BULL TROUT
(*Salvelinus confluentus*)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Portland, Oregon

5-YEAR REVIEW

Bull trout / *Salvelinus confluentus*

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METHODOLOGY USED TO COMPLETE THIS 5-YEAR REVIEW

The U.S. Fish and Wildlife Service (Service) initiated a 5-year review on the status of bull trout in April 2004. The Service solicited information through an April 13, 2004, *Federal Register* notice (69 FR 19449) from all interested sources to assist with this review. The Service also met with staff of State fish and wildlife agencies to identify the information that the States could provide for use in the 5-year review process. Information from various federal agencies was also integrated into the analysis.

The States of Idaho, Montana, and Nevada submitted a combined report on the status of bull trout. The State of Idaho submitted a separate population viability analysis, which applied only to bull trout within the State of Idaho. The fish and wildlife agencies of Oregon and Washington each submitted reports. We also received comments from the public. The information contained within the various state reports, assessments, and the public comments were provided to the structured decision-making panelists (described below) and considered in the final recommendation.

The Service also developed its own assessment of the current status of bull trout using a model that ranked risk to bull trout in each of the 121 core areas relative to their vulnerability to extirpation. This assessment provided information that complemented the information provided by the State agencies, public and other interested entities.

In a meeting on March 7-9, 2005, the Service utilized a structured decision-making model to assess the available information using two panels. The first panel was made up of seven scientists from outside the Service with expertise in different academic disciplines relevant to the 5-year review. The Science Panel discussed the strengths and weaknesses of the various data, hypotheses, and opinions relative to the current status of bull trout, including the various State reports and the status assessment developed by Service staff. This panel addressed only the scientific aspects related to bull trout status and threats to evaluate the risk of extinction to bull trout. A second panel made up of seven Service managers observed and asked questions of the Science Panel. The Managers Panel also participated in policy discussions and discussed what should be the appropriate 5-year review recommendation.

Based on comments received from both the Science and Manager Panel, Service biologists revised the Service's assessment of bull trout status to provide clarification and include additional key information. The revised version was sent to the Science Panel for review; comments provided by the Science Panel and the revised status assessment were considered at a subsequent April 28-29, 2005, meeting of the Manager Panel. The Managers Panel applied their expertise along with Service policies and the ESA to make their determination whether or not new information suggests a change in the listing status of bull trout is warranted.

A draft 5-year review document was completed in August 2006, but the Service delayed release of the document to allow time to further consultation with the affected States, Native American tribes, and Federal agencies. In addition, the Service reevaluated its approach to listing bull trout under its Distinct Population Segment (DPS) policy. This document is a result of those efforts.

GENERAL INFORMATION

FR Notice announcing initiation of this review: April 13, 2004. 5-year review of the bull trout (69 FR 19449). Comment period extended on July 1, 2004 (69 FR 39949).

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Additionally, a Service scientist, **William Ardren** of the Abernathy Fish Technology Center, Conservation Genetics Laboratory, Abernathy, Washington, attended the meetings to provide a Service perspective on science issues in general and bull trout genetics in particular. At the second Manager's Panel meeting, he was joined by **Paul Wilson** of the Columbia River

Fisheries Protection Office, Vancouver, Washington, and **Jason Dunham** of the US Geological Survey, Corvallis, Oregon, as science experts who could advise and support the managers when science issues arose.

Cooperating Field Office(s):	Central Washington Field Office, Wenatchee, WA Klamath Falls Fish and Wildlife Office, Klamath Falls, OR Oregon Fish and Wildlife Office, Portland OR Central Oregon Field Office, Bend, OR Eastern Oregon Field Office, La Grande, OR Western Washington Fish and Wildlife Office, Lacey, WA Creston Fish and Wildlife Center, Kalispell, MT Nevada Fish and Wildlife Office, Reno, NV Snake River Fish and Wildlife Office, Boise, ID Upper Columbia Fish and Wildlife Office, Spokane, WA
Cooperating Region(s):	Region 1, Portland, OR Region 6, Denver, CO Region 8, Sacramento, CA

BACKGROUND

Existing Recovery Plan or Outline

Bull Trout Draft Recovery Plan for the Klamath River, Columbia River, and St. Mary-Belly River DPSs, 2002. Bull Trout Draft Recovery Plan for the Coastal-Puget Sound and Jarbidge River DPS, 2004. All bull trout draft recovery plans have received public comment and scientific peer review. Finalization of the plans has been held in abeyance pending completion of the 5-year review process.

Species Existing Recovery Priority Number

The recovery priority number for each of the five bull trout populations segments in the coterminous United States is 9C, indicating that: (1) these populations are distinct population segments of a species; (2) the five populations are subject to a moderate degree of threat(s); (3) the recovery potential is high; and (4) the degree of potential conflict during recovery is high.

Listing History

The distinct population segments of bull trout were listed as threatened in the Columbia and Klamath River basins (63 FR 31647, June 10, 1998 - Columbia/Klamath final rule; 63 FR 42757). The distinct population segment of bull trout in the Jarbidge River basin was emergency listed as endangered (63 FR 42757, August 11, 1998) and then listed as threatened (64 FR 17110, April 8, 1999).

Bull trout in the coterminous United States were listed as threatened on November 1, 1999 (64 FR 58910). The coterminous listing added 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 listing actions indicated above.

Associated Actions

A 4(d) rule addressing fishing activities authorized by State, National Park Service, and Native American Tribal fish and wildlife conservation laws and regulations, except in the Jarbidge River Basin in Nevada and Idaho, was promulgated in the 1999 coterminous listing. Critical habitat was designated for the Klamath River and Columbia River populations in 2004 (69 FR 59996). This rule became the subject of litigation and on June 18, 2005, the court granted a voluntary remand. Separately, a proposed critical habitat rule for the Coastal-Puget Sound, Jarbidge River, and Saint Mary-Belly River populations was released for public comment in 2004 (69 FR 35768). The Service published a final designation for the Klamath River, Columbia River, Coastal-Puget Sound, Jarbidge River, and Saint Mary-Belly River populations in a single rule on September 26, 2005.

Similarity of appearance is an issue in the Coastal-Puget Sound population area. Bull trout are sympatric with Dolly Varden (*Salvelinus malma*) in some of the drainages where they occur. Because the two species are virtually impossible to visually differentiate, the Washington Department of Fish and Wildlife (WDFW) currently manages bull trout and Dolly Varden together as "native char."

Review History

Oct 30, 1992	The Service received a petition to list bull trout as an endangered species throughout its range from the Friends of the Wild Swan, Alliance for the Wild Rockies, and the Swan View Coalition.
Jan 7, 1993	The Service received a second petition requesting the listing of bull trout in the Klamath River Basin from the Oregon Chapter of the American Fisheries Society.
May 17, 1993	The Service published in the *Federal Register* a 90-day petition finding determining that the petitioners had provided substantial information indicating that listing of bull trout may be warranted (58 FR 28849).
June 10, 1994	The Service published in the *Federal Register* a 12-month finding that listing was warranted for bull trout within the coterminous United States, but precluded by other higher priority work. Due to the lack or unavailability of information, the Service found that listing bull trout in Alaska and Canada was not warranted (59 FR 30254).
Nov 1, 1994	Two of the petitioners, Friends of the Wild Swan and Alliance for the Wild Rockies, filed a lawsuit challenging the 1994 finding.
June 12, 1995	The Service published in the *Federal Register* the recycled 12-month finding concluding that listing was still warranted but precluded (60 FR 30825).
June 22, 1995	The Oregon Federal District Court issued an order declaring the 1994 challenge to the original finding moot because the Service had issued a 1995 finding. The court instructed the plaintiffs to amend their complaint to challenge the 1995 finding if they so desired. The plaintiffs declined to amend their complaint and appealed to the Ninth Circuit Court of Appeals.
April 2, 1996	The Ninth Circuit Court of Appeals overturned the Oregon Federal District Court and remanded the case back to the District Court for further proceedings, ruling that this type of action was capable of repetition but evades judicial review.

Nov 13, 1996 The Oregon Federal District Court granted the plaintiffs' motion for summary judgment, directing the Service to reconsider the 1994 finding and respond to the court within 4 months. The ruling included specific direction to consider only the information in the Service record at the time of the original 1994 finding.

March 13, 1997 In compliance with the District Court order, the Service issued a reconsidered finding based solely on the 1994 record, which concluded that two populations of bull trout warranted listing (Klamath River and Columbia River population segments).

March 25, 1997 Plaintiffs petitioned the court to compel the Service to issue a proposed rule within 30 days to list the Klamath and Columbia River bull trout populations based on the 1994 record.

April 11, 1997 The Service and the plaintiffs signed an agreement stipulating that within 60 days the Service would complete a proposed rule to list the Klamath River population segment as endangered and the Columbia River population segment as threatened.

June 13, 1997 A proposed rule to list the Klamath River basin bull trout population segment as endangered and the Columbia River population segment as threatened was published in the *Federal Register* by the Service (62 FR 32268).

Dec 4, 1997 The Oregon Federal District Court ordered the Service to reconsider several aspects of the 1997 finding concerning listing of bull trout. The court directed the Service to consider whether listing of the bull trout is warranted throughout its range; whether listing is warranted throughout the coterminous United States; if the Service determines that listing throughout its range, or throughout the coterminous United States is not warranted, or is warranted but precluded; and whether listing of the Coastal-Puget Sound distinct population segment is warranted. The court subsequently directed the Service to prepare its response by June 12, 1998.

June 10, 1998 The Service published in the *Federal Register* a final rule to list the Klamath River and the Columbia River bull trout population segments as threatened under the Endangered Species Act (ESA) (63 FR 31647).

Aug 11, 1998 The Service published in the *Federal Register* an emergency-listing of the Jarbidge River (Idaho, Nevada) bull trout population segment as endangered after road crews from the Elko County Road Department destroyed 27 percent of the river's bull trout habitat while conducting unauthorized road construction activities (63 FR 42757).

April 8, 1999	The Service published a final rule in the *Federal Register* to list the Jarbidge River population of bull trout as threatened under the ESA (64 FR 17110).
Nov 1, 1999	The Service published a final rule in the *Federal Register* to list all bull trout in the coterminous United States as threatened (64 FR 58909).
Nov 29, 2002	The Service published in the *Federal Register* a notice of document availability for review and comment for the Draft Recovery Plan for the Three of the Five Distinct Population Segment of Bull Trout (Klamath River, Columbia River, and Saint Mary-Belly River populations) (67 FR 71439).
Nov 29, 2002	The Service published in the *Federal Register* a proposed rule for the designation of critical habitat for the Klamath River and Columbia River distinct population segments of bull trout and notice of availability of the draft recovery plan (67 FR 71235).
June 25, 2004	The Service published in the *Federal Register* a proposed rule for the designation of critical habitat for the Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River populations of bull trout (69 FR 35768).
July 1, 2004	The Service published in the *Federal Register* notices of document availability for review and comment for the draft Recovery Plans for the Coastal-Puget Sound (69 FR 39950) and Jarbidge River (69 FR 39951) distinct population segments of bull trout.
Oct 6, 2004	The Service published a final rule in the *Federal Register* on designation of critical habitat for the Klamath River and Columbia River populations of bull trout (69 FR 59995).
Dec 14, 2004	Alliance for the Wild Rockies *et al.* filed a complaint challenging the adequacy of the final critical habitat designation for the Klamath River and Columbia River bull trout populations. Our motion for partial voluntary remand was subsequently granted by the court with a final rule due by September 15, 2005.
May 3, 2005	The Service published a notice of the availability of the draft economic analysis (DEA) and reopening of a 30-day comment period until June 2, 2005 (70 FR 22835), for the Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River populations of bull trout.
May 25, 2005	The Service published in the *Federal Register* a final rule to open the comment period for the proposed and final designation of critical habitat for the Klamath River and Columbia River populations of bull trout (70 FR 29998).

Jun 6, 2005 The Service published a notice clarifying the reopening, until June 24, 2005, of the comment period for the proposed and final designation of critical habitat for the Klamath River and Columbia River bull trout populations (70 FR 32732).

Jun 27, 2005 Judge Jones extended the deadline for designating critical habitat for the Puget Sound-Coastal, Jarbidge River, and St. Mary-Belly River bull trout populations to September 15, 2005.

Sep 26, 2005 The Service published a final rule designating critical habitat for the Klamath River, Columbia River, Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River populations of bull trout (70 FR 56212)

August 3, 2006 The Service completed a draft 5-year review but delayed release to allow time to further consultation with the affected States, Native American tribes, and Federal agencies.

Most recent Species Status as reported in the Biennial Recovery Report to Congress

Species Status: (T, 9c, S)

Recovery Achieved: (1)

Reference Documents

Recovery Plans for the Klamath River, Columbia River, and St. Mary-Belly River populations of bull trout. U.S. Fish and Wildlife Service, Pacific Region, 2002. Draft Recovery Plans for the Jarbidge River and Coastal-Puget Sound populations of bull trout. U.S. Fish and Wildlife Service, Pacific Region, 2004. Critical Habitat for the Klamath River, Columbia River, Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River populations of bull trout (70 FR 56212).

REVIEW ANALYSIS

I. Distinct Population Segment Policy

The bull trout is listed in the lower 48 states, and is not listed in Canada, pursuant to the Service's DPS policy (USFWS 1996).

When the Service began listing bull trout under the Endangered Species Act (Act) in 1998 (USFWS 1998), 5 different DPS's were identified pursuant to the DPS policy: Coastal/Puget Sound; Klamath River; Columbia River; Jarbidge River Basin; and St. Mary/Belly River. In 1999, these five DPS's were combined into one DPS for the following reasons: (1) the DPS policy states that we should designate DPSs "sparingly", and (2) all five DPS's had the same "threatened" status. This led the Service to list bull trout as one DPS throughout the coterminous United States (USFWS 1999). In that rule we stated, in regard to the five original DPS's: " In recognition of the scientific basis for the identification of these bull trout population segments as DPS's, and for the purposes of consultation and recovery planning, we will continue to refer to these populations as DPS's. These DPS's will serve as interim recovery units in the absence of an approved recovery plan."

Our DPS policy requires that, "The appropriate application of the policy will also be considered in the 5-year reviews of the status of listed species required by section 4(c)(2) of the Act." Since the conterminous listing, new information suggests potential changes in the number of distinct population segments and their boundaries (e.g., Spruell et al., 2003). In addition to strong scientific evidence continuing to support identification of multiple population segments of bull trout, the Service and some State and Tribal partners have identified policy reasons for revisiting the Service's application of its DPS policy to bull trout. Advantages of designating multiple bull trout DPS's within the coterminous United States distribution of bull trout include: (a) focusing regulatory protection and recovery resources in those areas where it is most needed; (b) providing additional incentive at the local level to implement recovery actions due to the greater impact those actions would have on discrete DPS's, thus making recovery and delisting more realistic; and, (c) simplifying our section 7(a)(2) analyses.

Therefore, in this review the Service recommends evaluating designation of multiple bull trout DPS's. Following approval of this 5-year review the Service will initiate a new, separate status assessment effort to identify DPSs and evaluate their status. The Service's determination that "threatened" status remains warranted for conterminously listed bull trout will not predetermine the outcome of status assessments of multiple DPS's. Each DPS identified will be evaluated separately regarding its status under the Act. Any change in DPS boundaries or bull trout status will require a separate rulemaking process that will include an opportunity for public participation.

In addition, consistent with the recent Interior Department Solicitor's Opinion on, "The Meaning of, 'In Danger of Extinction Throughout All or a Significant Portion of its Range"' (USDOI, 2007), our new status assessment will explore what the appropriate entity or entities may be for protection under the Act.

II. Recovery Plan

There is no final recovery plan at this time. Draft recovery plans for the Klamath River, Columbia River, and St. Mary-Belly River populations were released in 2002. Draft recovery plans for the Coastal-Puget Sound and Jarbidge River populations were released in 2004. All bull trout draft recovery plans have been released for public comment and scientific peer review by the Western Division of the American Fisheries Society and representatives of several industry groups. Finalization of these draft plans has been held in abeyance pending completion of the 5-year review process.

