

Listing and Recovery Planning for Bull Trout

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Abstract--As of November 1, 1999, all bull trout in the coterminous United States were listed as threatened under the Endangered Species Act by the U.S. Fish and Wildlife Service (Service). The Service had earlier identified five distinct population segments of bull trout--Columbia River (Idaho, Montana, Oregon, and Washington), Klamath River (south central Oregon), Jarbidge River (southern Idaho and northern Nevada), Coastal-Puget Sound (western Washington), and St. Mary-Belly River (northwest Montana)--for which some population segments had been listed in 1998. All population segments have declined in overall distribution and abundance due primarily to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, and the introduction of nonnative species. In January 1999, the Service convened a recovery team to develop a recovery plan. The recovery team consists of Service personnel and representatives of state fish and wildlife agencies and Native American Tribes. The recovery team has identified 22 recovery units encompassing the Columbia River population segment, developed a draft recovery goal and objectives, and is developing recovery criteria. Recovery unit teams, consisting of personnel from natural resource agencies, industry and private groups, and Native American Tribes, have formed to assist in developing individual chapters specific to each recovery unit.

INTRODUCTION

On June 10, 1998, the U.S. Fish and Wildlife Service (Service) issued a rule listing the Columbia River and Klamath River populations of bull trout (*Salvelinus confluentus*) as threatened species (63 FR 31647) under the authority of the Endangered Species Act of 1973 (Act), as amended. This decision conferred full protection of the Act on bull trout occurring in four northwestern states. The listing contained a special rule allowing "take" of bull trout (i.e., through angling) if conducted in accordance with State and Native

American Tribal fish and wildlife conservation laws and regulations existing on the date the rule was issued. A proposed rule to list the remaining three population segments of bull trout (Coastal-Puget Sound, Jarbidge River, and St. Mary-Belly River) as threatened was also published on the same date (63 FR 31693). An emergency rule listing the Jarbidge River population segment as endangered was published on August 11, 1998 (63 FR 42757) due to road construction activities, and the population was subsequently listed as threatened on April 8, 1999 (64 FR 17110), when the emergency rule expired. The Coastal-Puget Sound and St. Mary-

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Belly River population segments were listed as threatened on November 1, 1999 (64 FR 58910), which resulted in all bull trout in the coterminous United States being listed as threatened.

The purpose of this paper is to summarize activities and analyses conducted in evaluating bull trout for listing, present the approach the Service is taking in developing a recovery plan, and report on the current status of recovery planning for bull trout. This paper will focus on activities for the population segments first listed, particularly the Columbia River population segment.

LISTING BULL TROUT

Listing Activities

On September 18, 1985, the Service published a notice of review (50 FR 37958) designating bull trout a category 2 candidate for listing in the coterminous United States. This action was the first formal designation of bull trout as a species of concern. Category 2 taxa were those for which conclusive data on biological vulnerability and threats were not currently available to support proposed rules. The Service elevated bull trout in the coterminous United States to category 1 for Federal listing on November 15, 1994 (59 FR 58982). Category 1 taxa were those for which the Service had on file substantial information on biological vulnerability and threats to support preparation of listing proposals. The Service ceased using category designations in February 1996 and included bull trout as a candidate species. Candidate species are those that the Service has on file sufficient information on biological vulnerability and threats to support proposals to list the species as threatened or endangered.

On October 30, 1992, the Service received a petition to list bull trout as an endangered species throughout its range from three conservation organizations (petitioners). A 90-day finding, published on May 17, 1993 (58 FR 28849), determined that the petitioners had provided substantial information indicating that listing of the species may be warranted. The Service initiated a rangewide status review of the species concurrent with publication of the 90-day finding.

On June 6, 1994, the Service concluded in the original finding that listing of bull trout throughout its range was not warranted due to unavailable or

insufficient data regarding threats to, and status and population trends of, the species within Canada and Alaska. However, the Service determined that sufficient information on the biological vulnerability and threats to the species was available to support a warranted finding to list bull trout within the coterminous United States. Because the Service concluded that the threats were imminent and moderate to this population segment, the Service gave the bull trout within the coterminous United States a listing priority number of 9 on a scale of 1 (highest) to 12 (lowest). As a result, the Service found that listing a distinct vertebrate population segment of bull trout residing in the coterminous United States was warranted but precluded due to higher priority listing actions.

