

## STRATEGY FOR RECOVERY

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

Currently, one core area is defined for the Hood River Recovery Unit, the Hood River Core Area (Figure 2). The Hood River Core Area encompasses tributaries containing local populations (both current and potential as identified by the recovery unit team) and the mainstem Hood River from its headwaters downstream to the confluence with the Columbia River. Although we know Hood River bull trout migrate to the Columbia River and back, we lack a clear understanding of the extent of their use and distribution in the Columbia River mainstem. Currently, no core areas have been defined for the Sandy River, but it is designated as core habitat. At the time of listing, there was no known occurrence of bull trout in the Sandy River. Presently, there is insufficient information on bull trout distribution and use of the Sandy River to identify a core area, however, additional information on bull trout use of the Sandy River as well as the mainstem Columbia River is defined as a primary research need.

### Recovery Goals and Objectives

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

- ▶ Current distribution of bull trout within the Hood River Recovery Unit is maintained and expanded to suitable habitat in the core area.

- ▶ Stable or increasing trends in abundance of bull trout in the Hood River Recovery Unit are maintained.
- ▶ Suitable habitat conditions for all bull trout life history stages and strategies are restored and maintained within the Hood River Recovery Unit.
- ▶ Genetic diversity and opportunities for genetic exchange within the Hood River Recovery Unit are maintained.

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

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

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

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

For the Hood River Core Area, there are currently two known local populations (Clear Branch above the dam and Hood River below the dam). Based on the above guidance, bull trout in the Hood River Core Area are in the increased risk category.

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

population sizes greater than 50 adults are necessary to prevent inbreeding depression and a potential decrease in viability or reproductive fitness of a population (Franklin 1980). To minimize the loss of genetic variation due to genetic drift, and to maintain constant genetic variance within a population, an effective population size of at least 500 is recommended (Franklin 1980, Soule 1980, Lande 1988). Effective population sizes required to maintain long-term genetic variation that can serve as a reservoir for future adaptations in response to natural selection and changing environmental conditions are discussed in Chapter 1 of the recovery plan.

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

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

Although accurate adult abundance estimates for the Hood River Core Area are not available, the recovery unit team estimates it at 300 or less. Trap count and snorkel count data support this estimate. This low adult abundance in the Hood River Core Area places it at risk from genetic drift. It is uncertain whether either of the two local populations are currently at risk from inbreeding depression, however, given the overall low abundance within the core area this remains a serious concern.

**Productivity.** A stable or increasing population is a key criterion for recovery under the requirements of the Endangered Species Act. Measures of the trend of a population (the tendency to increase, decrease, or remain stable) include population growth rate or productivity. Estimates of population growth rate (*i.e.*,

productivity over the entire life cycle) that indicate a population is consistently failing to replace itself also indicate an increased risk of extinction. Therefore, the reproductive rate should indicate that the population is replacing itself, or growing.

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

The population growth rate is an indicator of probability of extinction. This probability cannot be measured directly, but it can be estimated as the consequence of the population growth rate and the variability in that rate. For a population to be considered viable, its natural productivity should be sufficient for the population to replace itself from generation to generation. Evaluations of population status will also have to take into account uncertainty in estimates of population growth rate or productivity. For a population to contribute to recovery, its growth rate must indicate that the population is stable or increasing for a period of time.

Based on less than ten years of population trend data, the Hood River Core Area is considered to be at least at an intermediate threat level. However, the relatively moderate to high variability in annual snorkel counts conducted in index reaches, in conjunction with low adult abundance, is a source of concern.

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

the core area was judged to be at intermediate risk. Finally, if the migratory life form was present in all or nearly all local populations, and had the ability to connect with other local populations, the core area was considered to be at diminished risk. The Hood River Core Area is considered at an intermediate threat level. Migratory life forms persist in at least some local populations with partial ability to connect with other local populations.

### **Recovery Criteria**

Recovery criteria for bull trout in the Hood River Recovery Unit the following:

1. **Distribution criteria will be met when bull trout are distributed among three or more local populations, including the existing Clear Branch and Hood River local populations in the Hood River Core Area.** In a recovered condition the Hood River Core Area will include up to four local populations. In addition to the two existing local populations (Clear Branch and Hood River), recovery actions may lead to defined spawning and rearing areas in the West Fork and possibly in the East Fork of Hood River. Additional population studies and a better understanding of bull trout fidelity to their natal streams is needed to better define local populations in the recovery unit. The extent of bull trout use of the Sandy River and mainstem Columbia River is a primary research need.
2. **Abundance criteria will be met when the estimated abundance of adult bull trout is at least 500 individuals distributed within the Hood River Recovery Unit.** Recovered abundance range was derived using the professional judgement of the Recovery Unit Team and estimation of productive capacity of identified local populations. The natural productive capacity of the Hood River Core Area will likely keep it below 1,000 spawning adults annually, and therefore at continued risk from genetic drift. Abundance for the Hood River Core Area may be refined as more information becomes available, through monitoring and research, including identified distribution and population criteria for the Sandy River. The U.S.