III. New Information

Since the time of the listings of bull trout in 1998 and 1999 (63 FR 31647, 64 FR 17110, 64 FR 58910), a great deal of new information has been collected on the status of bull trout and its threats. In addition, several new analytical methods have been employed that have resulted in relevant new information. The new information is described in detail in several Service documents: draft recovery plans (USFWS 2002b, 2004b & 2004c), proposed and final critical habitat rules (USFWS 2002a; 2004a; 2004d, USFWS 2005c), USFWS Science Team Report (Whitesel *et al.* 2004), Bull Trout Core Area Templates (USFWS 2005a), and the Bull Trout Core Area Conservation Status Assessment (USFWS 2005b). 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 (IDFG 2004; Gamblin and Snyder 2004; Fuller 2005; Hagener 2005; Hanson 2005; Haskins 2005; IDFG 2005).

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, St. Mary-Belly Rivers and the Coastal-Puget Sound. 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[1].

A. Improved Analyses

Genetics

Since listing, advances in techniques in genetics have improved our understanding of the genetic relationships among bull trout populations. Spruell *et al.* (2003) described the genetic population structure of 65 bull trout populations from the northwestern United States, using four microsatellite loci. That analysis assessed genetic variation and described population variation among bull trout populations as relatively low, and

[1] The draft recovery plan (USFWS 2002b) identified a bull trout core area as the closest approximation of a biologically functioning unit for bull trout. Core areas require both habitat and bull trout to function, and the number and characteristics of local populations inhabiting a core area provide a relative indication of the core area's likelihood to persist. The draft recovery plan described 121 bull trout core areas across the species range in the five states.

variation between populations as relatively high. Spruell *et al.* (2003) also concluded 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 science associated with bull trout population structure and size and concluded that, "local bull trout populations tend to be more genetically distinct from each other than local populations of other salmonid species."

Telemetry and Tracking

Since listing, advancements in radio telemetry 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. This technology 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).

Bull Trout Core Area Conservation Status Assessment

In 2005, the Service assessed, for each of the 121 bull trout core areas, the conservation status of bull trout and their risk of vulnerability to extirpation. The model used to rank the relative risk to bull trout was based on a modification to Montana's application of the Natural Heritage Program's NatureServe Conservation Status Assessment Criteria (hereafter "Heritage"), which have been applied in previous assessments of fish status, including bull trout (Master *et al.* 2003; MNHP 2004). The model integrates four factors: population abundance, distribution, population trend, and threats. Details of the methodology, data, and results of the assessment are found in USFWS 2005a and USFWS 2005b and are described more fully in Section IV of this document. In addition, the assessment includes an evaluation of the life history composition and level of connectivity within each core area and the level of connectivity among core areas and Canada. The Bull Trout Core Area Conservation Status Assessment was presented as part of the bull trout 5-year review panel discussions held March 7-9 and April 28-29, 2005, in Portland, Oregon (USFWS 2005b).

Peer Review of Core Area Analysis

In the interval between the two panel meetings, five of the seven Science Panel members submitted written peer review of the Bull Trout Core Area Conservation Status Assessment (USFWS 2005b). The peer reviews were structured to respond to specific issues, collectively identified by the Science and Manager Panels in their March 7-9, 2005, meeting as potential concerns about the use of the Heritage ranking process for assessing bull trout core areas.

The peer reviewers unanimously agreed that the status assessment was a useful and informative way to assess risk to bull trout core areas, believing it generated, in the words of one reviewer, "educated approximations of risk in a standardized, scientific fashion."

The reviewers also concurred with the Service that the core area level was the appropriate scale at which to apply the assessment tool. They were less certain about, and some expressed reservations with, the ways in which the results of the assessment might be interpreted. They were unsure of the potential to "roll up" the core areas to an overall regional or rangewide assessment for bull trout.

The peer reviewers felt that the design of the Heritage ranking process, which assigned "low risk" point values to particular ranking attributes such as trend or abundance that were classified as "unknown" (due to a lack of core-area specific information), would result in an inherently lower ranking of overall core area risk. Some reviewers found this to be a potential flaw in the model and suggested potential remedies by assigning and testing a probabilistic framework, rule sets, or other fixes. Reviewers agreed that the optimistic output of the model should be taken into account when interpreting and applying the outcome of the assessment.

Reviewers agreed that, while this iteration of the risk assessment largely applied the standard Heritage ranking model, the few modifications that were made were considered valid. They felt that in future ranking efforts, the Service should work toward reducing the uncertainty in individual criteria and strive to bolster the quantitative measures, particularly in regard to assessing connectivity and threats. They felt that doing so would reduce the potential for compounding any bias or uncertainty and would provide a better tool for confidently applying the assessment at a larger scale. Specific suggestions were provided.

Reviewers agreed that sound logic and conservation biology theory were generally applied in this assessment. They recognized the limitations the Service encountered in interpreting disparate data sets, particularly with regards to bull trout distribution, abundance, and trend. While the reviewers did not generally advocate the use of professional judgment in certain aspects of the criteria and their application, they felt the ways in which the Service used professional judgment were generally sound and defensible, especially given the limitations of the data and the broad scale at which we were making our determination. They urged that future such efforts should work to minimize the use of professional judgment and strive to document the logic track, emphasizing transparency and repeatability in the process. They also noted the need to explicitly examine and document all assumptions.

Finally, the reviewers emphasized the importance of protecting unique populations, or those residing in unique environments, and agreed that migratory life history forms and connectivity, both within and among core areas, was vitally important. They felt that this review should "set the stage" for future assessments and that identifying areas of important data gaps and limitations in the existing methodology or its application were vital. They highlighted the need for more and better bull trout population trend information and monitoring as key to refining the methodology for future evaluations.

Decision Making

The Service convened a manager's panel, which observed the deliberations of the science panel and weighed all of the new information, including the state reports, assessments,

public comments, the core area status assessment and peer review comments. They then engaged in structured deliberations and exercises in a workshop setting to determine if a change in status was warranted. This approach is particularly valuable when uncertainty about the species is pronounced or there is scientific disagreement over issues such as the magnitude of the threats that exist. Through the use of risk modeling and input and comment from a scientific panel, the Service was better able to draw out the uncertainties and areas of disagreement and engage in informed deliberations about the species' status under the ESA. For this particular species, there are large areas where population abundance and trend are not well known; the Service used both a science panel and a manager's panel to ensure that a robust presentation of the information (or lack of such information) occurred, and that any recommendation on change of status would be fully informed. The managers undertook several exercises specifically intended to provoke thought and discussion on the biology of the species and examination of assumptions and beliefs about the appropriate regulatory context and management judgment.

B. Biology and Habitat

New information on biology and habitat since listing is provided in the draft recovery plans for bull trout (USFWS 2002b, 2004b, 2004c), which represent a collaborative effort between multiple stakeholders including Federal and State agencies, local governments, Tribes, and Canada. Additional new information is found in the bull trout critical habitat designations (USFWS 2002a, 2004a, 2004d, 2005c). The five States (Montana, Idaho, Nevada, Washington, and Oregon) also provided updated population and distribution information for core areas within the coterminous range of bull trout (IDFG 2004; Gamblin and Snyder 2004; Fuller 2005; Hagener 2005; Hanson 2005; Haskins 2005; IDFG 2005).

The availability of new information on the biology and habitat use of the species varies across and within core areas. Not all core area populations have been or are currently being monitored. Additional bull trout survey and monitoring efforts have occurred since listing, with various entities (e.g., U.S. Forest Service, Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife) continuing to expand upon these efforts. Distribution and life history information is generally available for all core areas, while additional information on population abundance and trend is now available for approximately 80 percent and 45 percent of the core areas, respectively.

To update the most recent information on bull trout status and their threats, the Service developed the Core Area Templates (USFWS 2005a). This document represents a compilation, core area by core area, of new information since listing on population status, threats, habitat, regulatory mechanisms, and conservation efforts. The new information was used in the bull trout core area conservation status assessment model to rank the conservation status of each of the 121 core areas (USFWS 2005b).

Population Abundance and Trend
It is not currently feasible to estimate rangewide bull trout abundance due to sampling variability, differences in methods used to estimate abundance, and, in some core areas, a complete lack of data. In the review process the following observations were made: most population trends are unknown; there is a broad distribution of risk across the landscape; most core area bull trout populations are at high risk or at risk; and the smallest core areas tend to be at a higher risk. Overall, no broad trend can be described for bull trout population abundance rangewide.

In general, geographically smaller core areas tend to have lower population numbers, while large adult populations (1,000 adults or more) tend to occur in larger core areas where the habitat is spatially well connected and well distributed throughout the core area. The quality and quantity of the habitat and its relative degree of connectivity play a major role in determining population size (USFWS 2005a).

As noted above, there are new data on population abundance for 80% of bull trout core areas. This information for each core area is found in the Core Area Templates (USFWS 2005a). In approximately 50% of bull trout core areas, abundance estimates were extrapolated from redd counts or from direct census counts that were provided by various state and federal agencies, draft recovery plans, and other entities. In some core areas, population estimates were calculated through a combination of limited data and expert knowledge by biologists familiar with the core areas. In other core areas, there was no data at all or insufficient data to estimate abundance.

Because there is a lack of data collected consistently over a number of years, no broad population trend can be described for bull trout rangewide. We had sufficient data to estimate population trends in only 55 core areas (45%), which are summarized in the Core Area Templates (USFWS 2005a) and in Section IV of this document (Table 1 and Figure 3).

Distribution
There has been no change in the distribution of bull trout in core areas since listing. However, the review was conducted at the broad core area level and thus, did not identify small, local changes in distribution. In the proposed critical habitat rules (USFWS 2002a and 2004a), bull trout distribution was described in terms of currently-occupied high quality habitat, known as Key Recovery Habitat. This represents the Service's best approximation of a mostly continuous stream (or lake) network, documented as occupied by bull trout (USFWS 2002a and 2004a).

Demographic Features
There continues to be limited information on demographic features across the coterminous range. Better information on age and size at maturity for specific local populations within core areas has recently been collected in some parts of the range (USFWS 2005a).

Genetics

Although there is new genetic information available since the time of listing, it has not significantly changed the overall view of population structure within and among core areas across the coterminous range. New genetic studies further support the theory that the bull trout is a wide-ranging species with multiple adaptable life history forms and a complex population structure reflecting a high degree of local site fidelity (Kanda and Allendorf 2001), and that there exists substantial genetic divergence between breeding populations (Dunham and Rieman 1999; Spruell *et al.* 2003). Whitesel *et al.* (2004) further analyzed the bull trout population structure and abundance and their conclusions also generally support this view. However, Whitesel *et al.* (2004) suggested that the original delineation of five distinct population segments might have been configured differently if the delineations were based solely on genetics.

Habitat Use and Condition

New information is available for local populations within some core areas on the complex migratory movements of fluvial, adfluvial, and anadromous life history forms (e.g., see USFWS 2002b; 2004a; 2004b, USFWS 2005a, and USFWS 2005b). This has increased our understanding of the extensive habitat use and connectivity requirements of the migratory life history form. Much of this new 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, Nelson et al. 2002, Neraas and Spruell 2001). There is also updated information available to assess the level of core area fragmentation across the coterminous range, which significantly influences the persistence of these migratory forms, though no conclusion can be reached whether or not fragmentation has increased or decreased since the time of listing. Additionally, there is new information on where habitat degradation/loss and/or habitat improvements have occurred within individual core areas since the time of listing (e.g., see USFWS 2002b; 2004b; 2004c, USFWS 2005a, and USFWS 2005b). Currently, there is no method available to evaluate the degree to which habitat restoration and/or degradation within core areas has had an effect on bull trout.

C. Threats, Conservation Measures, and Regulatory Mechanisms

Updated information since listing on threats to bull trout and their habitat is provided in the draft recovery plans (USFWS 2002b; 2004b; 2004c), Core Area Templates (USFWS 2005a), and in appendix D of the Bull Trout Core Area Conservation Status Assessment (USFWS 2005b). Many threats are widespread, while others are more regional in nature. The review analysis indicated that 75 of the 121 (64%) core areas face either imminent, substantial, or moderate threats. The core area threats are mapped in Section IV (Figure 4 and Table 1).

Changes in Habitat Condition

Changes in habitat condition vary across and within core areas. Some habitat improvements (e.g., passage improvements, stream restoration, diversion screening, road decommissioning) have occurred at the local population level within individual core areas since the time of listing, however, no monitoring is in place to measure results and their effects to bull trout. In the future, some connectivity improvements may occur

under Federal Energy Regulatory Commission relicensing agreements and planned habitat restoration activities such as culvert replacements that are being undertaken by the Forest Service and Bureau of Land Management. In other areas, modification and destruction of habitat continue to threaten bull trout from a wide array of ongoing land uses such as forest management, road building, and development. In the Coastal-Puget Sound region, degradation to nearshore marine foraging, migration, and overwintering habitats is an increasing threat for the anadromous life history form. Fragmentation of habitat from dams, water withdrawals, diversion structures, culverts, thermal barriers, and other conditions continues to be a concern with fifty-seven percent of core areas (n=69) across the coterminous range having been characterized as having low to moderate connectivity (USFWS 2005b). Approximately 21 percent of the core areas (n=25) occur within National Parks or designated wilderness and remain largely intact, though many of these are quite small (if the area of occupancy is small, it is more vulnerable to negative effects from localized events). Overall, the information indicates that connectivity of habitat within and among core areas is low (USFWS 2005b).

Incidental Harvest

Across the coterminous range, directed bull trout fisheries continue to be restrictive, occurring in only those areas with relatively large bull trout populations. Incidental harvest can occur across the range of bull trout, with the risk of incidental catch being relative to the level of target species fishing effort. The threat of harvest has not significantly increased since the time of listing, as most waters have been closed to bull trout angling since that time.

Disease or predation

At the time of listing disease and predation were not identified as significant threats. The status of these threats has not been changed since listing but remain threats to be monitored. Some predation threats are identified under factor “e, other natural or manmade factors affecting its continued existence.”

Regulatory mechanisms

The implementation and effectiveness of regulatory mechanisms vary across the coterminous range. Some State Forest practices rules have been updated for the protection of threatened, endangered, and sensitive species. We list here a brief summary of all State forest practices rules that benefit bull trout when implemented and note which have been updated since listing:

Montana

The Montana Streamside Management Zone Act regulations, implemented in 1993, mandates a 50-100 foot zone around streams, lakes and wetlands where timber harvest, broadcast burning, equipment operation, road construction, slash deposition, and toxic material handling are regulated. There are many other specific provisions in these regulations.

Idaho

The Idaho Forest Practices Act, enacted in 1974 and last amended in 1991, established Idaho Streamside Protection Zones of 30 to 75 feet where tree retention, shade retention, stream crossings, equipment operation, and ground-based skidding are regulated. There are many other specific provisions in these regulations.
The Snake River Basin Adjudication Idaho Forestry Program is in development and will supplement the existing Idaho Forestry Program. The objective of the supplemental forestry program is the protection of listed salmon and bull trout, and private landowners in the Salmon/Clearwater River basins will be encouraged to participate.

Oregon

The Oregon Forest Practices Act, enacted in 1972 and amended numerous times through 2003, addresses, in part, roads, landslide potential, chemical applications, reforestation, and aquatic protection. It established Riparian Management Areas (RMA) of 100 feet from streams and lakes and 300 feet from wetlands; requires riparian area tree retention; restricts mechanical equipment within the RMA; and requires State Forester approval of a written plan for harvest activities within the RMA.

Washington

The Washington Forest Practices Act was enacted in 1974 and new Emergency Forest and Fish Rules (FFR) were adopted in 2003. Combined, they mandate wetland management zones of 25 to 100 feet and riparian management zones (RMZ) of 75 to 200 feet; require varying degrees of live and down tree retention and shade retention; limits road construction and equipment entry in RMZ; and prohibits activity in channel migration zones except stream crossing road construction and yarding activities. The Washington Department of Natural Resources Forest Practices Habitat Conservation Plan, which implements FFR, was completed and became effective in 2006.