On November 1, 1994, two of the original petitioners filed suit in the U.S. District Court of Oregon arguing that the warranted but precluded finding was arbitrary and capricious. After further legal review, the Court issued an order and opinion remanding the original finding to the Service for further consideration on November 13, 1996. The reconsidered 12-month finding based on the 1994 Administrative Record was delivered to the Court on March 13, 1997.

Based upon the Court agreement and stipulation, and information contained solely in the 1994 record, the Service proposed the Klamath River population of bull trout as endangered and Columbia River population of bull trout as threatened on June 13, 1997 (62 FR 32268). On December 4, 1997, the Court ordered the Service to reconsider several aspects of the 1997 reconsidered finding. On February 2, 1998, the Court allowed the Service until June 12, 1998 to respond. The final listing determination for the Klamath River and Columbia River population segments of bull trout and the proposed listing rule for the Coastal-Puget Sound, Jarbidge River, and St. Mary-Belly River distinct population segments (63 FR 31693), concurrently published on June 10, 1998, constituted the Service's response. An emergency rule listing the Jarbidge River population segment as endangered was published on August 11, 1998 (63 FR 42757) due to habitat destruction caused by unauthorized road construction activities, and the population was subsequently listed as threatened on April 8, 1999 (64 FR 17110), when the emergency rule expired. The Coastal-Puget Sound and St. Mary-Belly River population segments were listed as threatened on November 1,

1999 (64 FR 58910), which resulted in all bull trout in the coterminous United States being listed as threatened. In summary, after seven years of review and litigation, all bull trout in the coterminous United States are now listed as threatened under the Act.

Analyses of Bull Trout Data

In the proposed rule, the Service identified distinct population segments within the coterminous United States because bull trout occur in widespread but fragmented habitats. Also, the threats to bull trout are diverse, and the amount and quality of information pertaining to fish abundance and trends varies greatly throughout the range.

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

The Service found that numerous bull trout groups are isolated from each other by either unsuitable

habitat or impassible dams and diversions, or both. Although many groups could be considered discrete, few meet the "significance" criteria. For example, although some genetic differences were identified among bull trout in specific watersheds of the Columbia River basin, they did not differ markedly and they inhabit similar habitats. The Service concluded that existing information supported designating five distinct population segments in the coterminous United States--1) Klamath River in south central Oregon, 2) Columbia River in Idaho, Montana, Oregon, and Washington, 3) Coastal-Puget Sound in western Washington, 4) Jarbidge River in southern Idaho and northern Nevada, and 5) St. Mary-Belly River in northwest Montana.

Although the range of bull trout extends into Canada and Alaska, bull trout outside the coterminous United States were not considered in this rulemaking. In accordance with the distinct vertebrate population policy, the Service may determine a population to be discrete at an international border where there are significant differences in the control of exploitation, management of habitat, conservation status, or regulatory mechanisms. Bull trout management and conservation strategy in Canada differs from the United States and such activities are beyond the regulatory scope of the Act. The best available information also disclosed uncertainty regarding the status of bull trout in Canada. The status of bull trout in Alaska is unknown.

To facilitate evaluation of current bull trout distribution and abundance in each population segment, the Service analyzed data on bull trout relative to subpopulations because fragmentation and barriers have isolated bull trout throughout their current range. A subpopulation was considered a reproductively isolated group of bull trout that spawns within a particular area of a river system. In areas where two groups of bull trout are separated by a barrier (e.g., an impassable dam or waterfall, or reaches of unsuitable habitat) that allows only individuals upstream access to those downstream (i.e., one-way passage), both groups were considered subpopulations.

The Service evaluated status of bull trout subpopulations based on modified criteria of Rieman et al. (1997), which included abundance, trends in abundance, and the presence of life-history forms of bull trout. The Service considered a subpopulation "strong" if 5,000 individuals or 500 spawners likely occur in the

subpopulation, abundance appears stable or increasing, and life-history forms were likely to persist; and "depressed" if less than 5,000 individuals or 500 spawners likely occur in the subpopulation, abundance appears to be declining, or a life-history form historically present has been lost. If there was insufficient abundance, trend, and life-history information to classify the status of a subpopulation as either "strong" or "depressed," the status was considered "unknown."