Fish and Wildlife Service will evaluate the identified abundance levels relative to the maintenance of long-term genetic variation which would provide the population the ability to adapt to natural selection and changing environmental conditions.

In the Hood River Core Area, increased abundance is expected to occur within existing population complexes, and through expansion to other areas as recovery progresses. We expect that it may take ten years or more to achieve an adult population level of 500 or more fish in the Hood Core Area. We do not know at this time how many adult bull trout occur in the Hood River Basin, and do not have sufficient information at present to estimate recovered adult numbers in individual local populations. There is potential to expand population abundance in the basin. Spawning habitat in the Clear Branch of Hood River needs to be protected, and in the Middle Fork Hood River it needs to be protected and expanded. There are opportunities to protect and expand year round rearing and migration habitat in the mainstem Hood River, and East and West Fork of Hood River, on public and private lands.

Opportunities to protect spawning and rearing habitat through purchase, conservation easement, land exchange or other means should be pursued. Restoration efforts to improve anadromous salmonid production in the Hood Core Area can be expected to benefit existing and potential migration corridors and overwintering habitat for bull trout, as well as improve their prey base.

3. **Trend criteria will be met when adult bull trout exhibit a stable or increasing trend for at least 2 generations at or above the recovered abundance level within the recovery unit.** Achievement of this recovery criteria will be based on a minimum of 10 years of monitoring data, or approximately two bull trout generations. The development of a standardized monitoring and evaluation program which would accurately describe trends in bull trout abundance is identified as a priority research need. As part of the overall recovery effort, the U.S. Fish and Wildlife

Service will take the lead in addressing this research need by forming a multi-agency technical team to develop protocols to evaluate trends in bull trout populations.

4. **Connectivity criteria will be met when passage barriers to bull trout have been addressed at Powerdale Dam, Clear Branch Dam, Coe Diversion, Eliot Diversion, Farmers Diversion and Tony Creek Diversion, and seasonal water quality barriers have been addressed in the East and West Forks of Hood River.** Passage barriers must be addressed in the Hood River Core Area to ensure opportunities for connectivity within and among local populations. This also includes providing adequate diversion screening.

Identification of these barriers does not imply that other actions associated with passage and habitat degradation are not crucial for recovery to occur. To achieve recovery in the Hood River Recovery Unit, all four recovery criteria (local populations, abundance, population trends, and connectivity) must be achieved. It is likely, that meeting all four recovery criteria will not be accomplished by providing passage past only these barriers.

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

### **Research Needs**

Based on the best scientific information available, the Hood River Recovery Unit Team has identified recovery criteria and actions necessary for recovery of

bull trout within the Hood River Recovery Unit. However, the recovery unit team recognizes that many uncertainties exist regarding bull trout population abundance, distribution, and recovery actions needed. The recovery unit team feels that if effective management and recovery are to occur, the recovery plan for the Hood River Recovery Unit should be viewed as a “living” document, to be updated as new information becomes available. As part of this adaptive management approach, the Hood River Recovery Unit Team has identified essential research needs within the recovery unit.

**Columbia River.** A primary research need is a complete understanding of the current, and future, role that the Columbia River should play in the recovery of bull trout. Bull trout migrate seasonally from the Hood River to the mainstem Columbia River, using the Columbia during a portion of their life history. It is essential to establish, with greater certainty, the current extent of bull trout distribution and seasonal use areas. To this end, the Team recommends development and application of a scientifically accepted, statistically rigorous, standardized protocol for determining present distribution of bull trout. Application of such a protocol will improve the Team’s ability to identify additional core areas, or revise the current classification.

Specifically, those tributaries where there have been anecdotal reports of bull trout captured should be targeted to clarify bull trout distribution within the recovery unit. These areas include, but are not limited to the East and West Forks of Hood River, the Sandy River, and the mainstem Columbia River.

