presence and mapping of suitable habitat patches using data on stream temperature, fish presence, local threats, connectivity, and climate sensitivity. These models were completed for much of the range of bull trout during 2014. In several core areas local applications of these models have been implemented or are in progress, providing detailed analyses that have also been employed to prioritize management actions in RUIPs. Potential climate change impacts, while not specifically assessed as an independent threat, are considered in the context of climatic influence on other threats when determining what recovery actions are needed in core areas.

The timeframe over which impacts are projected in this threats assessment process is based on the foreseeable future for evaluation of threatened status. For bull trout, the foreseeable future for bull trout was first described during the 2008 5-year review process (USFWS 2008a as being 4 to 10 generations (approximately 28 to 70 years). For consistency, the time frame used for assessing core area status and population persistence is set in the middle of that range, at approximately 50 years.

Threats Assessment Decision Matrix

For each core area, participating experts will be asked to evaluate all identified primary threats with respect to two independent metrics: threat severity and management effectiveness. The categories used for these metrics are defined below, with several examples to describe circumstances in which these categories could be appropriately applied to particular types of threats (nonnative fish impacts, impaired connectivity, etc.). These metrics are combined into a decision matrix (Table 1 below) that will be used to assess whether current management or conservation actions effectively address the threat.

For this analysis, threats are classified into several major categories: Upland/riparian land management (Factor A; including impacts of forestry, grazing, road maintenance, etc. on sedimentation, temperature, and stream habitat); instream impacts (Factor A; instream flow, entrainment); water quality (Factor A; contaminants, mining impacts); nonnative fishes (Factors C and E; including competition, predation, and hybridization effects); connectivity impairment (Factor E: dams, culverts, etc.), forage fish availability (Factor E), and angling impacts (Factors B and D; poaching and bycatch). Projected impacts related to climate change should be incorporated in the analysis in terms of their effects on these threat categories (e.g., through water temperature, instream flow, brown trout colonization) over the foreseeable future. This aggregation of threats is designed for the purpose of general core area status assessment; data arising from section 7 consultations on bull trout are fully applicable to this analysis but the framework of pathways of effects and their indicators commonly used in section 7 analyses (USFWS 1999) uses a slightly different aggregation of threats as appropriate for project-level assessments (see Table 2 below). We do not anticipate a need to alter the threats classifications currently used in section 7 consultations. See Appendix G for more information regarding the relationship between recovery and section 7(a)(2) of the Act.

Small population size can also constitute a primary threat under Factor E (demographic stochasticity, loss of genetic diversity), but threats related to population size are addressed separately as discussed below.

Both axes of the matrix will be evaluated for each combination of core area and threat. As an ancillary exercise, it may be useful to consider each particular threat (e.g., nonnative fishes) at a broader recovery unit level, ranking all core areas in the recovery unit by the relative severity of that threat from most to least affected. This relative ranking could provide a cross-check against core area specific analyses, to improve the consistency of threat evaluations throughout the recovery unit.

Each threat will be individually assessed at the core area level and the Service will make an overall determination for each core area of whether threats are being effectively managed.

These core area determinations will then be rolled up to the recovery unit level to assess recovery criteria.

Table 1. Example of Threats Assessment Decision Matrix.

Threats Assessment Decision Matrix					
	Threat Severity				
Management Effectiveness		**Minor**	**Moderate**	**High**	**Severe**
	None or Ineffective				
	Partially Effective				
	Mostly Effective				
	Effective				

Table 2. Interrelation between the bull trout pathways and indicators matrix and threat classifications in this assessment tool. Note that section 7 consultations primarily address specific project impacts, while an overall assessment of core area threats generally has a broader geographic scope, can aggregate detailed local analyses to a broader level assessment, and involves assessment of core area status over the foreseeable future.

Pathways	**Indicators**	**Assessment Tool Threat Types**
Channel Condition and Dynamics	- Channel bed stability - Floodplain connectivity - Streambank condition - Width/depth ratio	Upland/Riparian Land Management [in relation to impacts on stream channel structure]
Disturbance	- Noise disturbance - Other disturbance	This pathway may relate more to localized project impacts than to overall core area condition; but is generally covered under upland/riparian land management.
Flow and Hydrology	- Altered flow patterns - Change in peak/base/summer low flows - Drainage network increase - Springs/seeps/groundwater connections	Instream Impacts [e.g. instream flow, entrainment]
Forage Base	- Prey availability - Species composition	Forage Fish Availability

Pathways	Indicators	Assessment Tool Threat Types
Habitat Access	- Chemical barriers - Physical barriers	Connectivity Impairment (e.g., dams, culverts)
Habitat Elements	- Cover (other) - Large pools - Large woody debris - Off-channel habitat - Percent fines in gravel - Pool frequency and quality - Refugia - Substrate embeddedness	Upland/Riparian Land Management [in relation to impacts on structural features of stream habitat]
Population Unit Characteristics	- Direct take (loss) of individuals - Growth and survival - Life history diversity and isolation - Persistence and genetic integrity - Population size	Small Population Size [in relation to genetics and population size] “Growth and survival” indicator could relate to multiple threat types that may affect this.
Water Quality	- Chemical contamination	Upland/Riparian Land Management [primarily direct land management impacts on

Pathways	Indicators	Assessment Tool Threat Types
	- Nutrients - Other water chemistry - Sediment - Temperature	water temperature and sedimentation] Water Quality [primarily in relation to chemical contaminants/nutrients/acidity]
Watershed Conditions	- Riparian condition - Road density and location - Watershed disturbance regime - Watershed disturbance history	Upland/Riparian Land Management
[none; significant core area level threat, but not a typical consultation subject]		Nonnative Fishes
[none; significant core area level threat, but not a typical consultation subject]		Angling Impacts

Threat Severity: The degree to which a specific threat would affect bull trout survival and persistence in a core area in the absence of management actions to eliminate or mitigate the threat. This assessment considers both the impacts on persistence of bull trout local populations and the spatial distribution and extent of threats within a core area.

To evaluate the severity of a threat within a core area, consider a hypothetical scenario where the threat remains unmanaged and other threats do not negatively affect bull trout in the core area. Ranking of threat severity should reflect a gradient in the proportion of existing local populations that would be expected to persist over 50 years in this scenario, ranging between the two extremes of extirpation of all local populations and persistence of all local populations at viable levels. Note that if the most probable expected outcome is a major reduction in abundance of a local population over 50 years, the inherent uncertainty of such a long-term projection will likely include some risk of the population being extirpated. Both core areas where some local populations are considered secure and others are expected to be extirpated, and core areas where all local populations have a moderate likelihood of persistence, might fall on similar intermediate positions on this gradient.