In addition to status, the Service estimated whether subpopulations were susceptible to extirpation from naturally occurring events. Subpopulations were considered at risk of extirpation from naturally occurring events if they were--1) unlikely to be reestablished by individuals from another subpopulation (i.e., functionally or geographically isolated from other subpopulations); 2) limited to a single spawning area (i.e., spatially restricted); and either 3) characterized by low individual or spawner numbers; or 4) primarily of a single life-history form. For example, a subpopulation of resident fish isolated upstream of an impassable waterfall would be considered at risk of extirpation from naturally occurring events if the subpopulation had low numbers of fish that spawn in a restricted area. In such cases, a natural event such as a fire or flood affecting the spawning area could eliminate the subpopulation, and reestablishment from fish downstream would be prevented by the impassable waterfall. However, a subpopulation residing downstream of the waterfall would not be considered at risk of extirpation from naturally occurring events because it could be reestablished by fish from the subpopulation upstream. Because resident bull trout may exhibit limited downstream movement (Nelson 1999), the Service's determination of subpopulations at risk of extirpation from naturally occurring events may have overestimated the number of subpopulations that are likely to be reestablished.

In the Columbia River population segment for example, the Service identified 141 subpopulations and considered the status of 5 (4%) to be "strong," 98 (70%) to be "depressed," and 38 (27%) to be "unknown" (Service 1998). Seventy-one (50%) of the subpopulations were considered at risk of extirpation from naturally occurring events, 64 (45%) were not considered at risk, and susceptibility to extirpation could not be determined for 6 (4%).

The Act stipulates that the Service evaluate species for listing relative to five factors: A) the present or threatened destruction, modification, or curtailment of habitat or range; B) overutilization for commercial, recreational, scientific, or educational purposes; C) disease or predation; D) the inadequacy of existing regulatory mechanisms; and E) other natural or manmade factors affecting continued existence. Because there are numerous activities affecting habitat of each bull trout subpopulation, the Service evaluated the first factor relative to several activities, which were dams, forest management practices, livestock grazing, agricultural practices, road construction and maintenance, mining, and residential development (Service 1998).

In regards to the first factor (i.e., habitat relations) for the Columbia River population segment, past or ongoing activities that affect most subpopulations were forest management practices (74%), livestock grazing (52%), and agricultural practices (48%).

The second factor (i.e., overutilization) is a concern for the Columbia River population segment, but States and Native American Tribes have instituted restrictive angling regulations. However, illegal and incidental harvest may be a factor in some areas.

The third factor (i.e., disease or predation) also affects the Columbia River population segment. Whirling disease has been documented in some areas of the Columbia River population segment, but it is not presently considered a limiting factor. However, 87 (62%) of the subpopulations co-exist with various introduced fish species for which predation may be occurring on bull trout.

The fourth factor (i.e., regulatory mechanisms) includes numerous Federal and State laws designed to conserve fishery resources, maintain water quality, and protect aquatic habitats. The Service found that, although many regulations have become more protective of bull trout and their habitats, the implementation and enforcement of existing regulations have not prevented past and ongoing habitat degradation affecting bull trout.

The fifth factor (i.e., other natural and manmade factors) includes introduced nonnative species, and isolation and habitat fragmentation. The majority of subpopulations in the Columbia River population segment (87 of 141, 62%) co-exist with introduced nonnative species that may hybridize or compete with bull trout, or

prey on bull trout. The Service also concluded that the occurrence of bull trout in numerous subpopulations was an indication of increasing habitat fragmentation resulting primarily from activities discussed in the first factor affecting the species. By increasing the degree of isolation among groups of bull trout, habitat fragmentation increases the vulnerability of bull trout to extirpation from numerous causes.