Bonneville Dam on the Columbia is a potential barrier to bull trout, although it is laddered and passes anadromous species of fish. Incidental catch has only been recorded in the Fish Passage Center database since 1997, and there is no record of bull trout use during this period. Prior to 1997, a bull trout sighting could have been noted as a comment, but would not have been recorded in the database. Records prior to 1997 need to be examined for any documentation of bull trout in the comments. Evaluating passage facilities and reservoir operations at Bonneville Dam as to their suitability for bull trout is identified as a term and condition of the

U.S. Fish and Wildlife Service's biological opinion for operation of the Federal Columbia River Hydropower System (USFWS 2000).

**Sandy River.** There is very little information on bull trout use in the Sandy River. Initially, basic research and monitoring is needed to document fish presence, and existing use. Other basic research includes simply knowing where the fish observed in the Sandy River come from (*i.e.*, Are they migrants from other basins, such as the Hood River, or is there a small remnant population of bull trout remaining within the basin that has escaped detection?). Once these basic questions are answered, research can begin to focus on limiting factors and habitat needs for bull trout in the Sandy River.

**Nonnative Fish Interactions in Laurance Lake.** The recent discovery of smallmouth bass in Laurance Lake exposes bull trout to a predator or competitor that was previously unknown in the Hood River Basin. Research to determine the extent of any interaction between the two species will be necessary to determine if there is a direct problem, as well as identify possible solutions to any identified impacts.

## **ACTIONS NEEDED**

### **Recovery Measures Narrative**

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

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

1. Protect, restore, and maintain suitable habitat conditions for bull trout.
  - 1.1 Maintain or improve water quality in bull trout core areas or core habitat.

- 1.1.1 Reduce general sediment sources. Stabilize roads, crossings, and other sources of sediment delivery. Complete sediment source inventory for non-Federal roads. Continue maintenance and rehabilitation on Forest Service roads as identified in watershed analyses. Reduce road densities as identified in watershed analyses. Work with irrigation districts to convert open canals to pipelines to reduce sediment delivery to streams.
  - 1.1.2 Reduce nutrient and chemical runoff. Reduce industrial, agricultural, and sewage effluent runoff (nutrients and chemicals). Continue monitoring for pesticides/toxic substances in the core area.
  - 1.1.3 Improve water temperature (water quality) below Laurance Lake during the spawning period (late summer to early fall). Identify the source of flows in the reservoir, and opportunities for cold water augmentation to reduce temperature.
- 1.2 Identify barriers or sites of entrainment for bull trout and implement tasks to provide passage and eliminate entrainment.
- 1.2.1 Reestablish connectivity at Clear Branch Dam. Reestablish connectivity above and below Clear Branch Dam. Restore passage over Clear Branch Dam by modifying or replacing existing trapping facility to improve trapping efficiency. Assess the effectiveness of downstream passage via spill (research need).
  - 1.2.2 Provide passage at Coe Branch Diversion. Provide downstream and upstream passage at Coe Branch Diversion

to meet National Marine Fisheries Service and U.S. Fish and Wildlife Service criteria.

- 1.2.3 Determine passage options for Tony Creek and Powerdale Dam. Determine passage options for Tony Creek diversions (upstream and downstream), at Dee Diversion (2-upstream), and at Powerdale Dam(upstream), and Eliot Diversion. Implement the most practical and cost-effective option.
  - 1.2.4 Improve fish passage at road crossings. Identify additional sites where road crossings might be a problem and where assessments are not completed.
  - 1.2.5 Determine the presence and extent of gas supersaturation at Powerdale and Clear Branch Dams. Cloudy (discolored) eyes have been noted occurring on bull trout captured at Powerdale Dam. One possibility is damage from gas supersaturation. Dissolved gas levels need to be evaluated at both dams to identify potential impacts, if any.
  - 1.2.6 Screen diversions and ditches. Screen water diversions and irrigation ditches. Improve screening to protect bull trout downstream migrants and adults at Powerdale, Farmers Canal, Tony Creek, Eliot, and others as identified. Work with water users and irrigation districts to fix problems.
  - 1.2.7 Improve instream flows. Restore connectivity and opportunities for migration by securing instream flows and/or water rights. High priorities include the East Fork of Hood River and others as identified.
- 1.3 Identify impaired stream channel and riparian areas and implement tasks to restore their appropriate functions.