Information on bull trout population trends may be used to inform threat severity assessments, but is most clearly applicable in cases where only one primary threat exists in a core area and no significant management is being done. Where multiple threats exist, the actual population trends may be a function of several of them; thus threats could be individually ranked at different severities based on the same population numbers if they are expected to have different degrees of impact on population persistence. Moreover, if a threat is being counteracted by ongoing management so that the population remains stable or increasing when it would otherwise be expected to decline, these population benefits should be reflected on the "Management Effectiveness" axis of the matrix rather than "Threat Severity" to avoid double-counting. Using actual population data as a direct surrogate for threat severity could thus result in underestimating the threat severity in absence of management. Other information such as models and status assessments should also be considered when assessing threat severity.

Resilience of bull trout populations at the recovery unit level is supported by a well distributed expression of migratory life history strategies, which improve population connectivity, reproductive success, and recolonization. Because of variations among core areas in habitat configuration and threat of invasion by nonnative fishes, each core area should be individually assessed for the relative importance of maintaining or reestablishing various migratory life history strategies. In core areas where expression of migratory life history is important for conservation (as determined in RUIPs), assessment of threat severity should incorporate impacts on life history diversity.

Minor: If unmanaged, threat is not expected to appreciably reduce persistence of bull trout local populations within the core area for the foreseeable future (50 years). If threat occurs broadly throughout the core area, its population-level impacts on local populations are expected to be minor or transient. If any local populations are expected to be substantially reduced by the threat, they are geographically localized (less than approximately 25 percent of local populations in the core area) and are not expected to be extirpated in the foreseeable future. The threat is not expected to substantially spread without management.

Examples:

- Brook trout occur in a core area but are not actively expanding and do not overlap with any bull trout local populations; or brook trout overlap but significant negative competitive interactions and hybridization are not believed to exist.
- Introduced nonnative fishes occur in mainstem habitat downstream from a bull trout local population, but interactions or impacts are not confirmed (e.g., walleye in the Saint Mary Recovery Unit).
- Lake trout and northern pike in core areas where they historically co-occurred with bull trout fluvial populations (Saint Mary Recovery Unit only) and are not known to negatively affect bull trout.
- In core areas where expression of migratory life history has been identified as important for conservation, a “minor” severity level for a connectivity-related threat would not be expected to result in loss of migratory life history expression. Most or all bull trout spawning/rearing habitat in the core area is connected with the historically occupied FMO habitat within the core area. Dams or reaches with water quality impairment, if present, provide effective two-way passage during most or all periods when bull trout are moving between FMO and spawning/rearing habitat. Dispersal between local populations in the core area is generally active and retains potential for re-colonization and metapopulation function. All migratory life history strategies that were historically present within the system are present.
- Habitat impairment from anthropogenic effects has little or no impact on habitat suitability and distribution for bull trout.

Moderate: If unmanaged, threat is expected to slightly to moderately reduce persistence of bull trout local populations within the core area for the foreseeable future (50 years). Impacts on bull trout in the core area have been documented and are well supported. Impacts from the threat are moderate but geographically widespread within the core area (more than approximately 25 percent of the local populations in the core area are expected to be substantially reduced but are generally not expected to be extirpated); or else the threat is more geographically restricted, but the affected local populations are expected to be severely reduced and are at some risk of extirpation in the foreseeable future. There may be risk of the threat spreading to currently unaffected local populations in the foreseeable future. Few local populations are expected to be extirpated in the foreseeable future by this threat alone, although it may substantially contribute to extirpation risk for local populations in combination with other threats.

Examples:

- Brook trout that co-occur with bull trout local populations, where some negative competitive interactions are likely or confirmed but hybridization is absent or minimal, and local bull trout populations are expected to persist in the foreseeable future.

- Nonnative warm-water fishes (bass, walleye, etc.) that occur in lakes or mainstem rivers that are used as FMO habitat, and have some negative effects through competition or predation that may reduce survival/dispersal success, but do not substantially exclude bull trout from using the habitat.

- Lake trout that compete with or prey upon bull trout in large lakes where some negative impacts on bull trout adfluvial populations have been observed but are not expected to significantly compromise their viability/persistence over the foreseeable future.

- In core areas where expression of migratory life history has been identified as important for conservation, a "moderate" severity level for a connectivity related threat may result in partial loss of migratory life history expression within the core area. Spawning/rearing habitat in the core area retains connection with historically occupied FMO habitat, but some local populations may be isolated, or there may be partial or seasonal barriers to dispersal that substantially reduce connectivity or survivorship during dispersal. Dispersal between local populations in the core area may be episodic or seasonally restricted to a few watersheds. Migratory life history strategies that were historically present within the system likely continue to exist but may not be expressed in all local populations.

- Habitat impacts are localized in a few local populations and not throughout the core area, or if widespread are at a degree compatible with persistence of most bull trout local populations at reduced levels.

High: If unmanaged, threat is expected to substantially reduce persistence of bull trout local populations within the core area for the foreseeable future (50 years). Impacts on bull trout in the core area are well supported and geographically widespread (affecting most or all local populations). Without active management affected local populations are generally expected to be severely reduced and are at some risk of extirpation in the foreseeable future. Threat substantially contributes to extirpation risk for local populations, alone or in combination with other threats.

Examples:

- Brook trout that co-occur with bull trout local populations, where hybridization or competition is occurring and may compromise the long-term survival or genetic integrity of local populations.

- Lake trout competition/predation in large lake/riverine systems where it significantly compromises long-term viability/persistence of adfluvial bull trout populations (e.g., Priest Lake or Pend Oreille core areas in the Columbia Headwaters Recovery Unit).

- In core areas where expression of migratory life history has been identified as important for conservation, a “high” severity level for a connectivity related threat is likely to result in loss of migratory life history expression within the core area. Most or all spawning/rearing habitat in the core area is effectively isolated from the historically occupied FMO habitat within or adjacent to the core area, either by physical barriers (dams, dewatered reaches, falls, etc.) that do not provide effective two-way passage or by reaches with water temperatures or water quality unsuitable for bull trout dispersal. Dispersal between local populations in the core area is substantially impaired or absent. Migratory life history strategies that were historically present within the system are currently absent or unusual, and most or all bull trout populations are resident. Connectivity impacts contribute to a significant probability of extirpation in the foreseeable future for a substantial proportion of local populations.

- The majority of local populations within a core area have negative habitat effects, which could result in extirpation of some local populations in the foreseeable future without active management.

Severe: If unmanaged, threat is expected to severely reduce persistence of bull trout local populations within the core area for the foreseeable future (50 years). Impacts on bull trout in the core area are well supported and affect all local populations. Threat substantially contributes to extirpation risk for local populations. Without active management all local populations are expected to be severely reduced, and most or all local populations are expected to be extirpated in the foreseeable future.