Nevada

The Nevada Forest Practice and Reforestation Act (Nevada Revised Statutes [NRS] 528) of 1955, as amended, establishes minimum standards of forest practice and requires compliance by every timber owner or operator in order to promote sustained productivity of forests in Nevada and to preserve the natural water supply in the interests of the economic welfare of the State. This statute outlines logging permit and application requirements and prohibits certain activities near bodies of water. No felling trees, skidding, rigging or construction of tractor or truck roads or landings, or the operation of vehicles may take place within 200 feet of any lake, reservoir, stream or other body of water unless a variance is first obtained from the State Forester, Director of Wildlife and the State Engineer. However, little, if any, timber harvest activity occurs on private land adjacent to occupied bull trout habitat, so NRS 528 has little to no effect on bull trout. This act has not been updated since 1955.

Conservation Measures

State agencies are specifically addressing bull trout through:

- Washington Bull Trout and Dolly Varden Management Plan developed in 2000.
- Montana Bull Trout Restoration Plan (Bull Trout Restoration Team appointed in 1994, and plan completed in 2000).
- Oregon Native Fish Conservation Policy (developed in 2004).
- Nevada Species Management Plan for Bull Trout (developed in 2005).
- State of Idaho Bull Trout Conservation Plan (developed in 1996); the watershed advisory group drafted 21 problem assessments throughout Idaho, which address all 59 key watersheds. To date, a conservation plan has been completed for one of the 21 key watersheds (Pend Oreille).

Habitat Conservation Plans

Habitat Conservation Plans (HCP) have resulted in land management practices that exceed State regulatory requirements. Habitat conservation plans addressing bull trout cover approximately 472 stream miles of aquatic habitat, or approximately 2.6 percent of the Key Recovery Habitat across Montana, Oregon, Washington, Nevada, and Idaho. A summary of those HCPs addressing bull trout follows:

Plum Creek Native Fish HCP

The permit for this HCP was issued and the implementation agreement signed in 2000. This HCP covers approximately 230 stream miles of occupied bull trout habitat in seven core areas in western Montana. Lands covered by the Plum Creek HCP occupy major portions of bull trout spawning and rearing watersheds in three of those core areas (Swan, Blackfoot, Clearwater). The HCP implements existing State forest practice regulations plus additional commitments to avoid disturbance and leave trees and other vegetation along streams with bull trout and other native fish; reduce grazing and its effects; manage roads to reduce impacts, plan land use to minimize development along bull trout streams, and adapt management when and where necessary.

Washington Department of Natural Resources HCP

This HCP was approved by the Service in 1997, and the implementation agreement was signed in 1999. This HCP covers approximately 150 stream miles of occupied bull trout habitat across 15 core areas in Washington, and enhances timber harvest conservation commitments over State regulations (expanded riparian management zones, expanded wetland protection), and expands road management commitments over State regulations. Bull trout are not covered under the HCP on the east side (3 of the 15 core areas), nor are any other aquatic species. East of the Cascade Crest, the Department of Natural Resources (DNR) is therefore required to follow State forest practice rules for riparian conservation. The DNR HCP lands on the west side of the Olympic Peninsula are managed as the Olympic Experimental State Forest. Conservation approaches here are similar to other areas of the HCP west of the Cascade Crest.

City of Seattle Cedar River Watershed HCP

In April 2000, The Cedar River Watershed HCP was completed and an incidental take permit was issued to the City of Seattle. The City of Seattle HCP, which falls within a single core area, addresses water management issues related to bull trout and includes

bull trout research and monitoring. The HCP is designed to manage water levels in Chester Morse Lake and Masonry Dam Reservoir to benefit instream flows in the lower river and bull trout spawning access to lake tributaries, and to manage 90,000 acres in the upper Cedar River as an ecological reserve.

Tacoma Water HCP

The Tacoma Water Green River Water Supply Operations and Watershed Protection HCP were completed July 2001. The Tacoma Water HCP, which falls within foraging, migratory and overwintering (FMO) habitat of the Green River, also addresses water management issues related to anadromous salmonids. The main features of this HCP include an upstream fish-passage facility which will open up 220 square miles of previously blocked fish habitat; sponsorship and funding for a downstream fish-passage facility at the Corps of Engineers Howard Hanson Dam; water-flow improvements; improved riparian forest management on Tacoma's lands; and several major habitat restoration projects.

Green Diamond HCP

The Green Diamond HCP (formerly referred to as the Simpson Timber HCP) was completed October 2000. This HCP, which falls within a single core area, is designed to conserve riparian forests, improve water quality, prevent management-related hill-slope instability, and address hydrological maturity of small subbasins.

Consultations

In response to the listing of bull trout, Federal agencies consult with the USFWS on the effects of their management and operations on bull trout and their habitat. Between the time of listing and 2003, approximately 200 formal consultations occurred. Ongoing land management plans (primarily Bureau of Land Management and Forest Service) and facility operations (primarily U.S. Army Corps of Engineers, Bonneville Power Administration, Bureau of Reclamation, and Federal Energy Regulatory Commission) include provisions to minimize adverse effects to bull trout, where possible, and avoid jeopardizing the species.

Federal Land Management Plans

PACFISH is the Interim Strategy for Managing Anadromous Fish-Producing Watersheds and includes Federal lands in Western Oregon and Washington, Idaho, and Portions of California. INFISH is the Interim Strategy for Managing Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana, and Portions of Nevada. Each strategy amended Forest Service (USFS) Land and Resource Management Plans and Bureau of Land Management (BLM) Resource Management Plans. Together PACFISH and INFISH cover thousands of miles of waterways within 16 million acres and provide a system for reducing effects from land management activities to aquatic resources through riparian management goals, landscape scale interim riparian management objectives, riparian habitat conservation areas, riparian standards, watershed analysis, and the designation of Key and Priority watersheds. These interim strategies have been in place since 1992 and are part of the management plans for the BLM and USFS lands.

The Interior Columbia Basin Management Plan (ICBMP) is the strategy that replaces the PACFISH and INFISH interim strategies. The Southwest Idaho Land and Resource Management Plan (LRMP) is the first LRMP under the strategy and provides measures that protect and restore soil, water, riparian and aquatic resources during project implementation while providing flexibility to address both short- and long-term social and economic goals on 6.6 million acres of National Forest lands. This plan includes a long-term Aquatic Conservation Strategy that focuses restoration dollars in priority subwatersheds identified as important to achieving ESA, Tribal, and Clean Water Act goals. The Southwest Idaho LRMP replaces the interim PACFISH/INFISH strategies and adds additional conservation elements, specifically, providing an ecosystem management foundation, a prioritization for restoration integrated across multiple scales, and adaptable active, passive and conservation management strategies that address both protection and restoration of habitat and 303(d) stream segments.

The Southeast Oregon Resource Management Plan (SEORMP) and Record of Decision is the second LRMP under the ICBMP strategy which describes the long-term (20+ years) plan for managing the public lands within the Malheur and Jordan Resource Areas of the Vale District. The SEORMP is a general resource management plan for 4.6 million acres of BLM administered public lands primarily in Malheur County with some acreage in Grant and Harney Counties, Oregon. The SEORMP contains resource objectives, land use allocations, management actions and direction needed to achieve program goals. Under the plan riparian areas, floodplains, and wetlands will be managed to restore, protect, or improve their natural functions relating to water storage, groundwater recharge, water quality, and fish and wildlife values.

The Northwest Forest Plan covers 24.5 million acres in Washington, Oregon, and northern California. The Aquatic Conservation Strategy (ACS) is a component of the Northwest Forest Plan. It was developed to restore and maintain the ecological health of watersheds and the aquatic ecosystems. The four main components of the ACS (Riparian Reserves, Watershed Analysis, Key Watersheds, and Watershed Restoration) are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems.

It is the objective of the Forest Service and the Bureau of Land Management to manage and maintain habitat and, where feasible, to restore habitats that are degraded. These plans provide for the protection of areas that could contribute to the recovery of fish and, overall, improve riparian habitat and water quality throughout the basin. These objectives are accomplished through such activities as closing and rehabilitating roads, replacing culverts, changing grazing and logging practices, and re-planting native vegetation along streams and rivers.

Nonnative Fish Introductions

Nonnative fish (especially lake trout and brook trout) introductions and their increasing distribution as a result of natural dispersal from 20th century introductions continue to threaten bull trout through predation, competition, and, in some cases, hybridization. Lake trout have expanded their distribution and abundance in some core areas and have been detected in at least three additional core areas in northwest Montana since the time

of listing (USFWS 2005a). Lake trout are replacing bull trout populations in some areas where the habitat is largely protected, such as Glacier National Park (Fredenberg 2002). Brook trout, with their apparent competitive advantage over bull trout in degraded habitats, continue to threaten bull trout through competition and hybridization, especially in areas where habitat conditions continue to decline. In some core areas, distribution of brook trout is greater than previously thought or documented at the time of listing (USFWS 2005a). Predatory interactions with other nonnative species such as brown trout and northern pike are an increasing concern for bull trout in some core areas (Zollweg 1998, Vidergar 2000, Kleinschmidt and Pratt 2001, Muhlfeld et al. 2000, Berg 2003, Bernall and Moran 2004).

IV. Bull Trout Core Area Conservation Status Assessment

We conducted a core area status assessment using a modification of the Natural Heritage Program's ranking model (Master et al. 2003). This analysis ranked by core area the extirpation risk of bull trout. Data used to rank core areas consisted of updated information on population abundance, distribution, population trend, and threats to bull trout which were summarized by core area in the Core Area Templates document (USFWS 2005a; Table 1). Complete details of the assessment are described in the Bull Trout Core Area Assessment (USFWS 2005b).

Population Abundance

Population values used in the core area assessment were based on conservative estimates for the number of adults. As noted in Section B above, in approximately half of the core areas, adult numbers were either assessed directly or extrapolated from redd counts. In about 30% of core areas, we supplemented the limited available population data with information from biologists with knowledge and experience with those core areas, which allowed us to accurately place those core areas into broad categories for estimated abundance.

In 24 of the 121 core areas (20%) where data were unavailable, the population size for a core area was treated as an unknown. Those populations classified as unknown in size were scored in the core area assessment as if they had 10,000 or more adult bull trout as is required in the Natural Heritage Program protocols (Master et al. 2003). This likely resulted in an overestimate of population abundance in most of those 24 core areas because habitat availability would likely restrict the abundance in those core areas to fewer than 10,000 adults.

The Natural Heritage's ranking model used in the core area assessment requires assigning population abundance values to one of the broad categories listed below. Based on population abundance estimates described above, we categorized the population sizes in the 121 bull trout core areas as follows (USFWS 2005b):

Number of adults	Number of core areas
1-50	15
50-250	39
250-1,000	27
1,000-2,500	12
2,500-10,000	3
10,000-100,000	1
Unknown	24
Total number of core areas	121

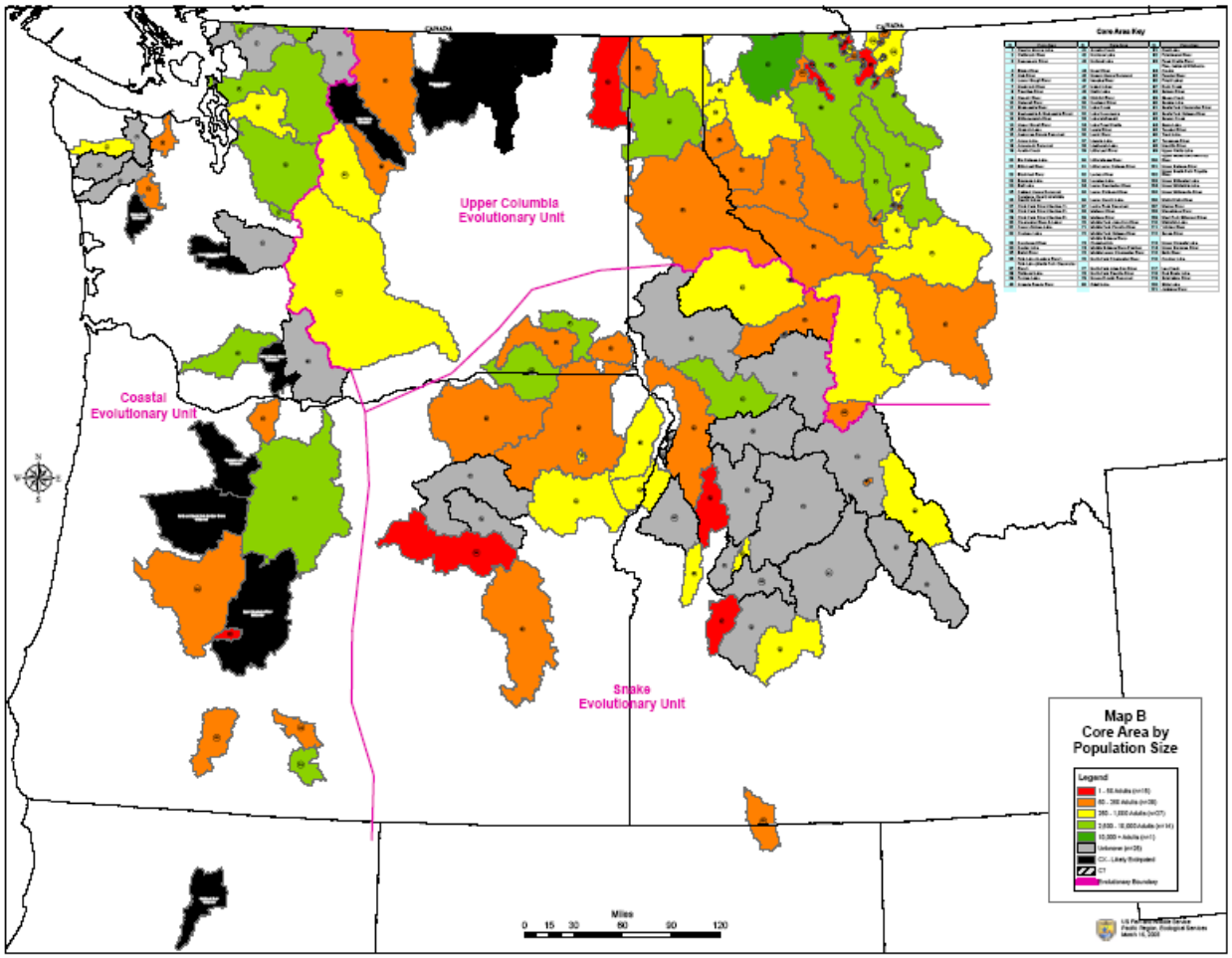
If we use the variable abundance estimates above and we assume that 24 "unknown" core area populations are distributed similarly to the 97 "known" populations, we can sum the number of core areas and calculate a theoretical upper and lower limit to adult bull trout abundance. That analysis indicates there could be between 48,000 and 247,000 adult bull trout in the U.S. portion of the range. These totals include estimates for U.S. core areas that extend into Canada, but not those that are wholly in Canada. The core area population data are displayed in Figure 1.

Geographic Distribution

Distribution values input into the Natural Heritage model were based on Key Recovery Habitat. Using the GIS layer of Key Recovery Habitat, the Service was able to categorize the extent of occupancy for the 121 bull trout core areas into one of the broad categories used by the Natural Heritage's model listed below:

Extent of habitat	Number of core areas
<4 km (~2.5 miles)	0
4-40 km (~2.5-25 miles)	22
40-200 km (~25-125 miles)	39
200-1,000 km (~125-620 miles)	5
1,000-5,000 km (~620-3,000 miles)	15
Unknown	0
Total number of core areas	121

Figure 1. Map of Core Areas by Population Size (red=0-50 adults; orange=50-250 adults; yellow=250-1000 adults; light green=2,500-10,000 adults; dark green=10,000+ adults; gray=unknown; black=likely extirpated).



The Key Recovery Habitat includes, for each core area, the identification of foraging and overwintering habitats, migratory corridors, and spawning and rearing areas. Spawning and rearing areas for over 600 local populations of bull trout have been identified. In identifying these habitats, the Service recognized that distribution of bull trout likely never approached 100 percent of the watershed in many of the core areas. Bull trout naturally occur in a patchy fashion on the landscape. Their distribution was (and is) naturally variable by core area, depending on the presence of geologic features, slope, elevation, aspect, water temperature, and other factors (Rieman *et al.* 1997).