RECOVERY PLANNING FOR BULL TROUT

Recovery is the process by which the decline of an endangered or threatened species is arrested or reversed, and threats to its survival are removed, so that long-term survival in nature can be ensured. The goal of the recovery process is to restore listed species to a point where they are secure, self-sustaining components of their ecosystem so as to allow delisting.

Recovery plans are not decision or regulatory documents. They are intended to provide information and guidance that the Service believes will lead to recovery of a listed species and their habitats. The Act specifically directs that all recovery plans include three component: 1) description of site-specific management actions necessary to achieve recovery; 2) objective, measurable criteria for delisting of the species; and 3) estimates of the time and cost to carry out recovery actions and achieve intermediate steps toward recovery, and ultimately to attain recovery. The Service also recommends that recovery plans are revised or updated every five years.

Approach to Recovery Planning for Bull Trout

Because the five bull trout population segments occur over a large area and population segments were subject to listing at different points in time, the Service sought to develop a systematic recovery planning approach that would accommodate planning over a large area and could also incorporate additional areas. The Service adopted a two-tiered approach, one tier addressing broad aspects of bull trout recovery (i.e., at the level of population segments) and another tier

addressing recovery of specific areas within a population segment (i.e., recovery units).

The recovery plan will consist of an introductory chapter followed by chapters devoted to individual recovery units. The introductory chapter will contain an overview of bull trout biology; description of the recovery strategy; guidance on recovery issues; programmatic-level recovery actions; and overall recovery goal, objectives, and criteria applicable to bull trout population segments. Each recovery unit chapter will address an individual recovery unit with objectives, recovery criteria, and recovery actions specific to each recovery unit. Each of the recovery unit chapters can be thought of as a “mini-recovery plan” that contributes to and is consistent with the overall recovery plan.

The Service is relying on two types of teams, an overall recovery team and recovery unit teams, to assist in developing the recovery plan. The recovery team is responsible for “big-picture” issues, such as producing the introductory chapter, identifying recovery units, and providing guidance in development of recovery unit chapters for coordination and consistency. The recovery team is composed of Service biologists, a representative from fish and wildlife resource agencies in each of four northwestern states (Idaho, Montana, Oregon, and Washington), and representatives of the Nez Perce Tribe and Upper Columbia River United Tribes (Confederated Tribes of the Colville Reservation, Coeur d’Alene Tribe, Kalispel Tribe, Kootenai Tribe of Idaho, and Spokane Tribe).

Recovery unit teams are responsible for assisting in the development of recovery unit chapters. Membership on recovery unit teams consists of persons with technical expertise in various aspects of bull trout biology within each recovery unit. Major tasks of recovery unit teams include: defining recovery for recovery units (i.e., recovery unit-specific objectives and recovery criteria, primarily in terms of distribution and population characteristics); reviewing factors affecting bull trout; describing ongoing conservation efforts; and developing specific recovery actions.

Status of Recovery Planning for Bull Trout

The Service convened the first meeting of the recovery team in January 1999. The team has since held nine meetings, and holds regularly scheduled

conference calls to discuss issues pertinent to the recovery plan. The primary accomplishments of the recovery team to date have been identifying recovery units for the Klamath River and Columbia River population segments, developing an overall goal and objectives for the recovery plan, and providing guidance to recovery unit teams. The guidance consists of a standard outline for each recovery unit chapter, terms to describe bull trout habitats and population units, and a “matrix” used to characterize bull trout populations. The recovery team has also benefitted from a group of scientific experts actively involved in research on bull trout or salmonid ecology. Several individuals have reviewed items produced by the recovery team.

Recovery Units

The recovery team considered several factors in identifying recovery units, with primary emphasis on known biological and genetic factors. Because every state has established conservation plans and strategies for bull trout or initiated efforts that are in various stages of development, political boundaries were also considered so that recovery unit chapters could build upon and mesh with ongoing activities. In some instances recovery unit boundaries were modified to maximize efficiency of established watershed groups, encompass areas of common threats, or accommodate other logistic concerns. The Klamath River population segment consists of a single recovery unit and the Columbia River population segment contains 22 recovery units. Most recovery units in the Columbia River population segment consist of one or more major river basin. Work is continuing on identifying recovery units in the remaining three population segments.