Examples:

- Brook trout that co-occur with bull trout populations with complete or near-complete overlap in distribution, where hybrids are commonly observed and remnant bull trout populations are small and declining in abundance.

- Lake trout competition/predation in highly vulnerable core areas (e.g., small montane lake systems) where bull trout extirpation is likely or expression of adfluvial life history is precluded and bull trout populations are reduced to remnant resident patches.

- In core areas where expression of migratory life history has been identified as important for conservation, a "severe" severity level for a connectivity related threat is consistent with full loss of migratory life history expression within the core area. Spawning/rearing habitat in the core area is restricted and effectively isolated from the historically occupied FMO habitat within or adjacent to the core area, either by physical barriers (dams, dewatered reaches, falls, etc.) that do not provide effective two-way passage or by reaches with water temperatures or water quality unsuitable for bull trout dispersal. Dispersal between local populations in the core area is absent. Migratory life history strategies that were historically present within the system are currently absent, and all bull trout populations are resident. Connectivity impacts contribute to a high probability of extirpation in the foreseeable future for most or all populations.

- Habitat conditions in the core area are generally not suitable for bull trout, such that remaining populations are few, restricted in distribution, and at extreme risk of extirpation within the foreseeable future without active management.

Management Effectiveness: The extent to which current management of this specific threat in a core area is 'effective' in reducing the degree of threat or mitigating its impact with respect to bull trout. This axis of the matrix reflects a gradient from the baseline of nonexistent or ineffective management, which does not alter the degree of threat, to management that entirely removes the threat or fully prevents or mitigates its effect on bull trout. Estimates of management effectiveness may be based on the best professional judgment of fisheries biologists who are familiar with the core area, and should be primarily supported where possible by data directly quantifying trends in the threat (e.g., lake trout population indices, fish passage data, sediment load measurements) in conjunction with data on historical changes in management. Surveys documenting bull trout population trends may also be used to inform this assessment to the extent that they can be attributed to particular threats. This association is likely to be most clear when only one threat with a relatively high severity is affecting the population; where multiple threats exist, attribution of their relative effects on bull trout trends should be made with caution. The management actions that are being implemented should be specifically identified when a management effectiveness category is assigned so that it is clear what activities are and are not being included in this assessment. Generally this axis of the matrix should reflect the success of ongoing, active management actions implemented without fundamentally altering existing infrastructure or constraints; thus for connectivity-related threats it could include mitigation such as fish passage facilities or changes in dam operations, while permanent removal of dams or culverts might better be reflected in changes on the "Threat Severity" axis.

None or Ineffective: No significant management of the threat is taking place in this core area, or there is little or no evidence that existing management actions are effectively reducing threat severity.

Partially Effective: Management of the threat is being done with moderate effectiveness or within a limited portion of the core area, including at least some of the local populations affected by the threat. There is evidence that threat severity is being reduced, but this reduction is localized or moderate.

Mostly Effective: Management of the threat is being done in most or all of the core area, including most or all local populations affected by the threat. Threat severity is substantially reduced throughout the core area, but some lesser negative effects persist; or comparably, the core area is divided between a majority of local populations where the threat has been effectively neutralized and a minority where management remains absent or ineffective.

Effective: Management of this threat reduces risk to all affected local populations, and the threat is largely or completely neutralized, with existing effects on bull trout being minor or absent. Ongoing management may or may not be necessary to maintain this condition.

Outcome: The recovery unit workshop is designed to allow participating biologists to complete both axes of the Threats Assessment Decision Matrix for each core area and threat combination, determining the appropriate matrix cell and presenting their assumptions and rationale for making that determination in context of the category definitions. Each of the participants' matrix values will collectively be tallied to express the range of expert opinion.

Assessment of Threats Effectively Managed

After the individual threats have been assessed in the Threats Assessment Decision Matrix, the Service will make a determination of whether threats are being effectively managed for the core area being evaluated. This assessment may include a collective evaluation of all threats within a core area to ensure that interactions and possible cumulative effects of even minor threats are considered.

In recovery units where shared FMO habitat outside core areas has been identified, this assessment should also evaluate whether connectivity and habitat in shared FMO areas is maintained in a condition sufficient for regular bull trout use and successful dispersal among the connecting core areas.

Available bull trout population information (e.g., trend, size, index, etc.) for each core area should be considered in this assessment. Because small population size may constitute a threat under Factor E due to demographic stochasticity and loss of genetic diversity, low populations in a core area could be incompatible with a determination that threats are being effectively managed. However, this threshold also depends on the geographic extent of available habitat within the core area, since geographically smaller core areas inherently have less ability to support a large population and less scope for realistic management to increase populations. Based on our best information about population size and habitat extent, the recovery plan does identify a number of core areas where current population levels appear substantially depressed relative to available habitat, and should be increased before determining that threats are effectively managed. Above this minimal threshold, population size should be considered in combination with other threats; in many core areas there is scope for population improvement in response to amelioration of various threats, and trends in population response can be indicative of threat management effectiveness.

The Service will consider the best available information during this assessment in the context of the requirements of the Act. Service managers will meet to determine whether threats are effectively managed in each core area based on the best available information (matrix cell assignments, supporting data, and rationales) provided to the Service by experts during the recovery unit workshops. Service technical staff familiar with the core areas will provide input to managers at this meeting. If the combination of threat severity and management effectiveness for any individual threat indicates that the threat is not effectively managed to be consistent with bull trout survival and persistence, then the entire core area will be identified as such. All threats will be assessed, and the cumulative effects of multiple threats that are individually minor or moderate could potentially result in a core area not being considered effectively managed.

Evaluation of Recovery Unit Status

The primary recovery strategy for recovery of bull trout in the coterminous United States is to: (1) conserve bull trout so that they are geographically widespread across representative habitats and demographically stable; (2) managing and ameliorating the primary threats in each of six recovery units at the core area scale such that bull trout will persist well into the future; (3) work cooperatively with partners to develop and implement bull trout recovery actions in each of the six recovery units; and (4) apply adaptive management principles to implementing the bull trout recovery program to account for new information. Recovery criteria described in the bull trout recovery plan represent our best assessment of the conditions that would most likely result in a determination that listing under the Act is no longer required.

After determining whether threats are effectively managed for a core area, a tally will be produced for the entire recovery unit that shows all core areas in a recovery unit and the number of local populations in each core area. For each recovery unit, the recovery criteria identified in this recovery plan will be assessed based on the number of core areas where primary threats are nonexistent or have been effectively managed. Additional information that will help assess the overall status of bull trout within a recovery unit and inform whether recovery criteria have been achieved include: evidence of demographically stable populations of bull trout; and an evaluation of the adequacy of existing regulatory mechanisms to provide adequate protection for bull trout in the foreseeable future (approximately the next 50 years).