A total of 42 core areas, each containing between 100 and 300 miles (~160-480 km) of Key Recovery Habitat, make up the mode of the distribution. Only one core area (Middle Fork Salmon River) contained over 1,000 miles of Key Recovery Habitat (n = 1,011). Fourteen other core areas each contained over 200 miles of Key Recovery Habitat as well as suitable lake habitat or marine nearshore habitat. The second highest amount of Key Recovery Habitat was 691 miles (in the Upper Salmon River core area); 5 of the 121 core areas exceeded 500 miles.

Significant portions of eight core areas (Chilliwack River, Upper Skagit River, Kootenai River, Lake Koocanusa, Flathead Lake, Belly River, Lee Creek, and Saint Mary River) are within British Columbia and Alberta, Canada. Distribution estimates do not include those Canadian habitats due to incomplete knowledge of bull trout distribution within Canada, but in most cases, the distribution category would not change due to the broad categorical ranges. The distribution map is shown in Figure 2.

Short-Term Abundance Trend

The Service assembled existing monitoring data, mostly collected by States and other contributors (e.g., IDFG and MFWP 2005), and evaluated the complete extent of available information for input into the Natural Heritage model. We used a minimum of 5 years continuous data as the standard for assessing trends. The longest-term data sets extend back about 25 years. A bull trout generation is roughly 5 to 7 years and, therefore, a period of 5 to 25 years approximates roughly 1 to 5 bull trout generations. Where data sets longer than 5 years were available, greater emphasis was placed on the most recent 5-year period (latest generation) in assessing the trend.

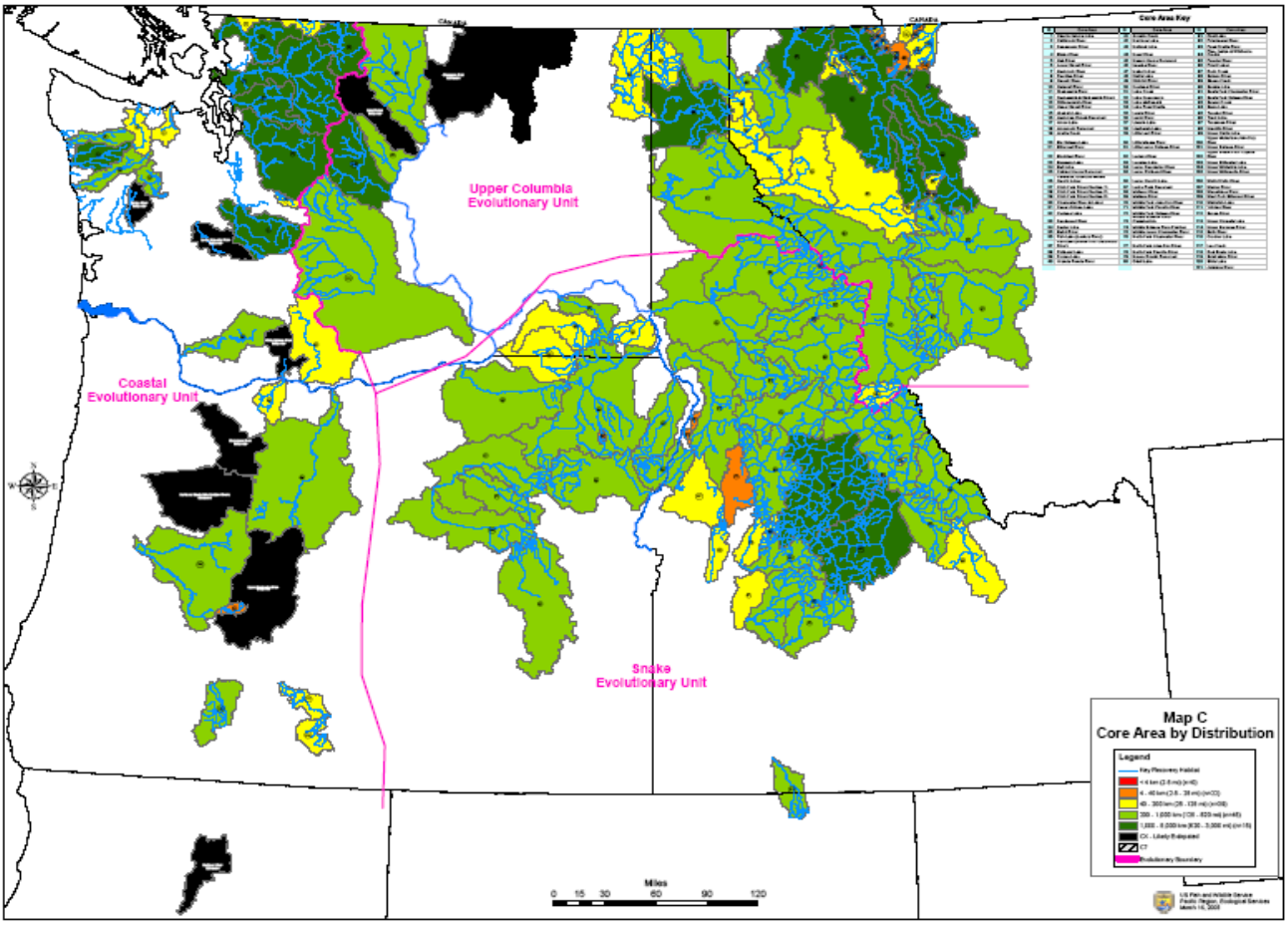
The quality of the trend information was highly uncertain due to the extremely variable nature of the data sets, the lack of consistency in methods and protocols (e.g., snorkel counts, redd counts, weir counts), and the relatively wide range in the proportion of each core area that was assessed. Several authors have previously cautioned about reliability, repeatability, and observer error in redd counts (see Maxell 1999; Dunham *et al.* 2000).

Natural variability in fish populations can exceed 100 percent from year to year and other factors such as streamflow, weather patterns, and partial barriers (e.g., beaver dams) or complete barriers (e.g., dewatered reaches) may redistribute spawning bull trout. Bull trout are particularly susceptible to these factors because they spawn in the late fall when spawning streams are typically at or near seasonal low flow volume. Using the best available scientific data, an approximation of bull trout population trend, assigned by knowledgeable biologists based on the partial count data that are available and deemed reliable, was determined to be the most accurate rating we can achieve.

Consequently, for each core area the assignment of population trend into one of the categories used in the Natural Heritage's model was made by a biologist with local knowledge of the core area and the population data set being considered. Using a standardized methodology (USFWS 2005b), the Service categorized the population trend in the 121 bull trout core areas as follows:

Trend category	Number of core areas
Severely Declining	4
Very Rapidly Declining	6
Rapidly Declining	4
Declining	9
Stable	18
Increasing	14
Unknown	66
Total number of core areas	121

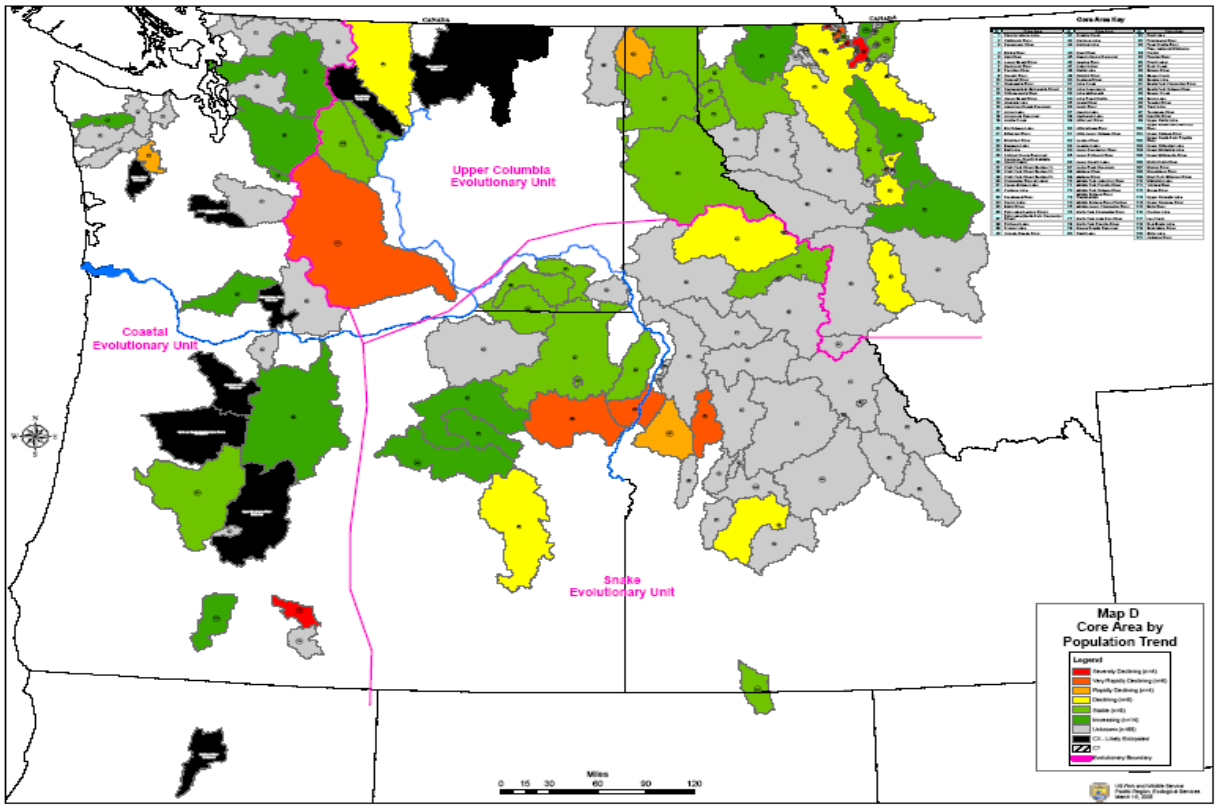
Figure 2. Map of Core Areas by Distribution (orange=4-40 km (~2.5-25 miles); yellow=40-200 km (~25-125 miles); light green=200-1,000 km (~125-620 miles); dark green=1,000-5,000 km (~620-3,000 miles); black=likely extirpated).



As noted above, data were inadequate in over half of the 121 bull trout core areas to estimate the short-term population trend. In those cases there were either no monitoring data, or data were not collected in a consistent fashion; the data that existed were intermittent or sporadic and did not provide a continuous record (at least 5 years); or the data were available but highly variable and we could not assess a trend with any degree of confidence.

Among the 55 core areas where trend estimates were made (representing 45 percent of all core areas) approximately equal numbers of core areas were determined to be stable (n = 18), increasing (n = 14) and decreasing at various rates (n = 23) (Figure 3). From this analysis, we might infer that the overall trend in bull trout populations across their range was neither increasing nor decreasing. However, the quantity and quality of population trend data are not sufficient to justify any conclusions about the overall trend of bull trout populations since the time of listing.

Figure 3. Map of Core Areas by Population Trend (red=severely declining; dark orange=very rapidly declining; light orange=rapidly declining; yellow=declining; light green=stable; dark green=increasing; gray=unknown; black=likely extirpated).



Threats

Threats to bull trout were quantified by core area for input into the Natural Heritage's Program ranking model. The potential range of threats is large and for each of the 121 core areas a distinct set of variables comes into play. In part, the existing status of bull trout in a given core area (population abundance, distribution, and trend) is a direct reflection of the past and current threats and a measure of how those threats are arrayed both spatially and temporally on the landscape.

The threat consideration in the core area assessment is intended to address the present and future status of the core area. The Natural Heritage Program rank criterion uses three elements of threat, described as "severity," "scope," and "immediacy." Each of the three categories is ranked independently as high, moderate, or low (insignificant). With three elements and three categories there are 27 possible combinations. Those 27

combinations are combined into seven risk categories (plus one "unknown" risk category). The following discussion describes how the three categories were applied in the Bull Trout Core Area Conservation Status Assessment (USFWS 2005b).

Severity

Severity captures the degree to which a threat impacts the population and the degree to which the threat is reversible. High severity indicates the threat is likely to result in substantial and irreversible losses of bull trout populations or habitat. One example, in the context of bull trout, is the establishment of a reproducing lake trout population in an adfluvial core area, which is especially severe and likely irreversible in small core areas where habitat is limited (Donald and Alger 1993, Fredenberg 2002). Another example of a high severity threat is the construction of a dam that would create a warm-water reservoir unsuitable for bull trout and that would also inundate or eliminate access to important spawning and rearing habitat.

A threat of moderate severity is one likely to result in major reductions in the population or long-term loss of habitat that will require in the neighborhood of 50 to 100 years to recover. Examples of moderate severity include major irrigation withdrawals or watershed impacts due to timber harvest or grazing that could be minimized over a period of time after the initial impact. In scoring severity, some judgment must be used to interpret the degree and longevity of the impact and interpret the appropriate rank between categories. If only a portion of a core area is likely to be affected, the threat is more likely to be moderate in severity. For example, major urban development or toxic runoff from a mining project may have irreversible impacts, but affect only a portion of a core area. The severity of these types of impacts would likely be moderate because the threat will not be spread to other portions of the core area.

A threat of low severity is one in which a reduction in population or habitat may occur, but the results are likely minor in extent or reversible in as few as 10 to 50 years. Examples might include minor impacts due to current timber management or roads. Threats of insignificant severity are rated the same as low severity and occur in circumstances where no reduction of population or degradation of habitat is foreseeable.

Scope

Scope refers to the proportion of the core area affected by a threat. Under the ranking protocol used in the Bull Trout Core Area Conservation Status Assessment (USFWS 2005b), scope was characterized as high (60 percent), moderate (20 to 60 percent), and low (5 to 20 percent); threats affecting less than 5 percent of a core area were considered insignificant. Assessment of scope was also based on the nature and location of the threat. A threat of high severity that affects only the spawning and rearing habitat may affect only a minor portion of the entire core area but may devastate the population. For that reason, the scope ranking is subject to modification based on local expertise that can assess the impact of the location of a threat in addition to how widespread it is. Essentially, the analysis and ranking of scope took into account the most sensitive portion of the ecosystem, which would typically be the spawning and rearing habitat for bull trout. Other sensitive portions of the ecosystem included key migration corridors through which migratory individuals must pass to complete their life cycle.

Immediacy
The ranking for immediacy of threat was a straightforward analysis of the operational timeframe of the threat. A rank of high immediacy meant the threat was operational immediately or within a year. For a rank of moderate immediacy, the threats would be operational in 2 to 5 years, and for a rank of low immediacy, the threats were estimated to be operational in 5 to 20 years. A threat was considered insignificant relative to immediacy if it was not likely to be operational within 20 years. For specific projects such as mines, timber sales, or similar activities, the classification of immediacy was rather transparent. For threats more biological in nature, such as nonnative species introductions or disease considerations, more careful evaluation and some subjectivity was required in order to assess a rank. Best professional judgment by biologists familiar with the core area was often used to judge the immediacy of a biological threat.

Synthesis of Severity, Scope, and Immediacy
The Natural Heritage Program criteria attaches greatest significance to the severity of the threat, followed by scope and then immediacy in synthesizing the three threat categories into eight rank classifications. For bull trout, this rationale seemed appropriate as threats of high severity are often likely to be long-lasting. Bull trout have relatively low inherent capacity to rebound from low population levels, in part due to high age at maturity and very specific habitat requirements. The final threat ranking categories are summarized in narrative format to describe the overall condition of threats we determined to be operating on the core area for the present and near future (see the details of scoring explained in Bull Trout Core Area Conservation Status Assessment (USFWS 2005b)).

We assigned the following ranks for threats to the 121 bull trout core areas:

Threat category	Number of core areas
Substantial, imminent threat	44
Moderate, imminent threat	31
Substantial, non-imminent threat	3
Moderate, non-imminent threat	7
Localized, substantial threat	2
Widespread, low-severity threat	19
Slightly threatened	8
Unthreatened	5
Unknown	2
Total number of core areas	121

Service biologists conducting this exercise concluded the vast majority of core areas had operative threats that should be currently categorized as high or moderate severity (USFWS 2005b). About one-fourth of core areas were scored high for severity (n = 29). Those core areas tended to also have high scope (n = 27) and high immediacy values (n = 24).

Conversely, about the same number of core areas were ranked at the other end of the threat scale and scored low or insignificant for severity (n = 31). These core areas tended to have variable ratings for scope but most had insignificant, low or moderate (n = 26) values. They also tended to have low or insignificant immediacy in the threats that were characterized (n = 24).