Goal and Objectives

The recovery team has also drafted an overall goal and four objectives for bull trout recovery. The recovery goal is to “ensure the long-term persistence of self-sustaining, complex interacting groups of bull trout distributed across the species native range.” This goal recognizes the importance of population and habitat characteristics that allow bull trout to maintain viability and the opportunity for bull trout to

migrate. The recovery team determined four objectives are necessary to attain this goal, these are to: 1) maintain current distribution of bull trout and restore distribution in some previously occupied areas within the species’ native range; 2) maintain stable or increasing trends in abundance of bull trout in all recovery units; 3) restore and maintain suitable habitat conditions for all bull trout life stages and life histories; and 4) conserve genetic diversity and provide opportunity for genetic exchange.

Recovery Unit Team Guidance–Chapter Outline

The recovery team has developed several items to guide recovery unit teams in developing individual chapters for the recovery plan. One item is a standard outline for recovery unit chapters. The outline is intended to ensure consistency in the organization and presentation of information in each chapter. Examples of topics included in the outline include: a description of the recovery unit, bull trout distribution and abundance, reasons for bull trout decline, ongoing conservation efforts, recovery-unit-specific objectives and criteria, and actions needed.

Recovery Unit Team Guidance–Terms

Various terms to describe bull trout habitat and population units have been used in the literature, agency reports, and documents for ongoing conservation efforts. In many instances there is considerable overlap and ambiguity in the terminology. To ensure consistency among recovery unit chapters and define the scope of recovery, the recovery team developed standardized terminology for bull trout habitat and population units to be used throughout the recovery plan. The recovery team defined two categories of bull trout habitat:

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

Foraging, migrating, and overwintering habitat: Relatively large streams and mainstem rivers, including

lakes or reservoirs, in which subadult and adult migratory bull trout use to forage, migrate, mature, or overwinter. Foraging, migrating, and overwintering habitat is typically (but not always) downstream from spawning and rearing habitat and must contain all the physical elements to meet critical overwintering, spawning migration, and subadult rearing needs. Although use of foraging, migrating, and overwintering habitat by bull trout may be seasonal or very brief (as in some migratory corridors), it is nonetheless a critical element for migratory bull trout to persist.

To draw a link between habitat and characteristics of particular bull trout groups, the recovery team adopted an additional term, core habitat

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

Terms for population units are hierarchical, allowing recovery efforts to be focused at various spatial scales. From broad to fine scales the terms are:

Distinct population segment: The Service has formally determined there are five bull trout distinct population segments across the species range within the coterminous United States--Klamath River, Columbia River, Jarbidge River, Coastal-Puget Sound, and St. Mary-Belly River. Each meets the tests of discreteness and significance under joint policy of the Service and NMFS (61 FR 4722), and these are the units against which recovery progress for delisting decisions currently must be measured.

Recovery unit: These are the major units for managing the recovery effort, with each recovery unit forming a separate chapter in the recovery plan. A distinct population segment may contain one or several recovery units. Several factors were considered in identifying recovery units (e.g., biological and genetic factors, political boundaries, and ongoing conservation efforts; see above). Biologically, recovery units are

considered groupings of bull trout for which gene flow was historically or is currently possible.

Recovery subunit: For some large and diverse recovery units, it may be necessary to subdivide recovery units into subunits to maintain a manageable entity. Subunits will be treated similar to recovery units for administrative purposes (e.g., may have separate goal and objectives or recovery criteria), but typically their identity is less biologically significant and more for organizational purposes.

Core population: A group of one or more local bull trout populations that exists within core habitat (see definition of local population below).

Core area: The combination of core habitat (i.e., habitat that could supply all elements for the long-term security of bull trout) and a core population (i.e., bull trout inhabiting core habitat) constitutes the basic unit on which to gauge recovery within a recovery unit. The recovery team termed this combination core area. Core areas require both habitat and bull trout to function, and the number (replication) and characteristics of local populations inhabiting a core area can provide a relative indication of the core area's likelihood to persist.