In order to attain recovered conditions in each of the six recovery units that comprise the coterminous population of bull trout, viable local bull trout populations are necessary across the existing landscape. To achieve viable recovery units, identified significant threats must be effectively managed to produce demographically stable bull trout populations. The recovery strategy presented in this plan is founded in principles of conservation biology and biodiversity, ensuring representation, redundancy, and resilience. Recovery entails reducing threats to ensure the conservation or restoration of bull trout core areas while striving for representation, resilience, and redundancy. In order to achieve representation, we have determined the need to largely maintain existing occupancy within most core areas and preserve existing life history forms that are present in these core areas. In order to achieve resilience, core areas that contain migratory life history expressions should be prioritized for conservation, and some currently "at risk" core areas will need to be improved. Redundancy will be achieved when a mosaic of healthy populations are distributed across the landscape within each of the six recovery units. Additionally, in some recovery units there are areas that were historically occupied by bull trout that are currently unoccupied. While these areas have the potential for recolonization, there may be areas where recolonization will not be required for the recovery unit or DPS to be recovered.

While the recovery plan identifies conservation actions for all occupied core areas, we do not intend that meeting the recovery criteria for the listed entity will necessarily require that every currently occupied core areas identified in this recovery plan must individually meet its recovery targets. We recognize that recovery bull trout at the recovery unit scale will require improvement in bull trout local populations and their essential habitats in some core areas relative to the time of listing, while bull trout and their habitats in other core areas will only need to be 'sustained' or 'maintained' into the foreseeable future (approximately 50 years).

In summary, ecologically viable populations of bull trout are necessary to produce stable core areas which in turn will result in viable recovery units. These recovery principles take into account the threats and physical or biological needs of bull trout throughout its range and focus on the range-wide recovery needs. Ultimately, when future evaluations are initiated to determine the status of bull trout at either the coterminous or recovery unit scale, they will be dependent upon the results from: threat assessment process to evaluate the status of threats across the range of bull trout; demonstration of demographically stable populations of bull trout; and evaluation of the adequacy of existing regulatory mechanisms to provide adequate protection for bull trout in the foreseeable future. This approach to achieving recovery should ensure adequate conservation of genetic diversity, life history features, and broad geographical representation (*i.e.*, adequate spatial distribution) of bull trout populations in the six recovery units that comprise the coterminous population of bull trout.

APPENDIX F. Comparison of Current and Former Core Area and Recovery Unit Classifications

This table provides a crosswalk between the structure of core areas and recovery units that was used in the early draft bull trout recovery plans (USFWS 2002a, 2004a, 2004b) and 5-year review (USFWS 2008a) and that used in this final recovery plan, with a key to the core area maps in Appendix B. Based on the most current available information, several core areas have been split or combined, additional core areas that were historically occupied are identified, and those that did not fit our core area definition have been removed. Core area changes are discussed in detail in the RUIPs.

Final Recovery Plan (2015)				**2002 and 2004 Draft Recovery Plans and 5-year Review (2008)**	
Map Key in Appendix B	**Current Core Area**	**Current Recovery Unit**	**Area Status**	**Former Core Area**	**Former Recovery Unit**
1 (Map A)	Chilliwack River	Coastal	Occupied	Chilliwack River	Puget Sound
2 (Map A)	Nooksack River	Coastal	Occupied	Nooksack River	Puget Sound
3 (Map A)	Upper Skagit River	Coastal	Occupied	Upper Skagit River	Puget Sound
4 (Map A)	Lower Skagit River	Coastal	Occupied	Lower Skagit River	Puget Sound
5 (Map A)	Stillaguamish River	Coastal	Occupied	Stillaguamish River	Puget Sound
6 (Map A)	Snohomish and Skykomish Rivers	Coastal	Occupied	Snohomish and Skykomish Rivers	Puget Sound
7 (Map A)	Chester Morse Lake	Coastal	Occupied	Chester Morse Lake	Puget Sound
8 (Map A)	Puyallup River	Coastal	Occupied	Puyallup River	Puget Sound
9 (Map A)	Elwha River	Coastal	Occupied	Elwha River	Olympic Peninsula
10 (Map A)	Dungeness River	Coastal	Occupied	Dungeness River	Olympic Peninsula
11 (Map A)	Hoh River	Coastal	Occupied	Hoh River	Olympic Peninsula
12 (Map A)	Queets River	Coastal	Occupied	Queets River	Olympic Peninsula
13 (Map A)	Quinault River	Coastal	Occupied	Quinault River	Olympic Peninsula
14 (Map A)	Skokomish River	Coastal	Occupied	Skokomish River	Olympic Peninsula
15 (Map A)	Lewis River	Coastal	Occupied	Lewis River	Lower Columbia River Basin
16 (Map A)	Klickitat River	Coastal	Occupied	Klickitat River	Lower Columbia River Basin
17 (Map A)	Hood River	Coastal	Occupied	Hood River	Hood River Basin

Final Recovery Plan (2015)				2002 and 2004 Draft Recovery Plans and 5-year Review (2008)	
Map Key in Appendix B	**Current Core Area**	**Current Recovery Unit**	**Area Status**	**Former Core Area**	**Former Recovery Unit**
18 (Map A)	Lower Deschutes River	Coastal	Occupied	Lower Deschutes River	Deschutes River Basin
19 (Map A)	Upper Willamette River	Coastal	Occupied	Upper Willamette River	Willamette River Basin
20 (Map A)	Odell Lake	Coastal	Occupied	Odell Lake	Odell Lake
21 (Map A)	White Salmon River	Coastal	Historic	[not identified as core area]	Lower Columbia River Basin
22 (Map A)	Clackamas River	Coastal	Occupied (reintroduced)	[not identified as core area]	Willamette River Basin
23 (Map A)	North Santiam River	Coastal	Historic	[not identified as core area]	Willamette River Basin
24 (Map A)	South Santiam River	Coastal	Historic	[not identified as core area]	Willamette River Basin
25 (Map A)	Upper Deschutes River	Coastal	Historic	[not identified as core area]	Deschutes River Basin
1 (Map B)	Sycan River	Klamath	Occupied	Sycan River	Klamath River
2 (Map B)	Upper Klamath Lake	Klamath	Occupied	Upper Klamath Lake	Klamath River
3 (Map B)	Upper Sprague River	Klamath	Occupied	Upper Sprague River	Klamath River
1 (Map C)	Methow River	Mid Columbia	Occupied	Methow River	Upper Columbia River
2 (Map C)	Entiat River	Mid Columbia	Occupied	Entiat River	Upper Columbia River
3 (Map C)	Wenatchee River	Mid Columbia	Occupied	Wenatchee River	Upper Columbia River
4 (Map C)	Yakima River	Mid Columbia	Occupied	Yakima River	Middle Columbia River
5 (Map C)	Touchet River	Mid Columbia	Occupied	Touchet River	Umatilla-Walla Walla River Basins
6 (Map C)	Tucannon River	Mid Columbia	Occupied	Tucannon River	Snake River Washington
7 (Map C)	Asotin Creek	Mid Columbia	Occupied	Asotin Creek	Snake River Washington
8 (Map C)	Walla Walla River	Mid Columbia	Occupied	Walla Walla River	Umatilla-Walla Walla River Basins