- 1.3.1 Protect and restore riparian zones. Protect and restore riparian vegetation in the core area.
- 1.3.2 Restore channel conditions. Conduct stream channel restoration activities where warranted and cost-effective. Based on results from completed Clear Branch project, assess feasibility of additional helicopter wood placement. Assess feasibility of similar work in Tony and Pinnacle creeks.
- 1.4 Operate dams to minimize negative effects on bull trout in reservoirs and downstream.
  - 1.4.1 Evaluate effects of Columbia Dams. Evaluate effects of mainstem Columbia hydropower operations.
- 1.5 *Identify upland conditions negatively affecting bull trout habitats and implement tasks to restore appropriate functions.*
- 2 Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.
  - 2.1 *Develop, implement, and enforce public and private fish stocking policies to reduce stocking of nonnative fishes that affect bull trout.*
  - 2.2 *Evaluate enforcement policies for preventing illegal transport and introduction of nonnative fishes within the recovery unit.*
  - 2.3 *Provide information to the public about ecosystem concerns of illegal introductions of nonnative fishes.*
  - 2.4 *Evaluate biological, economic, and social effects of control of nonnative fishes.*

- 2.5 *Implement control of nonnative fishes where found to be feasible and appropriate.*
  - 2.6 *Develop tasks to reduce negative effects of nonnative taxa on bull trout.*
- 3 Establish fisheries management goals and objectives compatible with bull trout recovery, and implement practices to achieve goals.
- 3.1 Develop and implement State and tribal native fish management plans integrating adaptive research.
    - 3.1.1 Incorporate bull trout recovery into State and Regional Conservation Plans. Incorporate bull trout recovery actions into The Oregon Plan for Salmon and Watersheds, Oregon Department of Fish and Wildlife Hood River Basin Plan, Hood River Watershed Action Plan, and the Pacific Northwest Power Planning Council Subbasin Plan. Request assistance with implementation of recovery strategies for bull trout through these plans.
    - 3.1.2 Integrate research results. Adaptively integrate research results into management programs.
    - 3.1.3 Restore forage (prey) base. Continue to restore historical prey base by reintroducing anadromous species where appropriate.
    - 3.1.4 Coordinate with other recovery efforts. Coordinate bull trout recovery with recovery efforts, management plans, etc. of other species, for example the Hood River Production Plan.

- 3.1.5 Establish bull trout in other areas. Assess feasibility of establishing bull trout in the West Fork of Hood River and East Fork of Hood River subwatersheds.
- 3.2 Evaluate and prevent overharvest and incidental angling mortality of bull trout.
  - 3.2.1 Assess impact of incidental harvest. Continue gathering statistical creel information below Powerdale Dam to estimate incidental harvest.
  - 3.2.2 Assess hooking mortality. Assess hooking mortality of bull trout in Laurance Lake, and modify angling regulations if necessary.
  - 3.2.3 Refine angling regulations. Develop and implement sport angling regulations that minimize incidental mortality of bull trout in fisheries closed to bull trout harvest. Periodically review harvest management and make recommendations for change as needed.
  - 3.2.4 Continue fish identification education. Continue to provide information to anglers about bull trout identification, special regulations, how to reduce hooking mortality of bull trout caught incidentally, and the value of bull trout and their habitat and their place in the ecosystem.
- 3.3 *Evaluate potential effects of introduced fishes and associated sport fisheries on bull trout recovery and implement tasks to minimize negative effects on bull trout.*
- 3.4 *Evaluate effects of existing and proposed sport fishing regulations on bull trout.*

- 4 Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.
  - 4.1 *Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery and management plans.*
  - 4.2 *Maintain existing opportunities for gene flow among bull trout populations.*
  - 4.3 *Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation.*
- 5 Conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks.
  - 5.1 Design and implement a standardized monitoring program to assess the effectiveness of recovery efforts affecting bull trout and their habitats.
    - 5.1.1 Evaluate restoration effectiveness. Evaluate effectiveness of different active and passive habitat restoration techniques in restoring watershed function and local bull trout populations, for example, Clear Branch above the dam and Pinnacle Creek (bridge removal).
    - 5.1.2 Coordinate with other monitoring efforts. Coordinate bull trout recovery monitoring in the Hood River Recovery Unit with the Oregon Plan for Salmon and Watersheds monitoring program.
  - 5.2 Conduct research evaluating relationships among bull trout distribution and abundance, bull trout habitat, and recovery tasks.