In about half of all core areas the severity of threat was considered moderate (n = 59). Scope and immediacy was mostly moderate or high in these core areas. Core area threats are mapped below and summarized by core area in Figure 4 below.

Summary Results

In addition to the four variables described above (population abundance, distribution, population trend, and threats), two other variables, environmental specificity and intrinsic vulnerability, are input into the Natural Heritage Program's ranking model to determine the overall ranking of each of the 121 bull trout core areas. Environmental specificity and intrinsic vulnerability are fixed values that do not vary by core area. Using the Natural Heritage Program's descriptions for these variables, bull trout are considered narrow specialists and moderately vulnerable (USFWS 2005b).

Descriptions of the final ranking categories for the bull trout core areas from the Bull Trout Core Area Conservation Status Assessment (USFWS 2005b) are given below:

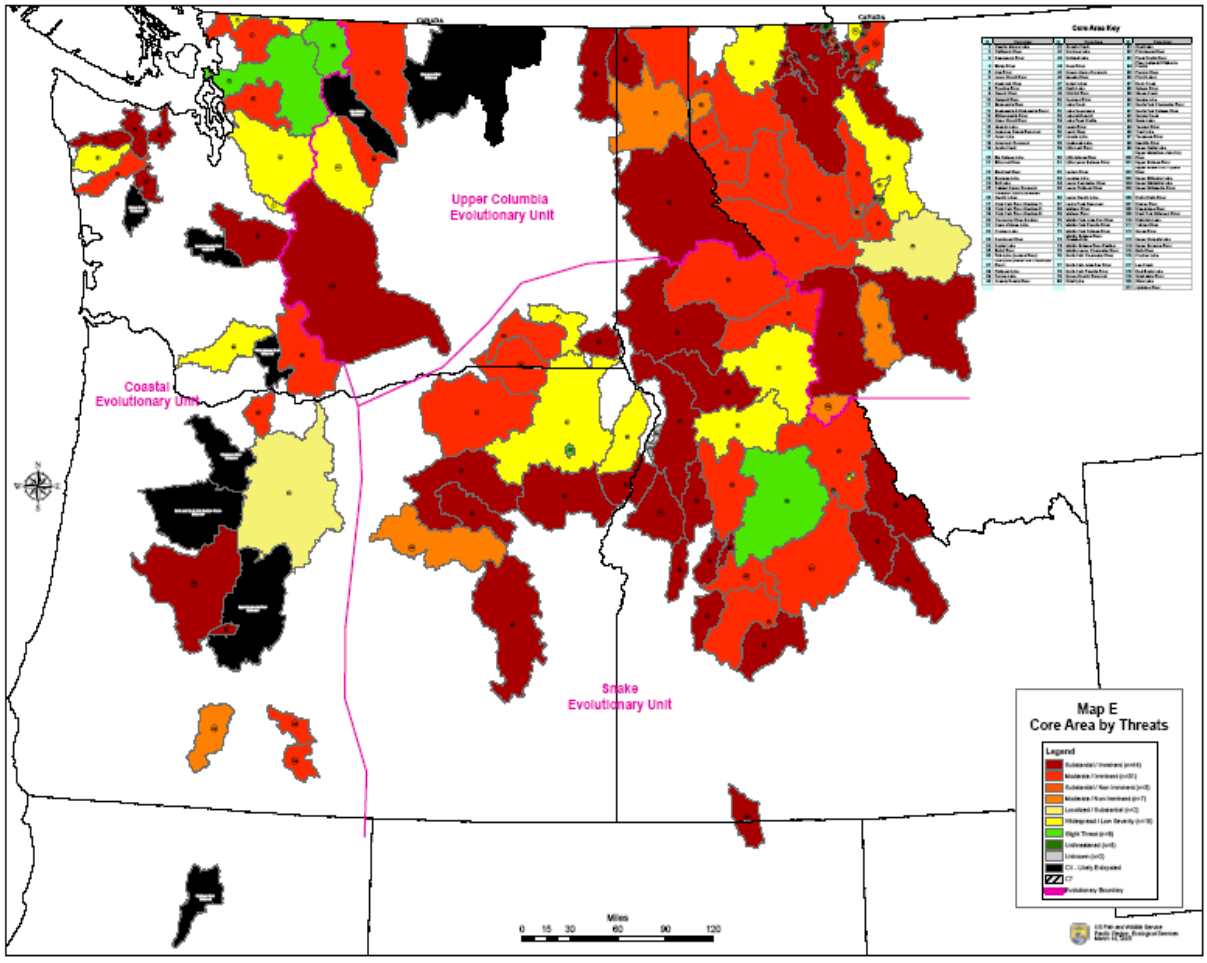
High Risk – Core area at high risk because of extremely limited and/or rapidly declining numbers, range, and/or habitat, making the bull trout in this core area highly vulnerable to extirpation.
At Risk – Core area at risk because of very limited and/or declining numbers, range, and/or habitat, making the bull trout in this core area vulnerable to extirpation.
Potential Risk – Core area potentially at risk because of limited and/or declining numbers, range, and/or habitat even though bull trout may be locally abundant in some portions of the core area.
Low Risk – Bull trout common or uncommon, but not rare, and usually widespread through the core area. Apparently not vulnerable at this time, but may be cause for long-term concern.
Unknown Risk – Core area currently unranked due to lack of information or due to substantially conflicting information about status and trends.

Core Area Rankings	Number of core areas
High Risk	43
At Risk	44
Potential Risk	28
Low Risk	4
Unknown Risk	2
Total number of core areas	121

Application of the model resulted in core areas with low population values and high threats receiving a lower rank, indicating a high risk. The model allows for core areas with low population values to be elevated up to one full rank if threats are low or

insignificant. Thus, even in the case of a very small population, with restricted habitat and declining trend, a low or insignificant threat ranking may result in the final rank being At Risk or Potential Risk. This is consistent with conservation biology theory that considers small and isolated populations to be at a higher level of risk than are large and connected populations. The most at-risk core areas were those with low population values that are subject to high threats.

Figure 4. Map of Core Areas by Threat Category (dark red=substantial, imminent threat; light red=moderate, imminent threat; dark orange=substantial, non-imminent threat; light orange=moderate, non-imminent threat; dull yellow=localized, substantial threat; bright yellow=widespread, low-severity threat; light green=slightly threatened; dark green=unthreatened; gray=unknown; black=likely extirpated).



Core areas with high population values (abundance, distribution, trend) and low to insignificant threats ranked Low Risk. However, a robust population of 10,000 adult bull trout with over 621 miles (1,000 km) of habitat (or 124 miles [200 km] if anadromous or adfluvial) and a stable population trend, with severe threats, would be ranked no lower than At Risk. Again, in line with conservation biology theory, strong populations that are well connected and spatially distributed on the landscape were considered inherently more stable and resilient to threats. The least at-risk core areas, and the only ones that earned a Low Risk, were those with relatively robust population parameters combined with low or insignificant threats.

Bull trout core areas historically ranged from At Risk to Low Risk, due to natural landscape features (e.g., barrier falls), natural patchiness of suitable habitat, historical fluctuations in climate, fire and flood, and other natural factors (Rieman and McIntyre 1995; Rieman and Allendorf 2001). See map of risks below and rank by core area below in Figure 5 and Table 1.

Core Area Life History and Connectivity Assessment

The maintenance of migratory forms of bull trout and connectivity to support these life history forms are important factors in evaluating persistence of the species within and among core areas. To compile this information in a consistent manner across the range for the bull trout, a system was developed to 1) characterize the life history composition within each core area, 2) determine the level of connectivity within each core area, and 3) determine the level of potential connectivity among core areas. Service biologists most familiar with each core area assigned the characterization for each field based upon a common rule set (USFWS 2005b).

Life History Forms

There are three migratory life history forms (fluvial, adfluvial, anadromous) which may be present within a core area. In core areas where more than one migratory form was present, the dominant and secondary form(s) were identified. The characterization of life history types as fluvial, adfluvial or anadromous is not absolute and individual fish may utilize more than one strategy during their lifetime (e.g., adfluvial one year but fluvial the next).

The adfluvial form is the dominant migratory life history form found within 48 percent (58/121) of the core areas; the fluvial life history form is considered the dominant form within 40 percent (49/121) of core areas. In many cases, formerly fluvial populations are now considered adfluvial, due to the creation of artificial reservoirs. However, the key distinction is really between migratory and resident forms, as the distinction between fluvial and adfluvial is largely semantic in these regulated reservoir habitats. In 5 percent (6/121) of core areas, which are located within the Coastal-Puget Sound population, the anadromous life history form is dominant.

In 69 percent of the core areas (83 of 121), only a single migratory form has been reported as present, while 25 percent (30 of 121) are reported to contain multiple migratory forms. Some core areas include resident bull trout in portions of the watershed(s), often in addition to a migratory form(s). In a few cases, the resident form may be the only one still present. Historically, where resident and migratory forms coexisted within the same core area, evidence indicates that the migratory form was typically dominant (e.g., Nelson et al. 2002). The evolutionary history of bull trout indicates that as an apex predator species the migratory life form was a highly successful strategy (Whitesel *et al.* 2004). Seven core areas (6 percent of the total) formerly had migratory fish but now only support a resident population. Only one core area is not known to have ever supported migratory bull trout.

With fragmentation, loss, and/or degradation of habitats within a core area (particularly key migration corridors between foraging and overwintering habitats), the migratory form may no longer be dominant. The resident form, which is currently dominant in 19 of 121 core areas (16 percent), is inherently at greater risk of loss to stochastic events than the migratory life history form (Rieman *et al.* 1997; USFWS 2002b). Migratory bull trout have the advantage of greater growth due to access to more productive waters, greater fecundity resulting in increased reproductive potential, and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Rieman and McIntyre 1993; MBSTG 1998; Frissell 1999).

Figure 5. Map of Core Areas by Risk Category (red=high risk; orange=at risk; yellow=potential risk; green=low risk; gray=unknown risk; black=likely extirpated).

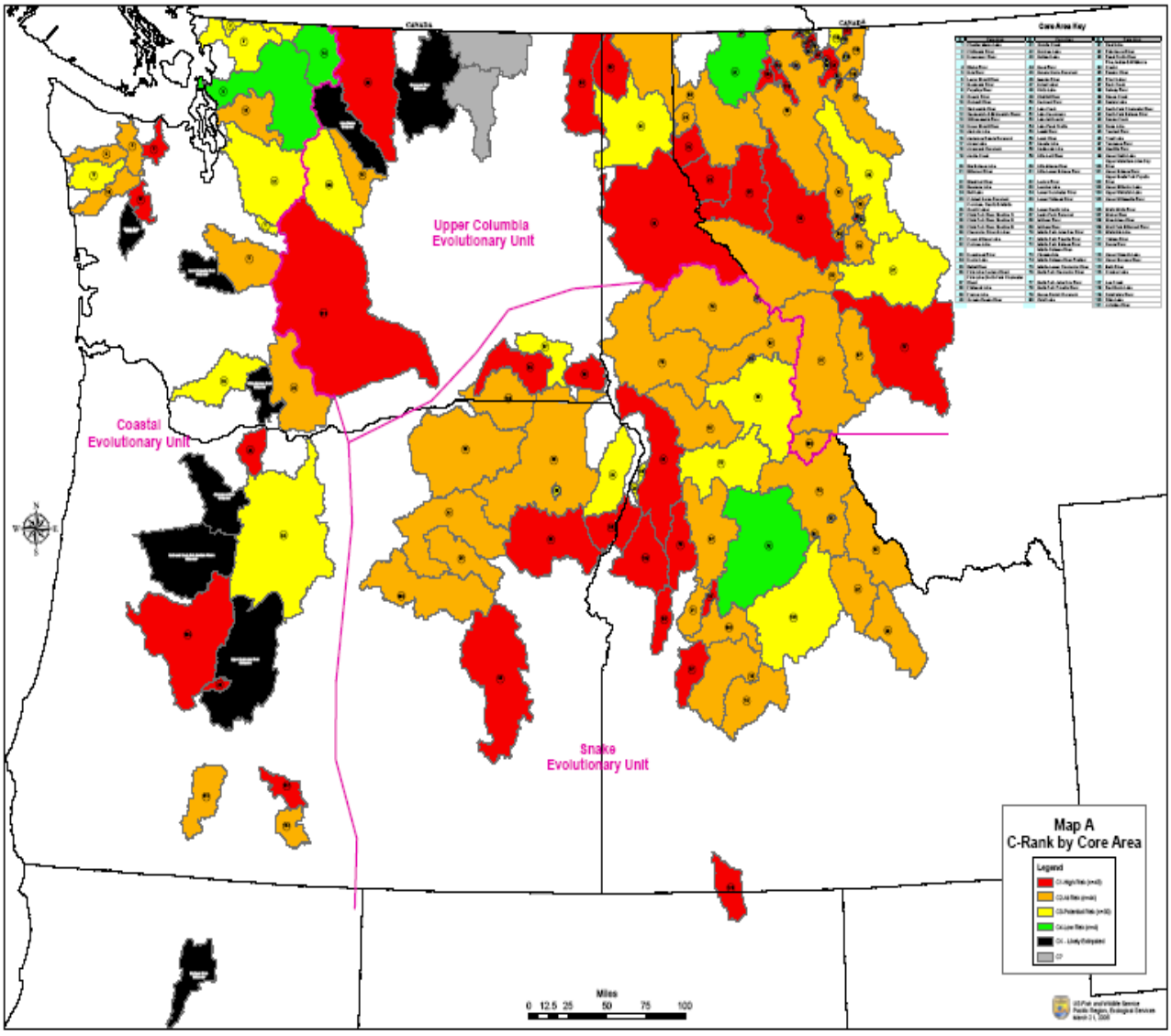


Table 1. Summary Table of Core Area Rankings for Population Abundance, Distribution, Trend, Threat, and Final Rank.