Final Recovery Plan (2015)				2002 and 2004 Draft Recovery Plans and 5-year Review (2008)	
Map Key in Appendix B	**Current Core Area**	**Current Recovery Unit**	**Area Status**	**Former Core Area**	**Former Recovery Unit**
9 (Map C)	Lookingglass/Wenaha Rivers	Mid Columbia	Occupied	Grande Ronde River (in part)	Grande Ronde River Basin
10 (Map C)	Umatilla River	Mid Columbia	Occupied	Umatilla River	Umatilla-Walla Walla River Basins
11 (Map C)	North Fork John Day River	Mid Columbia	Occupied	North Fork John Day River	John Day River
12 (Map C)	Middle Fork John Day River	Mid Columbia	Occupied	Middle Fork John Day River	John Day River
13 (Map C)	Upper Mainstem John Day River	Mid Columbia	Occupied	Upper Mainstem John Day River	John Day River
14 (Map C)	Upper Grande Ronde River	Mid Columbia	Occupied	Grande Ronde River (in part)	Grande Ronde River Basin
15 (Map C)	Powder River	Mid Columbia	Occupied	Powder River (in part)	Hells Canyon Complex
16 (Map C)	Little Minam River	Mid Columbia	Occupied	Little Minam River	Grande Ronde River Basin
17 (Map C)	Wallowa/Minam Rivers	Mid Columbia	Occupied	Grande Ronde River (in part)	Grande Ronde River Basin
18 (Map C)	Imnaha River	Mid Columbia	Occupied	Imnaha River	Imnaha-Snake Rivers
19 (Map C)	Pine, Indian, and Wildhorse Creeks	Mid Columbia	Occupied	Pine, Indian, and Wildhorse Creeks	Hells Canyon Complex
None	None	Mid Columbia	[Granite Creek core area removed in final plan – see RUIP]	Granite Creek	Imnaha-Snake Rivers

Final Recovery Plan (2015)				2002 and 2004 Draft Recovery Plans and 5-year Review (2008)	
Map Key in Appendix B	**Current Core Area**	**Current Recovery Unit**	**Area Status**	**Former Core Area**	**Former Recovery Unit**
None	None	Mid Columbia	[Sheep Creek core area removed in final plan – see RUIP]	Sheep Creek	Imnaha-Snake Rivers
20 (Map C)	South Fork Clearwater River	Mid Columbia	Occupied	South Fork Clearwater River	Clearwater River
21 (Map C)	Selway River	Mid Columbia	Occupied	Selway River	Clearwater River
22 (Map C)	Lochsa River (in part)	Mid Columbia	Occupied	Lochsa River	Clearwater River
22 (Map C)	Lochsa River (in part)	Mid Columbia	Occupied	Fish Lake (Lochsa River)	Clearwater River
23 (Map C)	North Fork Clearwater River (in part)	Mid Columbia	Occupied	North Fork Clearwater River	Clearwater River
23 (Map C)	North Fork Clearwater River (in part)	Mid Columbia	Occupied	Fish Lake (North Fork Clearwater River)	Clearwater River
None	None [Clearwater FMO only]	Mid Columbia	FMO only	Middle-Lower Clearwater River	Clearwater River
24 (Map C)	South Salmo River	Mid Columbia	Occupied [added as core area in final plan – see RUIP]	[not identified as core area]	Northeast Washington
25 (Map C)	Eagle Creek	Mid Columbia	Historic	Powder River (in part)	Hells Canyon Complex
26 (Map C)	Chelan River	Mid Columbia	Historic	[not identified as core area]	Upper Columbia River
27 (Map C)	Northeastern Washington	Mid Columbia	Research Needs Area	[not identified as core area]	Northeast Washington

Final Recovery Plan (2015)				2002 and 2004 Draft Recovery Plans and 5-year Review (2008)	
Map Key in Appendix B	**Current Core Area**	**Current Recovery Unit**	**Area Status**	**Former Core Area**	**Former Recovery Unit**
None	None	Mid Columbia	[Burnt River Research Needs Area removed in final plan – see RUIP]	[not identified as core area]	Hells Canyon Complex
1 (Map D)	Upper Malheur River	Upper Snake	Occupied	Malheur River (in part)	Malheur River Basin
2 (Map D)	North Fork Malheur River	Upper Snake	Occupied	Malheur River (in part)	Malheur River Basin
3 (Map D)	Little Lower Salmon River	Upper Snake	Occupied	Little Lower Salmon River	Salmon River
4 (Map D)	Weiser River	Upper Snake	Occupied	Weiser River	Southwest Idaho River Basins
5 (Map D)	Squaw Creek	Upper Snake	Occupied	Squaw Creek	Southwest Idaho River Basins
6 (Map D)	North Fork Payette River	Upper Snake	Occupied	North Fork Payette River	Southwest Idaho River Basins
7 (Map D)	Middle Salmon River - Chamberlain	Upper Snake	Occupied	Middle Salmon River - Chamberlain	Salmon River
8 (Map D)	Middle Salmon River - Panther	Upper Snake	Occupied	Middle Salmon River - Panther	Salmon River
9 (Map D)	Lake Creek	Upper Snake	Occupied	Lake Creek	Salmon River
10 (Map D)	Opal Lake	Upper Snake	Occupied	Opal Lake	Salmon River
11 (Map D)	Lemhi River	Upper Snake	Occupied	Lemhi River	Salmon River
12 (Map D)	Middle Fork Salmon River	Upper Snake	Occupied	Middle Fork Salmon River	Salmon River
13 (Map D)	South Fork Salmon River	Upper Snake	Occupied	South Fork Salmon River	Salmon River