Local population: A group of bull trout that spawns within a particular stream or portion of a stream system. Until site-specific research indicates spatial, temporal, or genetic isolation, a local population will be considered as the smallest group of fish that is known to represent an interacting reproductive unit. For most waters where specific information is lacking, a local population may be represented by a single headwater tributary or complex of headwater tributaries. Gene flow among local populations may occur (e.g., those within a core population or broader population unit), but is assumed to be infrequent compared to that among individuals within a local population.

As being used in the recovery plan, the concept of core area is similar to that in a conservation strategy for bull trout proposed by Rieman and McIntyre (1993). In the strategy, core areas must be selected to provide all critical habitat elements, should be selected from the best available habitat or habitat with the best opportunity to be restored to high quality, must provide for replication of multiple local populations (minimum 5-10) within its boundaries, should be large enough to incorporate genetic and phenotypic diversity but small enough to ensure that

component local populations effectively connect, and must be distributed throughout the historic range of the species. In the recovery plan, the context of core area has been expanded with a use more specifically toward restoration. For example, recovery may entail designating core areas that contain a single local population, which is inconsistent with how the core area concept is used in Rieman and McIntyre (1993). However, in the context of restoration, comparing qualities of core areas noted in the recovery plan to the characteristics of core areas in the strategy may assist in identifying conditions and activities that may be necessary for recovery.

Recovery Unit Team Guidance–Matrix

The recovery team recognized the need to characterize bull trout populations in a consistent manner using variables useful for developing recovery criteria. The population status matrix was developed for bull trout as a tool for recovery unit teams to assess population attributes within individual core areas of recovery units.

The matrix relied on concepts contained in both the conservation strategy proposed by Rieman and McIntyre (1993) and the approach described in the NMFS document “Viable salmonid populations and the recovery of evolutionarily significant units” (McElhany et al. 2000). Four variables were selected that indicate attributes of demographic, population structure, and life history characteristics. The variables were: adult abundance (number of adult-sized bull trout), productivity (population trend and variability), number of local populations, and life history forms (an indicator of connectivity). Ranges of values or descriptions were associated with variables so that core areas could be assigned to one of three categories for each variable--increasing, intermediate, and diminishing degree of threat.

In applying the matrix, recovery unit teams were requested to characterize bull trout for each core area within a recovery unit using the matrix. This described the current condition of bull trout in the core areas. The recovery unit teams were then requested to estimate how core areas would be characterized if threats in each were addressed. This described the potential conditions that might be achieved for each core area in the future. The information is intended to assist in the development

of recovery criteria for each recovery unit. Using this approach, potential future conditions can be estimated based on attributes of a specific core area, not necessarily based on predetermined standards. This approach acknowledges that the potential future condition of bull trout in some core area may be less than that ideally described by conservation biology theory. Bull trout in such core areas may be limited by natural attributes or patch size, and may always remain at a higher level of risk of extirpation than bull trout in other core areas.

CLOSING

The recovery team is continuing work on developing criteria by which to gauge achievement of recovery objectives and on which delisting decisions can be based. Although preliminary, the team is currently focusing on two categories of criteria, bull trout distribution and characteristics of bull trout populations. Distribution criteria likely will address the present distribution of bull trout core areas and local populations within each recovery unit, and designate areas essential for recovery where bull trout have been locally extirpated. Criteria addressing population characteristics will likely be developed from information generated by applying the matrix, such as that concerning adult abundance, trends in abundance, number of local populations, and barriers inhibiting migratory fish and connectivity. criteria may use several variables describing conditions of core areas, e.g., bull trout abundance, productivity, and the number of local populations and their connectivity.

Developing a recovery plan for a species as widely distributed as bull trout is a challenging undertaking. The assistance and cooperation among various State and Federal agencies, Native American Tribes, and private groups will be essential for completion of the recovery plan. Because a recovery plan is a guidance document, continued assistance and cooperation among the same various groups involved in plan development, as well as others, will be essential for actions in the plan to be implemented and contribute to recovery of bull trout. In short, the recovery plan will guide recovery, but it is the groups that will make it happen. Because our knowledge of bull trout will increase as recovery actions are implemented and their

effects are subsequently monitored, the Service views the recovery plan as a living document that must be responsive to improvements in our knowledge.

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