Core Area	Population Abundance Category (individuals)	Distribution Range Rank (stream length miles)	Short-term Trend Rank	Threat Rank	Final Rank
Sycan River	50-250	25-125	Severely declining	Moderate, imminent	High Risk
Upper Klamath Lake	50-250	125-620	Increasing	Moderate, non-imminent	At Risk
Upper Sprague River	1000-2500	25-125	Unknown	Moderate, imminent	At Risk
Akokala Lake	50-250	2.5-25	Unknown	Unthreatened	Potential Risk
Arrow Lake	50-250	25-125	Unknown	Slightly	Potential Risk
Big Salmon Lake	250-1000	25-125	Declining	Widespread, low-severity	At Risk
Bitterroot River	250-1000	125-620	Unknown	Substantial, imminent	At Risk
Blackfoot River	250-1000	125-620	Increasing	Localized, substantial	Potential Risk
Bowman Lake	1-50	2.5-25	Very rapid decline	Substantial, imminent	High Risk
Cabinet Gorge Res.	50-250	25-125	Stable	Moderate, imminent	High Risk
Quartz Lake(s)	250-1000	25-125	Stable	Substantial, non-imminent	At Risk
Clark Fork River- Sec 1	50-250	125-620	Unknown	Substantial, imminent	High Risk
Clark Fork River-Sec 2	50-250	125-620	Unknown	Moderate, imminent	At Risk
Clark Fork River- Sec 3	50-250	25-125	Unknown	Moderate, imminent	High Risk
Clearwater R. & Lakes	250-1000	125-620	Declining	Moderate, imminent	At Risk
Cyclone Lake	1-50	2.5-25	Very rapid decline	Moderate, non-imminent	High Risk
Doctor Lake	50-250	25-125	Unknown	Slightly	Potential Risk
Flathead Lake	1000-2500	620-3000	Declining	Substantial, imminent	At Risk
Frozen Lake	50-250	25-125	Unknown	Slightly	Potential Risk
Harrison Lake	1-50	200-1000	Unknown	Moderate, imminent	High Risk
Holland Lake	50-250	125-620	Rapidly declining	Substantial, non-imminent	High Risk
Hungry Horse Res.	2500-10000	620-3000	Increasing	Widespread, low-severity	Potential Risk
Isabel Lakes	250-1000	2.5-25	Unknown	Unthreatened	Potential Risk
Kintla Lake	1-50	2.5-25	Severely declining	Substantial, imminent	High Risk
Lake McDonald	1-50	2.5-25	Severely declining	Substantial, imminent	High Risk
Lake Pend Oreille	2500-10000	620-3000	Stable	Moderate, non-imminent	Potential Risk
Lincoln Lake	50-250	2.5-25	Unknown	Moderate, imminent	High Risk
Lindbergh Lake	50-250	25-125	Unknown	Substantial, non-imminent	At Risk
Logging Lake	50-250	2.5-25	Severely declining	Substantial, imminent	High Risk
Lower Flathead River	50-250	25-125	Unknown	Moderate, imminent	High Risk
Lower Quartz Lake	50-250	2.5-25	Unknown	Substantial, imminent	High Risk
Noxon Rapids Res.	50-250	25-125	Unknown	Moderate, imminent	High Risk
Priest Lakes	50-250	25-125	Rapidly declining	Substantial, imminent	High Risk
Rock Creek	250-1000	125-620	Declining	Moderate, non-imminent	At Risk
Swan Lake	1000-2500	620-3000	Stable	Moderate, imminent	At Risk
Trout Lake	250-1000	2.5-25	Unknown	Slightly	Potential Risk
Upper Kintla Lake	250-1000	25-125	Unknown	Unthreatened	Potential Risk
Upper Stillwater Lake	50-250	25-125	Unknown	Substantial, imminent	High Risk
Upper Whitefish Lake	1-50	25-125	Unknown	Substantial, imminent	High Risk
West Fork Bitterroot R.	50-250	25-125	Unknown	Moderate, non-imminent	At Risk
Whitefish Lake	1-50	25-125	Unknown	Substantial, imminent	High Risk
Bull Lake	250-1000	25-125	Stable	Moderate, non-imminent	At Risk
Kootenai River	250-1000	125-620	Stable	Moderate, imminent	At Risk
Lake Koocanusa	10000-100000	620-3000	Increasing	Widespread, low-severity	Low Risk
Sophie Lake	1-50	2.5-25	Unknown	Substantial, imminent	High Risk
Upper Willamette River	50-250	125-620	Stable	Substantial, imminent	High Risk

Core Area	Population Abundance Category (individuals)	Distribution Range Rank (stream length miles)	Short-term Trend Rank	Threat Rank	Final Rank
Hood River	50-250	25-125	Unknown	Moderate, imminent	High Risk
Lower Deschutes River	1000-2500	125-620	Increasing	Localized, substantial	Potential Risk
Odell Lake	1-50	2.5-25	Unknown	Substantial, imminent	High Risk
Middle Fk John Day R.	unknown	125-620	Increasing	Substantial, imminent	At Risk
North Fk John Day R.	unknown	125-620	Increasing	Substantial, imminent	At Risk
Up.Mnstm John Day R.	1-50	125-620	Increasing	Moderate, non-imminent	At Risk
Touchet River	50-250	25-125	Stable	Moderate, imminent	High Risk
Umatilla River	50-250	125-620	Unknown	Moderate, imminent	At Risk
Walla Walla River	1000-2500	25-125	Stable	Moderate, imminent	At Risk
Grande Ronde River	50-250	125-620	Stable	Widespread, low-severity	At Risk
Little Minam River	250-1000	2.5-25	Stable	Slightly	Potential Risk
Granite Creek	unknown	2.5-25	Unknown	Unthreatened	Unknown Risk
Imnaha River	250-1000	125-620	Stable	Widespread, low-severity	Potential Risk
Sheep Creek	unknown	2.5-25	Unknown	Unthreatened	Unknown Risk
Pine, Indian & Wildhorse Creeks	250-1000	125-620	Very rapid decline	Substantial, imminent	High Risk
Powder River	250-1000	125-620	Very rapid decline	Substantial, imminent	High Risk
Malheur River	50-250	125-620	Declining	Substantial, imminent	High Risk
Coeur d'Alene Lake	50-250	125-620	Stable	Substantial, imminent	High Risk
Fish Lake (Lochsa R.)	1-50	2.5-25	Unknown	Widespread, low-severity	At Risk
Fish Lake (N. Fk Clearwater R.)	1-50	125-620	Declining	Moderate, imminent	High Risk
Lochsa River	50-250	125-620	Stable	Moderate, imminent	At Risk
Mid-Low Clearwater R.	unknown	125-620	Unknown	Substantial, imminent	At Risk
North Fk Clearwater R.	250-1000	125-620	Declining	Moderate, imminent	At Risk
Selway River	unknown	125-620	Unknown	Widespread, low-severity	Potential Risk
South Fk Clearwater R.	1000-2500	125-620	Unknown	Substantial, imminent	At Risk
Lake Creek	50-250	25-125	Unknown	Widespread, low-severity	At Risk
Lemhi River	250-1000	125-620	Unknown	Substantial, imminent	At Risk
Little-Lower Salmon R.	50-250	125-620	Unknown	Substantial, imminent	High Risk
Middle Fork Salmon R.	unknown	620-3000	Unknown	Slightly	Low Risk
Middle Salmon River / Chamberlain	unknown	125-620	Unknown	Widespread, low-severity	Potential Risk
Middle Salmon River / Panther	unknown	125-620	Unknown	Moderate, imminent	At Risk
Opal Lake	unknown	2.5-25	Unknown	Widespread, low-severity	Potential Risk
Pahsimeroi River	unknown	125-620	Unknown	Substantial, imminent	At Risk
South Fork Salmon R.	unknown	125-620	Unknown	Moderate, imminent	At Risk
Upper Salmon River	unknown	620-3000	Unknown	Moderate, imminent	Potential Risk
Anderson Ranch Res.	250-1000	125-620	Unknown	Substantial, imminent	At Risk
Arrowrock Reservoir	unknown	125-620	Declining	Moderate, imminent	At Risk
Deadwood River	250-1000	25-125	Unknown	Substantial, imminent	High Risk
Lucky Peak Reservoir	1-50	25-125	Unknown	Substantial, imminent	High Risk
Middle Fork Payette R.	unknown	25-125	Unknown	Substantial, imminent	At Risk
North Fork Payette R.	1-50	2.5-25	Very rapid decline	Substantial, imminent	High Risk
Squaw Creek	250-1000	25-125	Unknown	Substantial, imminent	High Risk

Core Area	Population Abundance Category (individuals)	Distribution Range Rank (stream length miles)	Short-term Trend Rank	Threat Rank	Final Rank
Upper S. Fk Payette R.	unknown	125-620	Unknown	Moderate, imminent	At Risk
Weiser River	unknown	<2.5	Rapidly declining	Substantial, imminent	High Risk
Little Lost River	unknown	25-125	Unknown	Substantial, imminent	At Risk
Klickitat River	unknown	25-125	Unknown	Moderate, imminent	At Risk
Lewis River	1000-2500	125-620	Increasing	Widespread, low-severity	Potential Risk
Yakima River	250-1000	125-620	Very rapid decline	Substantial, imminent	High Risk
Entiat River	50-250	125-620	Stable	Moderate, imminent	At Risk
Methow River	50-250	125-620	Declining	Moderate, imminent	High Risk
Wenatchee River	250-1000	620-3000	Stable	Widespread, low-severity	Potential Risk
Pend Oreille River	1-50	25-125	Unknown	Substantial, imminent	High Risk
Asotin Creek	50-250	25-125	Unknown	Substantial, imminent	High Risk
Tucannon River	1000-2500	125-620	Stable	Widespread, low-severity	Potential Risk
Jarbidge River	50-250	125-620	Unknown	Substantial, imminent	High Risk
Chester Morse Lake	1000-2500	25-125	Increasing	Widespread, low-severity	Potential Risk
Chilliwack River	1000-2500	25-125	Unknown	Widespread, low-severity	Potential Risk
Lower Skagit River	2500-10000	620-3000	Increasing	Slightly	Low Risk
Nooksack River	unknown	620-3000	Unknown	Moderate, imminent	Potential Risk
Puyallup River	unknown	620-3000	Unknown	Substantial, imminent	At Risk
Snohomish & Skykomish Rivers	1000-2500	620-3000	Increasing	Widespread, low-severity	Potential Risk
Stillaguamish River	250-1000	620-3000	Unknown	Moderate, imminent	At Risk
Upper Skagit River	unknown	620-3000	Unknown	Slightly	Low Risk
Dungeness River	50-250	25-125	Unknown	Substantial, imminent	High Risk
Elwha River	unknown	25-125	Unknown	Substantial, imminent	At Risk
Hoh River	250-1000	125-620	Increasing	Substantial, imminent	At Risk
Queets River	unknown	620-3000	Unknown	Widespread, low-severity	Potential Risk
Quinault River	unknown	125-620	Unknown	Moderate, imminent	At Risk
Skokomish River	50-250	125-620	Rapidly declining	Substantial, imminent	High Risk
Belly River	250-1000	25-125	Increasing	Widespread, low-severity	Potential Risk
Cracker Lake	250-1000	25-125	Unknown	Unthreatened	Potential Risk
Lee Creek	50-250	2.5-25	Unknown	Substantial, imminent	High Risk
Red Eagle Lake	50-250	2.5-25	Unknown	Widespread, low-severity	At Risk
Saint Mary River	250-1000	25-125	Stable	Moderate, imminent	At Risk
Slide Lake	50-250	2.5-25	Unknown	Unthreatened	Potential Risk

Core Area Extent and Connectivity

Connectivity, especially hydrologic connectivity, is essential to the ecological integrity of the landscape (Pringle 2003). Connectivity of habitats within core areas, and in some cases with habitats outside core areas is critical for migratory bull trout to successfully complete their life history (Rieman and McIntyre 1993; MBTSG 1998; Brenkman and Corbett 2005). Connectivity among local populations is also important to provide the opportunity for genetic exchange within core areas and for refounding after local extinction events (Rieman and McIntyre 1993; Rieman *et al.* 1997). Multiple local populations distributed throughout a watershed allow risk to be spread, since the simultaneous loss of all local populations is unlikely. In addition, if the local populations are well connected, the core area is more resilient through potential refounding. In some

cases, connectivity among adjacent core areas is important for maintaining/restoring the original population structure that existed prior to fragmentation by artificial barriers. Connectivity among core areas also provides for the opportunity of genetic exchange (one- or two-way) to maintain diversity and allows the potential for refounding.

To a certain extent, the distinction between connectivity "within" core areas and connectivity "among" core areas is a temporal distinction. A core area represents a largely self-contained biologically functioning unit for bull trout (USFWS 2002b; 2004b; 2004c; after Rieman and McIntyre 1993). Over the short term (several generations), connectivity within a core area is critical to a bull trout population maximizing its potential (abundance, distribution, trend), and perhaps even to its genetic persistence. However, over a longer time frame, perhaps even evolutionary time, core areas necessarily share (or once shared) some degree of connectivity (Whitesel *et al.* 2004). Connectivity within and among core areas, and the potential to recolonize through migratory life history forms, is important to the long term persistence of bull trout.

The degree of passage at upper and lower bounds of core areas were used to describe the degree of "external" connectivity among core areas (see Bull Trout Core Area Conservation Status Assessment [USFWS 2005b]). As the measure of external connectivity, we assigned a score to each core area based upon whether there was restricted, unrestricted, or no passage both upstream and downstream. Sixteen of 121 core areas (13 percent) were completely isolated, with no passage of bull trout in either direction. We found that 57 of 121 core areas (47 percent) had low (i.e., significantly impaired) external connectivity with no passage at one of the core area's bounds and restricted passage at the other. Thirty-six percent of the core areas (43 of 121) scored as having "moderate" (i.e., partially impaired) connectivity with other core areas, meaning either "restricted passage" at both bounds, or "unrestricted passage" at one bound and "no passage" at the other. Only 4 percent of the core areas (5 of 121) scored as having "high" connectivity with other core areas, and only one core area scored "2," meaning "unrestricted passage at both bounds."

These scoring results would suggest that external connectivity among core areas is low across the range, overall. In some cases, the isolation is natural, but in most circumstances, it has been caused or exacerbated by human factors. This current lack of connectivity among core areas limits access to some FMO habitat and significantly reduces the probability of refounding events should a core area become extirpated. It also illustrates why we consider core areas to be important biological units and why threats should be evaluated primarily at the core area level.

Connectivity of habitats within core areas, termed "internal connectivity," is also critical in order for migratory bull trout to successfully complete their life history. This internal connectivity provides interaction among local populations to allow for genetic exchange and refounding. Similar to describing connectivity "among" core areas, the degree of connectivity "within" each core area was characterized as low, moderate, or high (see Bull Trout Core Area Conservation Status Assessment [USFWS 2005b]).

"Low" internal connectivity applied to 30 of 121 core areas (25 percent) where the majority of local populations are artificially separated from one another, or migratory or resident forms (if dominant) have impaired access (year round or seasonally) to a majority of the habitat within the core area. Access was determined to be impaired by degraded habitat conditions or by artificial barriers (e.g., diversions, culverts).

"Moderate" internal connectivity applied to 39 of 121 core areas (32 percent) where some portion (but not the majority) of local populations are artificially separated from the others, or migratory or resident forms (if dominant) have impaired access to smaller portions of habitat within the core area. In this category, connectivity issues are still considered significant.

"High" internal connectivity applied to 52 of 121 core areas (43 percent), where connectivity between local populations is generally unimpaired, or where only minor or insignificant portions of usable habitat are currently inaccessible.

Maintaining internal connectivity may be even more critical to the persistence of those core areas that scored "low" or "moderate" with respect to external connectivity. Core areas with low connectivity at both the internal and external level would seem to be highly vulnerable to extirpation. Twenty-five core areas (21 percent) characterized as having low internal connectivity also scored as having low external connectivity. Another 17 core areas (14 percent) characterized as having moderate internal connectivity also scored as having low external connectivity.

Habitat

There is no known direct means by which habitat quality and trends in habitat conditions for bull trout can be accurately measured or tracked on a landscape scale, especially over a short period of time such as a 5-year period. After consideration of public and peer review comments on the original proposed critical habitat rules (USFWS 2002a), the Service documented and described approximately 20,483 miles of stream habitat, 574,534 acres of lakes, and 985 miles of marine shoreline in the U.S. portions of the range that are important to the conservation of bull trout. This entire habitat was known to be occupied by bull trout and it is referred to in this 5-year review as Key Recovery Habitat. As previously mentioned, these watersheds were grouped into 121 core areas and described in the draft recovery plan as supporting over 600 separate local populations of bull trout (USFWS 2002b). Additional unquantified miles of stream are known to be occupied by bull trout, often at a lower frequency or density, but did not meet the minimum standard we used to identify Key Recovery Habitat.

As part of the extensive analysis of the Interior Columbia Basin Ecosystem Management Project (ICBEMP), Quigley *et al.* (2001) described measures of ecological integrity for the interior Columbia River Basin. They used the structure, strength, and diversity of native fish communities and habitat variables such as road density, fire frequency and other indicators as proxies to characterize ecological integrity. Based on that assessment, aquatic integrity was rated high in 10 percent, medium in 37 percent, and low in 54 percent of the 164 subbasins analyzed. This analysis appeared to have a high degree of concordance with our analysis of the Bull Trout Core Area Conservation Status

Assessment (USFWS 2005b) though no formal comparison has been conducted. Road density and nonnative species distribution (especially congeneric brook trout and lake trout), as summarized in Quigley *et al.* (2001), are two of the strongest indicators that may function as proxies relative to the status of bull trout core areas. However, as described in the threats analysis (below), there are many additional factors that have the potential to interrupt the ecological integrity of bull trout habitat.

V. Threats Assessment (5-Factor Analysis)

Supporting documentation for the original bull trout listing (63 FR 31647) included extensive evaluation of threats to bull trout at a landscape scale and a tabular analysis describing which threats 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 scale levels.

The Bull Trout Draft Recovery Plans (USFWS 2002b) for the Columbia River, Klamath River and St. Mary Belly populations, and for the Coastal-Puget and Jarbidge populations (USFWS 2004b, 2004c), provide detailed information on threats at the Recovery Unit scale, similar to regional watersheds. Much of that threat information was incorporated from existing State bull trout management plans (e.g., Montana Bull Trout Restoration Team 2000; Batt 1996) where it was originally compiled. A broad range of expert opinion both inside and outside the Service was incorporated in the threats analyses for the recovery plans.