Final Recovery Plan (2015)				2002 and 2004 Draft Recovery Plans and 5-year Review (2008)	
Map Key in Appendix B	**Current Core Area**	**Current Recovery Unit**	**Area Status**	**Former Core Area**	**Former Recovery Unit**
14 (Map D)	Middle Fork Payette River	Upper Snake	Occupied	Middle Fork Payette River	Southwest Idaho River Basins
15 (Map D)	Deadwood River	Upper Snake	Occupied	Deadwood River	Southwest Idaho River Basins
16 (Map D)	Upper South Fork Payette River	Upper Snake	Occupied	Upper South Fork Payette River	Southwest Idaho River Basins
17 (Map D)	Upper Salmon River	Upper Snake	Occupied	Upper Salmon River	Salmon River
18 (Map D)	Pahsimeroi River	Upper Snake	Occupied	Pahsimeroi River	Salmon River
19 (Map D)	Little Lost River	Upper Snake	Occupied	Little Lost River	Little Lost River
20 (Map D)	Arrowrock Reservoir	Upper Snake	Occupied	Arrowrock Reservoir	Southwest Idaho River Basins
None	None	Upper Snake	N/A	Lucky Peak Reservoir	Southwest Idaho River Basins
21 (Map D)	Anderson Ranch Reservoir	Upper Snake	Occupied	Anderson Ranch Reservoir	Southwest Idaho River Basins
22 (Map D)	Jarbidge River	Upper Snake	Occupied	Jarbidge River	Jarbidge River
1 (Map E)	Lake Pend Oreille (in part)	Columbia Headwaters	Occupied	Lake Pend Oreille	Clark Fork River Basin
1 (Map E)	Lake Pend Oreille (in part)	Columbia Headwaters	Occupied	Cabinet Gorge Reservoir	Clark Fork River Basin
1 (Map E)	Lake Pend Oreille (in part)	Columbia Headwaters	Occupied	Clark Fork River (Section 3)	Clark Fork River Basin
1 (Map E)	Lake Pend Oreille (in part)	Columbia Headwaters	Occupied	Lower Flathead River	Clark Fork River Basin
1 (Map E)	Lake Pend Oreille (in part)	Columbia Headwaters	Occupied	Noxon Rapids Reservoir	Clark Fork River Basin

Final Recovery Plan (2015)				2002 and 2004 Draft Recovery Plans and 5-year Review (2008)	
Map Key in Appendix B	**Current Core Area**	**Current Recovery Unit**	**Area Status**	**Former Core Area**	**Former Recovery Unit**
1 (Map E)	Lake Pend Oreille (in part)	Columbia Headwaters	Occupied	Pend Oreille River	Northeast Washington
2 (Map E)	Priest Lakes	Columbia Headwaters	Occupied	Priest Lakes	Clark Fork River Basin
3 (Map E)	Kootenai River	Columbia Headwaters	Occupied	Kootenai River	Kootenai River Basin
4 (Map E)	Coeur d'Alene Lake	Columbia Headwaters	Occupied	Coeur d'Alene Lake	Coeur d'Alene Lake Basin
5 (Map E)	Bull Lake	Columbia Headwaters	Occupied	Bull Lake	Kootenai River Basin
6 (Map E)	Lake Koocanusa (in part)	Columbia Headwaters	Occupied	Lake Koocanusa	Kootenai River Basin
6 (Map E)	Lake Koocanusa (in part)	Columbia Headwaters	Occupied	Sophie Lake	Kootenai River Basin
7 (Map E)	Upper Stillwater Lake	Columbia Headwaters	Occupied	Upper Stillwater Lake	Clark Fork River Basin
8 (Map E)	Upper Whitefish Lake	Columbia Headwaters	Occupied	Upper Whitefish Lake	Clark Fork River Basin
9 (Map E)	Cyclone Lake	Columbia Headwaters	Occupied	Cyclone Lake	Clark Fork River Basin
10 (Map E)	Whitefish Lake	Columbia Headwaters	Occupied	Whitefish Lake	Clark Fork River Basin
11 (Map E)	Flathead Lake (in part)	Columbia Headwaters	Occupied	Flathead Lake	Clark Fork River Basin
11 (Map E)	Flathead Lake (in part)	Columbia Headwaters	Occupied	Kintla Lake	Clark Fork River Basin

Final Recovery Plan (2015)				**2002 and 2004 Draft Recovery Plans and 5-year Review (2008)**	
Map Key in Appendix B	**Current Core Area**	**Current Recovery Unit**	**Area Status**	**Former Core Area**	**Former Recovery Unit**
11 (Map E)	Flathead Lake (in part)	Columbia Headwaters	Occupied	Lake McDonald	Clark Fork River Basin
12 (Map E)	Frozen Lake	Columbia Headwaters	Occupied	Frozen Lake	Clark Fork River Basin
13 (Map E)	Upper Kintla Lake	Columbia Headwaters	Occupied	Upper Kintla Lake	Clark Fork River Basin
14 (Map E)	Akokala Lake	Columbia Headwaters	Occupied	Akokala Lake	Clark Fork River Basin
15 (Map E)	Bowman Lake	Columbia Headwaters	Occupied	Bowman Lake	Clark Fork River Basin
16 (Map E)	Quartz Lakes	Columbia Headwaters	Occupied	Quartz Lakes	Clark Fork River Basin
17 (Map E)	Lower Quartz Lake	Columbia Headwaters	Occupied	Lower Quartz Lake	Clark Fork River Basin
18 (Map E)	Logging Lake	Columbia Headwaters	Occupied	Logging Lake	Clark Fork River Basin
19 (Map E)	Trout/Arrow Lakes (in part)	Columbia Headwaters	Occupied	Arrow Lake	Clark Fork River Basin
19 (Map E)	Trout/Arrow Lakes (in part)	Columbia Headwaters	Occupied	Trout Lake	Clark Fork River Basin
20 (Map E)	Lincoln Lake	Columbia Headwaters	Occupied	Lincoln Lake	Clark Fork River Basin
21 (Map E)	Harrison Lake	Columbia Headwaters	Occupied	Harrison Lake	Clark Fork River Basin
22 (Map E)	Isabel Lakes	Columbia Headwaters	Occupied	Isabel Lakes	Clark Fork River Basin

Final Recovery Plan (2015)				2002 and 2004 Draft Recovery Plans and 5-year Review (2008)	
Map Key in Appendix B	**Current Core Area**	**Current Recovery Unit**	**Area Status**	**Former Core Area**	**Former Recovery Unit**
23 (Map E)	Hungry Horse Reservoir	Columbia Headwaters	Occupied	Hungry Horse Reservoir	Clark Fork River Basin
24 (Map E)	Swan Lake	Columbia Headwaters	Occupied	Swan Lake	Clark Fork River Basin
25 (Map E)	Big Salmon Lake	Columbia Headwaters	Occupied	Big Salmon Lake	Clark Fork River Basin
26 (Map E)	Holland Lake	Columbia Headwaters	Occupied	Holland Lake	Clark Fork River Basin
27 (Map E)	Doctor Lake	Columbia Headwaters	Occupied	Doctor Lake	Clark Fork River Basin
28 (Map E)	Lindbergh Lake	Columbia Headwaters	Occupied	Lindbergh Lake	Clark Fork River Basin
29 (Map E)	Clearwater River and Lakes	Columbia Headwaters	Occupied	Clearwater River and Lakes	Clark Fork River Basin
30 (Map E)	Middle Clark Fork River	Columbia Headwaters	Occupied	Clark Fork River (Section 2)	Clark Fork River Basin
31 (Map E)	Blackfoot River	Columbia Headwaters	Occupied	Blackfoot River	Clark Fork River Basin
32 (Map E)	Bitterroot River	Columbia Headwaters	Occupied	Bitterroot River	Clark Fork River Basin
33 (Map E)	Rock Creek	Columbia Headwaters	Occupied	Rock Creek	Clark Fork River Basin
34 (Map E)	Upper Clark Fork River	Columbia Headwaters	Occupied	Clark Fork River (Section 1)	Clark Fork River Basin
35 (Map E)	West Fork Bitterroot River	Columbia Headwaters	Occupied	West Fork Bitterroot River	Clark Fork River Basin