- 5.2.1 Assess threats from catastrophic events. Assess potential threats to bull trout populations in the Hood River basin from catastrophic events such as volcanic eruptions, fire, land slides, debris flows, etc.
- 5.2.2 Incorporate recovery efforts into county plans. Provide input in the county comprehensive planning reviews and updates.
- 5.2.3 Investigate bull trout ecology in Laurance Lake. Investigate bull trout ecology in Laurance Lake.
- 5.2.4 Evaluate food web. Evaluate food web interactions in the core area, for example, Laurance Lake.
- 5.2.5 Determine extent of use of the Columbia River. Determine use in the Columbia River by Hood River bull trout, including distribution, movement patterns, preferred habitat, and prey base.
- 5.3 *Conduct evaluations of the adequacy and effectiveness of current and past best management practices in maintaining or achieving habitat conditions conducive to bull trout recovery.*
- 5.4 Evaluate effects of diseases and parasites on bull trout, and develop and implement strategies to minimize negative effects.
  - 5.4.1 Monitor to detect pathogen effects. Monitor for effects of fish pathogens on Oregon bull trout populations. Follow department protocols (in development) for handling and disposition of bull trout mortalities, for example, submission to Oregon Department of Fish and Wildlife fish pathology laboratories for disease assessment.

- 5.4.2 Research eye abnormalities. Implement a research project to determine causes of observed eye abnormalities in Hood River bull trout. Take corrective action based on findings.
- 5.5 *Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout.*
- 5.6 Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout.
  - 5.6.1 Gather more detailed life history information. Determine life history of bull trout in the Hood River basin. Additional information needed includes, 1) annual abundance of breeders per local population and total for the recovery unit; 2) population structure and connectivity; 3) life history characteristics including age at first spawning, incidence, regularity and timing of repeat spawning, and total life span; 4) reproductive success in production of pre-adult offspring; 5) survival rates to breeding adult; and 6) reproductive success in replacement of breeders. Have scales read. Work with WDFW to record and report tagged bull trout from the Hood system that are captured in Washington tributaries to the Columbia.
- 6 Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.
  - 6.1 Use partnerships and collaborative processes to protect, maintain, and restore functioning core areas for bull trout.
    - 6.1.1 Support local restoration/conservation efforts. Support collaborative efforts by local watershed groups to accomplish site-specific protection/restoration activities. Support habitat

restoration efforts of the Hood River watershed council, the Confederated Tribes of the Warm Springs, and the USFS. Improved habitat will provide for a more abundant prey base. Participate in restoration efforts, provide technical support, etc.

- 6.1.2 Provide long-term habitat protection. Provide long-term habitat protection through purchase, conservation easements, management plans, land exchanges, etc.
- 6.1.3 Cooperate on Columbia issues. Work cooperatively with Washington State on bull trout issues in the mainstem Columbia River.
- 6.1.4 Cooperate with Tribes. Work cooperatively with the Confederated Tribe of the Warm Springs Reservation government to implement recovery actions.
- 6.1.5 Identify and utilize all potential recovery resources. Identify and secure funding and cooperation to implement recovery strategies including pursuing cooperative funding, partnerships, challenge cost share opportunities, and other private and governmental grants; and utilizing mitigation and natural resource damage settlement funds as available.
- 6.1.6 Prepare and distribute educational materials. Develop educational materials on bull trout and their habitat needs, for example, watershed form and function, riparian and side channel restoration, large wood placement, marking storm drains in urban areas, etc.
- 6.1.7 Facilitate media coverage. Invite reporters from Oregon Field Guide or other programs to film activities focusing on bull trout in the basin.

- 6.1.8 Develop volunteer educational opportunities. Use volunteer opportunities to provide information to the public about bull trout, for example, fin clipping of rainbow by volunteers.
- 6.2 Use existing Federal authorities to conserve and restore bull trout.
  - 6.2.1 Incorporate recovery tasks into FERC relicensing. Identify opportunities to incorporate bull trout recovery actions into hydro-relicensing projects in the Hood River Recovery Unit, for example, Powerdale and Clear Branch dams.
- 6.3 *Enforce existing Federal, State, and Tribal habitat protection standards and regulations and evaluate their effectiveness for bull trout conservation.*
- 7 Assess the implementation of bull trout recovery by recovery units, and revise recovery unit plans based on evaluations.
  - 7.1 *Convene annual meetings of each recovery unit team to review progress on recovery plan implementation.*
  - 7.2 *Assess effectiveness of recovery efforts.*
  - 7.3 *Revise scope of recovery as suggested by new information.*
    - 7.3.1 Periodically review progress towards recovery goals and assess recovery task priorities. Annually review progress toward population and adult abundance criteria and recommend changes, as needed, to the Snake River Washington Recovery Unit chapter. In addition, review tasks, task priorities, completed tasks, budget, time frames, particular successes, and feasibility within the Snake River Washington Recovery Unit.