In the draft recovery plans (USFWS 2002b), as well as the State restoration planning processes (e.g., Montana Bull Trout Restoration Team 2000; Batt 1996) common categories were used to describe and evaluate habitat impacts. They included dams, forest management practices, livestock grazing, agricultural practices, transportation networks, mining, residential development and urbanization, fisheries management activities, and any of a host of general practices and some natural activities (e.g., fire or flood under certain circumstances) that may have contributed to, and may still contribute to, isolation and habitat fragmentation. These general threat categories to bull trout were further recognized by the 5-Year Review expert panel convened in March 2005.

Many of these categories incorporate a suite of specific activities that fall under their broader umbrella. For specifics, refer to the draft recovery plan (USFWS 2002b) or its excerpts in Appendix E of the Bull Trout Core Area Conservation Status Assessment (USFWS 2005b). Each core area is subjected to a unique blend of these factors and many of these activities are unevenly distributed on the landscape, even within core areas or individual watersheds. Collectively, human (and some natural) activities on the landscape that act to reduce the 4 C's essential to bull trout (clean, cold, complex, and connected watersheds) are likely to act as threats.

The threats analyses are based on the collective body of information, compiled in a chronological sequence, dating back to the individual State plans and including the final listing rule and its documentation, the draft recovery plan, additional critical habitat

analysis incorporated in proposed and final rules, and the most recent up-to-date template review. The collective record for this effort is voluminous, and exceeds several thousand pages. Habitat loss and fragmentation, and effects from nonnative species are widely regarded as the most significant threats impacting bull trout. The order of those threats and their potential synergistic effects vary greatly by core area and among local populations.

There are habitat restoration efforts and other potentially beneficial management activities occurring in most of the 121 bull trout core areas, and these were considered in the Bull Trout Core Area Conservation Status Assessment (USFWS 2005b).

The following discussion briefly summarizes how results of the ranking exercise described above translate into our evaluation of the five listing factors.

Factor A: The present or threatened destruction, modification, or curtailment of its habitat or range

Most of the threats to bull trout that are described and characterized in the State plans (e.g., Montana Bull Trout Restoration Team 2000; Batt 1996), the draft recovery plans (USFWS 2002b, 2004b, 2004c), the proposed and final critical habitat rules (USFWS 2002a; 2004a; 2004d), the updated Bull Trout Core Area Templates (USFWS 2005a), and the Bull Trout Core Area Conservation Status Assessment (USFWS 2005b) fall into the category of destruction, modification, or curtailment of habitat. Most of these impacts (e.g., dewatering, sedimentation, thermal modification, water quality degradation) are human-caused and are a consequence of specific land and water management activities. These unavoidable consequences can be, and frequently are, mitigated or moderated, especially on Federal lands and in certain headwater areas where bull trout spawning and rearing habitat occurs.

In much of the range of bull trout, sporadic or localized drought has contributed to wildfire and other impacts to bull trout habitat. We have not observed a collective or measurable change in this threat factor across the bull trout range since the time of listing. Substantial or moderate and imminent threats to bull trout, primarily related to habitat impacts, were found to exist in 75 of 121 bull trout core areas (62 percent) during the course of our analysis (USFWS 2005b) and only 13 of 121 core areas (11 percent) were ranked as slightly threatened or unthreatened. These threats occur across nearly the entire landscape (USFWS 2002b), with the exception of only a few core areas that are either wholly or mostly isolated in protected areas. Even in the latter cases, the migratory nature of the species may result in substantial effects during the time or stages of the life cycle when individuals are exposed to habitat impacts outside of these “protected areas.” The magnitude, severity, and intensity of threats in this category remain high for bull trout across its range.

In some cases, management actions such as restoration of degraded habitat and improvement of fish passage are occurring, but these actions are occurring on only a small percentage of bull trout watersheds and for the most part, it is too soon to measure significant results from those activities. Along with the nonnative species threat, the present or threatened destruction, modification, or curtailment of bull trout

habitat or range must be considered the most significant determinant of the status of bull trout core areas into the foreseeable future. The Bull Trout Core Area Templates (USFWS 2005a), and the Bull Trout Core Area Conservation Status Assessment (USFWS 2005b) contain specific analysis of threats by core area.

Factor B: Overutilization for commercial, recreational, scientific or educational purposes

Illegal harvest and ongoing incidental kill of bull trout by anglers catching and releasing fish or pursuing other species were identified as concerns at the time of listing (63 FR 31647). As a result of actions taken by States and Tribes prior to the Federal listing of bull trout in 1998, angling regulations have restricted intentional bull trout harvest to only a handful of locations since the early and mid-1990's (63 FR 31647). These actions resolved most pre-listing concerns about the overutilization of bull trout by anglers legally harvesting fish. In some core areas, bull trout numbers appear to have responded positively to those angling restrictions (USFWS 2005a).

Factor C: Disease or predation

Disease was considered only a minor threat in the original bull trout listing (63 FR 31647) but remains as a threat to be monitored. The effect of disease on bull trout is largely indirect, but still potentially significant.

Since the time of listing, whirling disease has spread throughout some drainages occupied by bull trout in western Montana and northern Idaho (USFWS 2005a). The establishment of whirling disease has been shown to dramatically alter salmonid communities and it disproportionately affects rainbow trout. Even though some wild bull trout populations are known to be infected with whirling disease in Montana (USFWS 2005a), direct effects of whirling disease on those bull trout have not been documented. There are, however, concerns that by reducing rainbow trout and, potentially, cutthroat trout populations, whirling disease may favor increases in brown trout populations (which are highly resistant to the parasite) or other species such as brook trout that might compete with or prey upon bull trout (see Factor E, below).

Predation was considered a significant threat to bull trout in the original listing (63 FR 31647). Nonnative lake trout, brown trout, and northern pike have all been documented as predators on juvenile bull trout. In some core areas, the entire Key Recovery Habitat of bull trout is co-occupied by one or more of these species. In addition, as described above, illegal introductions of walleye are continuing to spread in western Montana lakes and reservoirs and downstream into Idaho. 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 other piscivorous nonnative species may play a role. At this time, the management application of predator removal (largely by State and Tribal mangers) has been limited and broader application remains problematic due to the fact that many of the predator species are also highly sought after sport fish species and may even be promoted by some State managers. The magnitude, severity, and intensity of this threat category remains relatively low for the species as a whole, but in specific core areas, disease or predation may be an increasingly important factor in bull trout declines.

Factor D: The inadequacy of existing regulatory mechanisms

Inadequacies of existing regulatory mechanisms were all discussed in the original listing of bull trout (63 FR 31647), and changes in those mechanisms have been taken into account in our analysis, as described below. Under the ESA, 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 requirements of the ESA 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). Other threats are currently being assessed through monitoring and information gathering and potential reductions in the scope of their effects on bull trout have yet to occur (e.g., operations of the Federal Columbia River Power System conducted by the U.S. Army Corps of Engineers, the Bonneville Power Administration, and the Bureau of Reclamation).

State forest practice rules have been updated in some areas, at least partly in response to concern for the conservation of sensitive, threatened and endangered species. Oregon has adopted various amendments to its rules and Washington has developed an entire set of new regulations primarily in response to Federal listings of species in the late 1990s. Montana and 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 in development and would supplement the existing Idaho Forestry Program to address species protected by the ESA. The objective of the supplemental forestry program is the protection of listed salmon and bull trout, and all private landowners in the Salmon/Clearwater River basins will be encouraged to participate. However, the effectiveness of the Snake River Basin Adjudication Idaho Forestry Program cannot be determined as the Program has not yet been approved or fully analyzed. In other parts of Idaho, forest practices remain essentially unchanged since the listing of bull trout in 1998.

In addition to consultation with other Federal agencies, the Service has engaged several private corporations and public agencies in the habitat conservation planning (HCP) process to provide for the conservation of bull trout. The development 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 ESA, the development of HCPs reduces threats and avoids jeopardy to bull trout, but does not eliminate adverse effects resulting from land management practices. Habitat conservation plans addressing bull trout cover approximately 472 stream miles of aquatic habitat, or approximately 2.6 percent of the Key Recovery Habitat across Montana, Oregon, Washington, Nevada, and Idaho.

Factor E: Other natural or manmade factors affecting its continued existence
A primary concern at the time of listing was that introduced non-native species, primarily other fish in the genus *Salvelinus* (e.g., brook trout and lake trout) and other fish species that have high potential to be competitors or predators (e.g., brown trout, northern pike, walleye), threaten bull trout even in areas of otherwise secure habitat. This threat category can be clearly demonstrated to have increased significantly since the 1998 listing. Flathead Lake, Lake Pend Oreille, Priest and Upper Priest Lakes, Swan Lake, and many smaller lakes in bull trout core areas in the relatively secure habitat of Glacier National Park (Fredenberg 2002), have all experienced increased impacts of lake trout population expansion since the listing. This threat is relatively widespread and is growing (USFWS 2005a), particularly in systems that contain adfluvial bull trout populations. The 1998 bull trout listing rule (63 FR 31647) stated that: "Negative effects of interactions with introduced non-native species may be the most pervasive threat to bull trout throughout the Columbia River basin." The most recent analysis indicated that about 75 percent of lakes containing adfluvial populations of bull trout also contain reproducing populations of brook trout, lake trout, brown trout, or some combination of the three species within their watershed (Fredenberg 2003). Nonnatives occur in 86 percent of the managed and roaded watersheds where adfluvial populations of bull trout exist. Only three large natural lakes (over 200 acres) remain in the entire Columbia River Basin that still contain bull trout in their natural abundance and secure habitat in the absence of these other species. We have also documented the recent spread of walleye populations and concerns remain about widespread impacts from northern pike, brook trout, and brown trout (USFWS 2005a). Magnitude, severity, and intensity of this threat factor are high and pressure from nonnative species is increasing. Along with Factor A (the present or threatened destruction, modification, or curtailment of its habitat or range), the nonnative species threat is considered the most significant determinant of the status of bull trout core areas for the foreseeable future.

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 redds on bull trout redds (Moran 2004). Brown trout are often piscivorous. The niche overlap between brown trout and bull trout is considerable and, as a result, brown trout may replace bull trout in certain circumstances. To date, documentation of this type of interaction is only fragmentary (USFWS 2005a).

VI. Results

Risk of Extinction Relative to ESA Definition of Terms
The Service Manager Panel convened to assist with assessing extinction risk (see New Information – Decision Making, above) opened their panel session by discussing the objectives of a 5-year review, ESA terminology, and particularly the risk factors each manager weighed when considering any change in species status; in other words, the rationale that would support the status quo or a change in status. The intent of the panel

approach was to improve the chances of reaching a correct status determination given the consequences to the species of reaching an incorrect outcome. The deliberations of the manager panel also provided an opportunity to explore the level and importance of biological uncertainty in the 5-year review.

In order to translate the available biological information into a regulatory/policy determination under the ESA, the manager panel spent time discussing terminology embedded in the regulatory definitions, including foreseeable future, significant portion of the range, and threatened and endangered. Then the manager panelists revisited the biology, with particular emphasis on the Core Area Status Assessment (USFWS 2005b). The Core Area Status Assessment was not prescriptive; instead it served as a structured method to elicit, review and evaluate a large amount of complex information from the field about habitat and population trends and threats. It therefore provided a structure for manager deliberations and helped assure that all available information was considered and all assumptions were examined. Thus it was a tool to help us think clearly and thoroughly about risk, and not a substitute for our deliberations about the appropriate status under the ESA.

With regard to the "foreseeable future," manager panel members were asked to agree by consensus on a reasonable timeframe for the foreseeable future term in the threatened definition. The Manager Panel defined the foreseeable future as being 4 to 10 generations (approximately 28 to 70 years).

The panel also reflected on the "significant portion of the range" term, and discussed some previous applications of this term by the Service. The panel reviewed the Core Area Status Assessment information and looked for patterns or discontinuities in risk over significant portions of bull trout range. Panel members deliberated on the ability of the species and supporting habitat to react to potential threat changes over the foreseeable future, as defined above, before making their decision.

The manager panelists' beliefs about the best listing category for the coterminous bull trout were expressed in spite of many uncertainties, as are all natural resource decisions. Uncertainties can lead to errors or over or under protection. After expressing their beliefs about the correct listing category, the managers reflected on the various sources of scientific uncertainty and the consequences of a decision error. Thus, the final recommendation about whether or not a change in listing status is warranted was based on the beliefs of the managers about the correct listing category and a discussion about decision error and its consequences for bull trout.

Is a Change in Classification Warranted?

No. To make this recommendation, the Managers' Panel reviewed compiled background materials, observed the two risk assessment meetings, observed deliberations by the expert panelists, reviewed comments by the expert panelists on modifications to the risk assessment, and participated in general and specific discussions about the application of the Act's definitions of the threatened and endangered categories.

Using score sheets, Manager Panel members anonymously expressed their beliefs about the most appropriate listing category for the coterminous bull trout. They expressed their beliefs by allocating 100 points across the three listing categories (Not listed, Threatened, Endangered). After an initial scoring, the panelists held a wide-ranging discussion that included among other things, continued clarification of ESA requirements; the concept of functional versus absolute extinction and the ESA; and the concept that there is no provision in the ESA for weighing the consequences of listing (e.g., relationships with stakeholders). The decision team members discussed how they interpreted ESA terms such as "foreseeable future," and "significant portion of the range," and "likely." They discussed those aspects of bull trout biology that weighed heavily in their scoring.

An anonymous rescore followed this discussion. In this rescore, the managers were asked for a written explanation of their score, including what information each weighed most heavily, what information contributed to each panelists' uncertainty, and an explanation of what each panelist meant by, or how each thought about, key terms such as "*in danger* of extinction," "*likely* to become an endangered species," "*significant portion of its range*," and "*foreseeable future*." Six of the seven managers allocated most of their points to the threatened category and one split points evenly between threatened and not listed.

The written explanations of scores provided by the Manager Panelists cited: bull trout's reliance on the 4C's (i.e., clean, cold, complex, and connected habitats); fragmentation of the species' range by various threats at multiple scales, impacting the ability of the species to persist; invasive species such as lake trout that are a direct and increasing threat to many strong populations; anticipated ongoing and likely additional threats expected to create local extirpation in core areas; and low likelihood that existing threats will be eliminated and species status will improve. Evolutionarily, the bull trout uses multiple life history strategies to reduce risk, but fragmentation of its habitat by dams, water diversions, and culverts has adversely affected this strategy. Roads present an additional threat.

Factors cited by the manager's panelists as contributing most to uncertainty about their conclusions included: lack of population, abundance and trend data over most of the bull trout's range; the likelihood that, while there is still a decreasing trend, it is not possible to tell how steep or fast the decline is or how it is distributed across its range; large extent of the bull trout's range; and the fact that there are some areas in better condition, or in worse condition, than others. All meeting notes and anonymous score sheets and accompanying rationales of individual panel members are available on file.

In summary, based on the discussions and scoring of the Managers Panel, we are not recommending a status change at this time. However, as indicated above in the Distinct Population Segment Policy section, we recommend re-evaluating the designation of multiple bull trout DPSs.

Recommendations for Future Action

This 5-year review clearly identified specific areas of weakness in our overall ability to accurately and quantitatively evaluate the current status of the bull trout. We also

identified concerns about the current draft approach to implementation of the bull trout recovery strategy. Following is a list of actions we recommend that would greatly improve future reviews and bolster the decision-making framework for determining the status of bull trout.

1. Improve and standardize the monitoring and evaluation process for bull trout populations. Currently, the determination of population abundance and population trends is extremely difficult, and consistent standards need to be applied to evaluation of distribution. Employ strategies to quantify these processes and work with State, Tribal, Federal, and private entities to expand population monitoring efforts and implement standardized monitoring.

2. Reach agreement on the baseline condition of core area status as of this 5-year review, incorporating both population and threats evaluations. Core areas are the proper units of analysis by which threats to bull trout and recovery standards should be measured. This baseline should be used in the ultimate development of recovery criteria that can be integrated into assessment of future progress toward delisting.

3. 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. Complete the recovery plans so that current ambiguity about recovery criteria is eliminated. Tentatively, portions of U.S. core areas that functionally include Canadian waters should be included in this reconfiguration.