Final Recovery Plan (2015)				2002 and 2004 Draft Recovery Plans and 5-year Review (2008)	
Map Key in Appendix B	**Current Core Area**	**Current Recovery Unit**	**Area Status**	**Former Core Area**	**Former Recovery Unit**
1 (Map F)	Saint Mary River (in part)	Saint Mary	Occupied	Saint Mary River	Saint Mary-Belly River Basins
1 (Map F)	Saint Mary River (in part)	Saint Mary	Occupied	Lee Creek	Saint Mary-Belly River Basins
None	None	Saint Mary	N/A	Belly River	Saint Mary-Belly River Basins
2 (Map F)	Slide Lake	Saint Mary	Occupied	Slide Lake	Saint Mary-Belly River Basins
3 (Map F)	Cracker Lake	Saint Mary	Occupied	Cracker Lake	Saint Mary-Belly River Basins
4 (Map F)	Red Eagle Lake	Saint Mary	Occupied	Red Eagle Lake	Saint Mary-Belly River Basins

APPENDIX G. Role of the Bull Trout Recovery Plan in Interagency Consultation, Cooperation with States, Coordination with Tribes, Habitat Conservation Planning, Recovery Permits, and Protective Regulations

Recovery is both a process, consisting of discrete actions to conserve listed species, and a biological condition of listed species such that self-sustaining and self-regulating populations can be supported as persistent members of the ecosystems upon which they depend. The Endangered Species Act (Act) clearly envisions recovery plans as the central organizing tool for guiding each species' recovery. In that regard, the bull trout recovery plan has utility with respect to the implementation of Federal and non-Federal actions carried out under or subject to compliance with sections 4, 6, 7, and 10 of the Act, and in meeting our government-to-government relationship with Tribes. See section II.H (Recovery Actions) in the Bull Trout Recovery Plan for more information on cooperation with State, Federal and Tribal Governments.

Interagency Consultation

Under section 7(a)(1) of the Act, all Federal agencies are required to utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered and threatened species. In that regard, Federal agencies have a greater obligation than do other parties to conserve listed species, and are required to be pro-active over and above any requirements that may result pursuant to compliance with section 7(a)(2) of the Act (discussed below). A recovery plan can provide an implementation roadmap to accomplish these requirements. A recovery plan delineates both general management approaches and site-specific management actions that the Service has determined are necessary to recover and/or protect listed species. Recovery plans also establish objective, measurable criteria for downlisting or delisting the species, and estimate the time and cost required to carry out these actions. A recovery plan is not a regulatory document and does not obligate cooperating or other parties to undertake specific tasks or expend funds. It should be noted that recovery plans address all areas determined to be important for recovery of listed species and identify needed management measures to achieve recovery. Critical habitat designations are not necessarily intended to encompass a species' entire current range. Because critical habitat designations may exclude areas based on factors such as economic cost, approved or pending management plans, or encouragement of cooperative conservation partnerships with landowners, the areas identified in recovery plans as important for recovery of the species may not be designated as critical habitat. Areas that are important to the conservation of the species, but are outside the critical habitat designation, should be subject to conservation actions implemented under section 7(a)(1) of the Act.

Recovery plans also guide Federal agencies in developing conservation measures as part of their proposed actions and in fulfilling their obligations under section 7(a)(2) of the Act to avoid jeopardizing listed species and adverse modification of designated critical habitat. Recovery plans can help to inform revisions to proposed Federal actions to avoid those outcomes.

In the context of the section 7(a)(2) compliance process, the Service has developed analytical tools to address the sources of positive influences or stressors that expose both the bull trout and its designated critical habitat to both positive and negative effects, respectively, of Federal agency actions. Currently, we apply an analytical framework for bull trout jeopardy analyses that relies heavily on the importance of known core area populations to the survival and recovery of the bull trout. This analytical framework will need to be revised and updated to reflect the recovery criteria in the bull trout recovery plan. Specifically, the recovery criteria state that the Service will initiate an assessment of whether recovery has been achieved and delisting is warranted when the following has been accomplished in each recovery unit:

- For the Coastal, Mid-Columbia, and Upper Snake Recovery Units: Primary threats are effectively managed in at least 75 percent of all core areas, representing 75 percent or more of bull trout local populations within each of these three recovery units.

- For the Columbia Headwaters Recovery Unit: Primary threats are effectively managed in 75 percent of simple core areas and 75 percent of complex core areas, representing 75 percent or more of bull trout local populations in both simple and complex core areas.

- For the Klamath and Saint Mary Recovery Units, all primary threats are effectively managed in all existing core areas, representing all existing local populations. In addition, in the Klamath Recovery Unit, because 9 of 17 known local populations have already been extirpated and the remainder are significantly imperiled and require active management of threats, effective threat management is necessary in 100 percent of core areas, and the geographic range of bull trout within this recovery unit will need to be expanded through reestablishment of extirpated local populations.

- In recovery units where shared FMO habitat outside core areas has been identified, connectivity and habitat in shared FMO areas should be maintained in a condition sufficient for regular bull trout use and successful dispersal among the connecting core areas for those core areas to meet the criterion.

Core areas form the building blocks that provide conservation of the bull trout's evolutionary legacy as represented by major genetic groups. The analysis required by section 7(a)(2) of the Act is focused not only on these populations but also on the habitat conditions necessary to support reproduction, numbers and distribution of the bull trout. Generally, the jeopardy analysis focuses on the range-wide status of bull trout, the factors responsible for that condition (threats), and what is necessary for this species to survive and recover (criteria). An emphasis is placed on characterizing the condition of bull trout in the area affected by the proposed Federal action and the role of affected populations in the survival and recovery of bull trout. That context is then used to determine the significance of adverse and beneficial effects of the proposed Federal action and any cumulative effects for purposes of making the jeopardy determination.

In the bull trout recovery plan we recognize core areas as the population units that are necessary to provide for bull trout biological needs in relation to genetic and phenotypic diversity, and spreading the risk of extinction caused by stochastic events. Given the recovery criteria above, we also recognize that not all core areas may be essential to either the survival or recovery of bull trout. Although we encourage the conservation of all bull trout core areas, we also recognize that in some recovery units, recovery (and thus survival) of the species can be achieved without requiring threats to be effectively managed in every individual core area.

Each of the six recovery units identified in the bull trout recovery plan is individually necessary to conserve biological features that are necessary for long-term sustainability of the listed entity (NMFS and USFWS 2010). Moreover, "when an action appreciably impairs or precludes the capability of a recovery unit from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species" (USFWS and NMFS 1998). Thus, if a proposed Federal action is found to be incompatible with the viability and conservation function of an affected core area, and if (in consideration of the recovery criteria for its recovery unit and the role of that core area within the recovery unit) we find that particular core area must be conserved in order to conserve the recovery unit overall and the listed entity in the coterminous United States, then a jeopardy finding may be warranted. Similarly, under a section 7(a)(2) adverse modification analysis, a Federal action is analyzed for how it affects the primary constituent elements (PCEs) of bull trout critical habitat, and how it will influence the recovery support function of affected critical habitat units. Generally, the conservation role of bull trout critical habitat is to support viable core area populations. PCEs and critical habitat units are analyzed individually and at the range-wide scale. Bull trout critical habitat units are equivalent to one or more core areas.

When consulting under section 7(a)(2) on the effects of a proposed Federal action on designated critical habitat, an independent analysis is also conducted for jeopardy to the species when effects to the bull trout are predicted (USFWS 2010a). The Service has developed a tool to crosswalk the analysis for critical habitat to the jeopardy analysis since it is comparable in many cases. Analyses can inform each other; for example, in occupied bull trout habitat, any adverse modification determination could result in a jeopardy determination for the species. See Appendix E, Table 2 for additional information regarding integration of recovery and section 7 threats assessment tools and analytical approaches.

Habitat Conservation Planning

Because the issuance of incidental take permits under section 10(a)(1)(B) of the Act constitutes a Federal action, such actions are subject to the section 7(a)(2) consultation requirements as discussed above. Recovery plans can effectively inform, in part, the development of these permit actions. See section I.B.6, Factor D (Inadequacy of Existing Regulatory Mechanisms) in the bull trout recovery plan for more information on bull trout recovery and HCPs.

Tribal Government Consultation

All of our actions involving American Indian Tribal Governments, including our consultation and collaboration, will take place on a government-to-government basis and be consistent with applicable executive and secretarial orders, memoranda, and policies, including Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments" (November 6, 2000); Secretarial Order 3206, "American Indian Tribal Rights, Federal-Tribal Responsibilities, and the Endangered Species Act" (June 5, 1997); Presidential Memorandum (November 5, 2009); the U.S. Fish and Wildlife Service's Native American Policy (June 28, 1994), and the Endangered Species Act.

We recognize the special government-to-government relationship between the Federal government of the United States and American Indian Tribal governments derived from the Constitution of the United States, treaties, Supreme Court doctrine, and Federal statutes. We acknowledge American Indian Tribal governments as sovereign nations with inherent powers of self-governance.

We also recognize that American Indian Tribes have long worked to conserve and monitor bull trout and other native salmonids on their lands. The efforts of many Tribes have contributed to bull trout conservation and maintained the Tribal cultural values of the bull trout and its habitat. Many Tribal lands have been managed with a holistic perspective, including reserves, modified silvicultural practices, and riparian and aquatic habitat restoration efforts, and therefore can be islands of high quality habitat that support many species as well as healthy ecosystems.

We are committed to engaging in regular and meaningful consultation and collaboration with American Indian Tribal governments to determine what cooperative and voluntary measures Tribes may take to support bull trout recovery actions and address other recovery needs and opportunities for bull trout, recognizing the special status of Tribes and Tribal lands. Consistent with existing laws and policies, and to honor this spirit of consultation and collaboration, we will give deference whenever possible to Tribal recovery plans, habitat and modeling data, and other conservation efforts.

Cooperation with States

Section 6 of the Act facilitates collaboration in species conservation through cooperative agreements with State fish and wildlife agencies provided such states have adequate and active programs for the conservation of species. The Service maintains cooperative agreements with all five states that have bull trout. These states are authorized to implement their conservation programs to conserve bull trout, and any take of bull trout that may result is authorized through an associated section 7 consultation (USFWS 2000). States typically implement recovery-related actions that may take bull trout, such as scientific collecting, control of invasive species, and habitat restoration efforts. They may also facilitate actions by others that may take bull trout (for example, Federal or university fisheries scientists) through their authority to designate others as agents of the State. To understand the status of bull trout, the take and effects to bull trout populations and their habitat, and modifications or new actions to be covered under the section 7 consultation for these agreements, reporting and annual coordination may be necessary. New information in the form of newly listed species and critical habitat may require the reinitiation of section 7 consultation on these cooperative agreements.

Enhancement of Survival Permits

The Service issues permits authorizing take of bull trout associated with actions that may enhance the propagation or survival of the species, including scientific collecting or research by non-state entities or implementation of other recovery-related activities. These permits are issued under the authority of section 10(a)(1)(A) of the Act. For example, active habitat restoration projects such as stream bank stabilization, channel reconstruction, or sediment abatement projects by the Forest Service or through Federal Energy Regulatory Commission (FERC) mitigation programs often involve short-term impacts in order to achieve longer term objectives and are frequently permitted under section 10(a)(1)(A) of the Act. Take of bull trout in the course of scientific research may also be permitted through this method, including broad-scale or site-specific fisheries monitoring such as utilizing electrofishing or other collection methods to document the long-term benefits of habitat restoration or other effects of management. Section 7(a)(2) consultation is also completed for these Federal actions.

Protective Regulations

Upon listing of the Klamath Basin and Columbia River Basin DPSs of the bull trout in 1998 (USFWS 1998), the Service promulgated a special rule under section 4(d) of the Act that authorized take of bull trout consistent with State and Tribal fishing regulations existing at the time of listing. This rule was expanded to the entire range of bull trout in the coterminous U.S. in the 1999 listing rule (USFWS 1999a) (50 CFR 17.44 (w)), with the exception of the Jarbidge population for which take prohibitions were reinstated in 2001 (50 CFR 17.44 (x)). All five States prohibited direct harvest of bull trout through angling wherever they occurred, except for one location in Oregon, one in Montana, and several locations in Washington. In the 1999 listing rule (USFWS 1999a), we identified our intention to continue to work with States and Tribes in assessing whether fishing regulations at the time of listing are adequate to protect bull trout and in developing management plans and agreements with the objective of recovery. Modifications to the bull trout 4(d) rule to offer additional species management authority to States or Tribes may be considered in the future, at the discretion of the Service.

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