4. Review core area delineations and refine delineations based on most recent scientific information.

5. Develop and implement a standardized and, to the extent practical, quantitative method for tracking recovery implementation so that progress toward eliminating threats can be regularly summarized and highest priority tasks can be implemented first. There will always be a need for the use of best available science and professional judgment in recovery, but an empirical basis is needed to support such determinations and build on successes.

6. Enlist and support the full engagement of State and Tribal partners as well as other Federal land and water managers in providing monitoring and evaluation information and tracking of recovery actions. Bull trout will continue to be managed as part of the sport fish complex and partners responsible for managing sport and subsistence fisheries collect much of the available data. They also will continue to make many of the decisions that affect the ultimate fate of bull trout. To that end, development of 4(d) rules, research permits, and other creative forms of regulatory relief that might reduce the ESA burden on healthy core areas should be pursued in a collaborative fashion.

7. The advancement of techniques for genetic analysis of fish is rapidly improving and our understanding of the evolutionary relationships amongst bull trout populations is evolving. These techniques will improve our ability to properly classify core areas and determine the historical attributes of natural population assemblages. Several projects are currently using new genetic techniques to assign bull trout to appropriate natal watersheds as they are passed over dams, greatly improving prospects for artificially enhancing genetic connectivity. The rapid assessment of genetic relationships should eventually be made a routine part of population evaluation and management.

REFERENCES

Alliance for the Wild Rockies (AWR). 2004. Comment letter for bull trout 5-year review. 24 pages plus attachments. December 30, 2004.

Bahr, M.A. and J.M. Shrimpton. 2004. Spatial and quantitative patterns of movement in large bull trout (*Salvelinus confluentus*) from a watershed in north-western British Columbia, Canada, are due to habitat selection and not differences in life history. Ecology of Freshwater Fish 13:294-304.

Batt, P.E. 1996. Governor Philip E. Batt's State of Idaho Bull Trout Conservation Plan. Office of the Governor. Boise, Idaho. 20 pp. plus lit cited and appendices.

Berg, R.K.. 2003. Fish populations status in eight major lakes in the Clearwater River drainage, Montana, 1995-2002. Federal Aid Report F-113-R1and F-113-R2. Montana Fish, Wildlife and Parks, Helena.

Bernall, S. and S. Moran. 2004. Cabinet Gorge Reservoir northern pike study. Annual progress report – 2003. Fish passage / native salmonid restoration program. Avista Corporation, Noxon, Montana.

Brenkman, S.J., and S.C. Corbett. 2005. Extent of anadromy in bull trout and implications for conservation of a threatened species. North American Journal of Fisheries Management 25:1073-1081.

Chandler, J., R. Wilkison, and T. Richter. 2001. Distribution, status, life history and limiting factors of redband trout and bull trout associated with the Hells Canyon Complex. Technical Report, Idaho Power Company. 166 pp.

Columbia River Fisheries Program Office (CRFPO). 2005. Bull Trout 5-Year Review, Memorandum from Staff to Rollie White, Project Manager submitting "CRFPO Comments on State Submittals for Bull Trout 5-Year Status Review Process". February 24, 2005.

Donald, D.B. and D.J. Alger. 1993. Geographic distribution, species displacement, and niche overlap for lake trout and bull trout in mountain lakes. Can. J. Zool. 71:238-247.

Dunham, J.B. and B.E. Rieman. 1999. Metapopulation structure of bull trout: Influences of physical, biotic, and geometrical landscape characteristics. Ecological Applications 9:642-655.

Dunham, J., B. Rieman, and K. Davis. 2000. Sources and magnitude of sampling error in redd counts for bull trout (*Salvelinus confluentus*). North American Journal of Fisheries Management 21:343-352.

Fredenberg, W. 2002. Further evidence that lake trout displace bull trout in mountain lakes. Intermountain Journal of Sciences 8(3):143-152.

Fredenberg, W. 2003. Informal survey of adfluvial bull trout waters of the Columbia River Basin. Prepared for Salvelinus confluentus Curiosity Society, Atlanta, Idaho conference 8/20/03.

Frissell, C.A. 1999. An ecosystem approach to habitat conservation for bull trout: groundwater and surface water protection. Open File Report 15699. Flathead Lake Biological Station, University of Montana, Polson.

Fuller, Ross, Washington Department of Fish Wildlife Fish Management Division Manager Letter subject: **"**Washington Department of Fish Wildlife Response to 5 Year Bull Trout Status Review". January 3, 2005.

Gamblin, M., and R. Snyder. 2004. Status of Bull Trout (*Salvelinus confluentus*) in Montana, Idaho, and Nevada: 2004. Idaho Department of Fish and Game and Montana Department of Fish, Wildlife and Parks.

Garrity, Michael. 2004. Executive Director of Alliance for the Wild Rockies, Letter submitting comments. December 30, 2004

Hagener, M. Jeff. 2005. Director of Montana Department of Fish, Wildlife and Parks, letter submitting State of Montana comments. January 3, 2005.

Hanson, Mary. 2005. Oregon Department of Fish and Wildlife ESA Coordinator, Letter submitting State of Oregon comments. January 3, 2005.

Haskins, Richard. 2005. Chief of Fisheries, Nevada Department of Fish and Wildlife**, l**etter transmitting State of Nevada comments. January 10, 2005.

Idaho Department of Fish and Game (IDFG). 2004. Bull Trout Status Review and Assessment in the State of Idaho. Idaho Department of Fish and Game. Boise ID.

Idaho Department of Fish and Game (IDFG) and Montana Department of Fish, Wildlife and Parks (MDFWP). 2005. Status of Bull Trout (*Salvelinus confluentus*) in Montana, Idaho, and Nevada: 2004.

Idaho Department of Fish and Game (IDFG). 2005. State of Idaho Comments: Bull Trout 5-Year Status Review.

IUCN. The World Conservation Union. 2001. IUCN Red List Categories and Criteria - version 3.1. Prepared by the IUCN Species Survival Commission as approved by the 51st meeting of the IUCN Council. Gland, Switzerland. http://www.iucn.org/themes/ssc/red-lists.htm) 32 pages.

Kanda, N. and Allendorf, F.W. 2001. Genetic population structure of bull trout from the Flathead River Basin as shown by microsatellites and mitochondrial DNA markers. Transactions of the American Fisheries Society 130: 92-106.

Kleinschmidt Associates and K.L Pratt Independent Consultant. 2001. Exotic species suppression, and recreational fishery enhancement plan for Cabinet Gorge Reservoir. Phase 1 – Volumes 1 and 2. Life history characteristics of exotic species and bull trout, potential interaction between species, review of suppression techniques, and potential impacts in the areas of interest. Avista Corporation, Spokane, Washington.

Mantua, N. J. and R.C. Francis. In press. Natural Climate Insurance for Pacific Northwest Salmon and Salmon Fisheries: Finding Our Way through the Entangled Bank. Symposium Report 43:121-134.

Master, L.L., L.E. Morse, A.S. Weakley, G.A. Hammerson, and D. Faber-Langendoen. 2003. NatureServe Conservation Status Assessment Criteria. Nature Serve, Arlington, VA, USA.

Maxell, B.A. 1999. A power analysis on the monitoring of bull trout stocks using redd counts. North American Journal of Fisheries Management 19:860-866.

Montana Bull Trout Scientific Group (MBTSG). 1998. The relationship between land management activities and habitat requirements of bull trout. Report prepared for the Montana Bull Trout Restoration Team. Montana Fish, Wildlife and Parks, Helena. 78 pages.

Montana Natural Heritage Program and Montana Fish, Wildlife and Parks (MNHP). 2004. Montana Animal Species of Concern. Online at >http://mtnhp.org/animal/index.html<.

Montana Natural Heritage Program (MNHP). 2005. State Rank Criteria for Montana Animal Species of Concern. Online at >http://mtnhp.org/animal/index.html<.

Montana Bull Trout Restoration Team (MBTRT). 2000. Restoration Plan for bull trout in the Clark Fork River Basin and Kootenai River Basin, Montana. Montana Fish, Wildlife and Parks, Helena, MT.

Moran, S. 2004. Lower Clark Fork River, Montana - Avista Project Area - 2003 annual bull and brown trout redd survey report. Avista Corporation. Noxon, Montana.

Mogen, J.T. and L.R. Kaeding. 2005. Identification and characterization of migratory and nonmigratory bull trout populations in the St. Mary River drainage, Montana. Transactions of the American Fisheries Society 134:841-852.

Muhlfeld, C., S. Glutting, R. Hunt, and B. Marotz. 2000. Seasonal distribution and movements of native and non-native fishes in the upper Flathead River, Montana. Flathead River Native Species Project - Summary Report 1997-1999. Montana Fish, Wildlife and Parks, Kalispell.

Nelson, M.L., T.E. McMahon, and R.F. Thurow. 2002. Decline of the migratory form in bull charr, *Salvelinus confluentus*, and implications for conservation. Environmental Biology of Fishes 64:321-332.

Neraas, L.P. and P. Spruell. 2001. Fragmentation of riverine systems: the genetic effects of dams on bull trout (Salvelinus confluentus) in the Clark Fork River system. Molecular Ecology (10):1153-1164.

Post, J.R., C. Mushens, A. Paul, and M. Sullivan. 2003. Assessment of alternative harvest regulations for sustaining recreational fisheries: model development and application to bull trout. North American Journal of Fisheries Management 23:22-34.

Pringle, C. 2003. What is hydrologic connectivity and why is it ecologically important? Hydrol. Process. 17, 2685-2689.

Quigley, T.M., R.W. Haynes, and W.J. Hann. 2001. Estimating ecological integrity in the interior Columbia River basin. Forest Ecology and Management 153(2001):161-178.

Rieman, B. and J.D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. USDA Forest Service Intermountain Research Station General Technical Report INT-302. Boise, Idaho.

Rieman, B.E. and J.D. McIntyre. 1995. Occurrence of bull trout in naturally fragmented habitat patches of varied size. Transactions American Fisheries Society 124(3):285-296.

Rieman, B.E., D.C. Lee, and R.F. Thurow. 1997. Distribution, status, and likely future trends of bull trout within the Columbia River and Klamath Basins. North American Journal of Fisheries Management 17:1111-1125.

Rieman, B.E. and F.W. Allendorf. 2001. Effective population size and genetic conservation criteria for bull trout. North American Journal of Fisheries Management 21:756-764.

Rieman, B.E., D. Isaac, S. Adams, D. Horan, D. Nagel, C. Luce and D. Meyers. 2007. Anticipated climate warming effects on bull trout habitats and populations across the interior Columbia River basin. Transactions of the American Fisheries Society, in press, July 20, 2007.

Schmetterling, D.A., and M.H. Long. 1999. Montana anglers' inability to identify bull trout and other salmonids. Fisheries 24(7):24-27.

Snover, A.K., P. W. Mote, L. Whitely Binder, A.F. Hamlet, and N. J. Mantua. 2005. Uncertain Future: Climate Change and its Effects on Puget Sound. A report for the Puget Sound Action Team by the Climate Impacts Group (Center for Science in the Earth System, Joint Institute for the Study of the Atmosphere and Oceans, University of Washington, Seattle. 35 pp.

Spruell, P., A.R. Hemmingsen, P.J. Howell, N. Kanda, and F.W. Allendorf. 2003. Conservation genetics of bull trout: geographic distribution of variation at microsatellite loci. Conservation Genetics 4:17-19.

Taylor, E.B., S. Pollard, and D. Louie. 1999. Mitochondrial DNA variation in bull trout (*Salvelinus confluentus*) from northwestern North America: implications for zoogeography and conservation. Molecular Ecology 8:1155-1170.

U. S. Department of the Interior (USDOI). 2007. The meaning of "In danger of extinction throughout all or a significant portion of its range". Interior Solicitor Memorandum M-37013, March 16, 2007.

U. S. Fish and Wildlife Service (USFWS). 1996. Policy regarding the recognition of distinct vertebrate population segments under the Endangered Species Act. Federal Register: 61: 47221.

U. S. Fish and Wildlife Service. 1998. Endangered and threatened wildlife and plants; determination of threatened status for bull trout in the Columbia and Klamath River basins; final rule. Federal Register: 63: 31647.

U. S. Fish and Wildlife Service. 1999. Endangered and threatened wildlife and plants; determination of threatened status for bull trout in the coterminous United States; final rule. Federal Register: 64: 58909.

U.S. Fish and Wildlife Service. 2001. Wenatchee River basin bull trout telemetry study 2001 progress report. Mid-Columbia River Fishery Resource Office, Leavenworth, Washington. Prepared by B. Kelly-Rigel and J. Delavergne. 9 pp.

U.S. Fish and Wildlife Service. 2002a. Proposed designation of critical habitat for the Klamath River and Columbia River distinct population segments of bull trout and notice of availability of the draft recovery plan. Federal Register 67(230):71236-71438.

U.S. Fish and Wildlife Service. 2002b. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan (Klamath River, Columbia River, and St. Mary-Belly River Distinct Population Segments). U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service. 2004a. Proposed designation of critical habitat for the Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River populations of bull trout. Federal Register 69(122):35768-35857.

U.S. Fish and Wildlife Service. 2004b. Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service. 2004c. Draft Recovery Plan for the Jarbidge Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service. 2004d. Designation of critical habitat for the Klamath River and Columbia River populations of bull trout. Federal Register: 69 (193):59996-60075.

U. S. Fish and Wildlife Service. 2005a. Bull trout core area templates - complete core area by core area analysis. W. Fredenberg and J. Chan, *editors*. U. S. Fish and Wildlife Service. Portland, Oregon. 660 pages.

U. S. Fish and Wildlife Service. 2005b. Bull trout core area conservation status assessment. W. Fredenberg, J. Chan, J. Young, and G. Mayfield, *editors*. U. S. Fish and Wildlife Service. Portland, Oregon. 95 pages plus attachments.

U. S. Fish and Wildlife Service. 2005c. Designation of critical habitat for the bull trout. Federal Register: 70 (185) 56212-56311.

Vidergar, D.T. 2000. Population estimates, food habits and estimates of consumption of selected predatory fishes in Lake Pend Oreille, Idaho. M.S. Thesis, University of Idaho, Moscow.

Whitesel, T.A. et.al. 2004. Bull trout recovery planning: A review of the science associated with population structure and size. Science Team Report #2004-01, U.S. Fish and Wildlife Service, Portland, Oregon. 41 pp plus lit cited and appendices.

Zollweg, E. 1998. Piscine predation on bull trout in the Flathead River, Montana. Masters Thesis, Montana State University, Bozeman.

Additional information considered, but not cited, in this review document

British Columbia Ministry of Water, Land and Air Protection. 2002. Environmental indicator: fish in British Columbia. (http://wlapwww.gov.bc.ca/soerpt/pdf/4fish/Fish_2002.pdf).

Fuller, R., Washington Department of Fish and Wildlife. 2005. Letter transmitting additional information on the status of bull trout in Washington.

Hanson, M., Oregon Department of Fish and Wildlife. 2005. Letter transmitting additional information on the status of bull trout in Oregon.

Idaho Department of Fish and Game and Montana Department of Fish, Wildlife and Parks (IDFG and MFWP). 2005b. Joint comment letter for bull trout 5-year review from Directors S. Huffaker and J.. Hagener transmitting the States' status assessment for bull trout. 2 pages, plus attachments. January 3, 2005.

Schaller, H., Cummings, T., Whitesel, T., Wilson P. 2005. Columbia River Fisheries Protection Office Comments on State Submittals for Bull Trout 5-Year Status Review Process. 10 pages. February 25, 2005.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW on Bull Trout (*Salvelinus confluentus)*

CURRENT CLASSIFICATION - Threatened

RECOMMENDATION resulting from the 5-Year Review

_____Delist

_____Endangered to Threatened

_____Threatened to Endangered

__X__No Change

REVIEW CONDUCTED BY - Region 1, Region 6, and Region 8

Signature _____ Date 4/25/08
Lead Regional Director, U.S. Fish and Wildlife Service, Region 1

Signature _____ Date 4/29/08
Acting Cooperating Regional Director, U.S. Fish and Wildlife Service, Region 8

Signature _____ Date 4/22/08
Cooperating Regional Director, U.S. Fish and Wildlife Service, Region 6