

Lesson 2

Current Status and Distribution of Bull Trout and Major Threats to Bull Trout Survival and Recovery

Time Needed: A one hour session

GOAL To understand why the Bull Trout is a Threatened Species and its importance as an indicator of water quality.

OBJECTIVES Students will:

- Learn the current status and distribution of Bull Trout
- Learn about population viability for Bull Trout and how populations are measured
- Learn the major threats affecting the Bull Trout's ability to survive and recover

MATERIALS

- Powerpoint Program, Part II
- Handout materials from U.S. Fish & Wildlife Service

VOCABULARY Algal blooms, bed load, Bull Trout, breeding population, catastrophic events, culvert, dissolved oxygen, distribution area, exotic species, extirpation, fine sediment, FMO habitat, gene flow, genetic isolation, groundwater, habitat connectivity, habitat fragmentation, heavy metals, inbreeding, inbreeding depression, indicator species, metapopulation, migration, native species, population viability, range, redd, redd counts, riparian area, Salmonids, source population, SR habitat, stream pH, Superfund, threatened species, watershed

TEACHER INPUT

[key words are typed in bold, questions for the students to answer are underlined, and *actions* to take are typed in italics]

Begin Part II of the powerpoint program.

Today, Bull Trout numbers are a fraction of what they were just a few decades ago and they are now legally classified under the federal Endangered Species Act as a "**Threatened Species**" in the

Clark Fork River Basin and elsewhere within its **range**, or **distribution area** in the states of Montana, Idaho, Oregon, Washington and Nevada. A 2003 survey by a leading Bull Trout expert with the U.S. Fish & Wildlife Service found 36.2% of Bull Trout populations are declining or have been **extirpated**. Only 5.9% of populations were increasing.

Their numbers are particularly low in the Upper Clark Fork Watershed, but they remain an essential part of the region's native biodiversity.

How do you think Bull Trout are counted?

During spawning, the female Bull Trout uses her tail to excavate stream bottom gravels, digging a **Redd**, or spawning nest where the eggs are laid. Each Fall, biologists count these redds to track population trends and spawning success. Biologists have made annual counts in areas of Montana and northern Idaho for the past 25 years or more. In the Upper Clark Fork Watershed, between 1998-2004, annual redd counts averaged about 50.

A **viable population** is one that is large enough to maintain the population's genetic variation indefinitely. Dr. Bruce Rieman with the U.S. Forest Service and Dr. Fred Allendorf with the University of Montana, report a minimum of 1,000 adult Bull Trout (approximately 500 redds) each year are necessary to ensure viability indefinitely. Approximately 500 adults or 250 redds can maintain genetic variability over the short term (no more than 100 years).

A viable population of Bull Trout could be one population of 1,000 adults, or 10 sub-populations of 100 adults that are connected as a "**meta-population**" or any combination that adds up to 1,000, so long as they are connected. Populations less than 1,000 adults within a **breeding population** are vulnerable to **inbreeding depression** and other negative effects.

Moreover, Bull Trout populations must be well-distributed and large enough to survive **catastrophic events** including forest fires, prolonged drought, landslides, fuel spills and other toxic discharges, earthquakes, and even volcanic eruptions (in the Pacific Northwest). To avoid extirpations, there must be a nearby **source population** of Bull Trout to recolonize areas where they have been extirpated. For this reason, (*show students the metapopulation graphic*) a metapopulation structure where several streams within a watershed contain Bull Trout, is preferable to having all the Bull Trout within just one or two tributaries, where a catastrophic event might wipe out the population, leaving no nearby source for recolonization.

Bull Trout have very specific habitat requirements that make them an ideal **indicator species** for watershed health and water quality. Biologists have dubbed these habitat requirements the **Five Cs**, representing **Cold, Clean, Complex, Connected** and **Comprehensive**. Where Bull Trout are thriving, it represents a healthy watershed. Conversely, if Bull Trout are in decline or absent from a

watershed, we know this indicates that water quality and/or quantity has been compromised, and remedial actions may be necessary.

What do you think some of the major threats to Bull Trout might be?

According to the U.S. Fish & Wildlife Service and the Montana Department of Fish, Wildlife & Parks, the leading threats to Bull Trout and their habitat include: dams and other blockages to migration, improper mining, logging and grazing practices, roads and inadequately designed **culverts**, **exotic** fish species and climate change. Additional threats include homesite and resort development, mistaken identity by anglers, and illegal poaching.

Dams and other blockages are the most consistently mentioned threat to Bull Trout survival and recovery. The extensive network of dams throughout Montana and the Pacific Northwest have blocked historic migrations and resulted in **habitat fragmentation** for Bull Trout, breaking populations into smaller, **genetically isolated** units.

Improper mining practices damage water quality by introducing heavy metals into streams. Inadequate cleanup of mining wastes results in long term degradation of water quality. Toxic metals reduce aquatic insect life, alter the **stream pH** and chemistry of the water and results in decreased fish populations.

The legacy of large-scale mining is the dominant cause of water quality degradation in the Upper Clark Fork Watershed. The area from Butte to the Milltown Dam is designated as a **Superfund Site** by the U.S. Environmental Protection Area and is the largest Superfund site in the nation.

Improper logging practices result in increased delivery of **fine sediments** into streams. It can also remove streamside shade and damage riparian areas. Clearcut logging on steep slopes can result in severe erosion. Fine sediments fill in the spaces between rocks in the streambed. This can smother Bull Trout eggs and fry and greatly reduce reproductive success. Streams filled with fine sediment may impede groundwater upwelling and reduce spawning activity.

Unpaved forest roads are a leading source of fine sediments. Often on steep mountain slopes, these roads transport water and fine sediments, especially during spring runoff and extreme rainfall events or rain on snow events. Inadequately designed road culverts can blow out during high water runoff, resulting in catastrophic bank collapse, **bedload movement** and destruction of aquatic habitat. Many culverts have steep drops that block fish migrations. For example, the Montana Department of Fish, Wildlife & Parks has identified hundreds of culverts that present problems for native fish.

Improper grazing practices can alter the stream environment in several ways. Cattle can trample banks and remove riparian vegetation. This results in wider, shallower streams with increased water temperature. Cattle can also urinate and defecate directly into the stream, damaging water quality and creating **algal blooms**. Water diversions for cattle can reduce water flows below minimum requirements for native fish. Grazed and ungrazed photo comparisons show the effects that cattle grazing has on riparian areas.

Many **exotic**, or non-native fish species have been introduced to Montana's trout waters and pose a direct threat. These include Lake Trout, which feed on young Bull Trout and Cutthroat trout, and Pike, which have inhabited the backwater behind Milltown Dam and other areas of western Montana. Lake trout are now firmly established in Montana's Flathead and Swan Lakes and in Idaho's Lake Pend Oreille. An adult Lake trout can easily ingest a good-sized Cutthroat or Bull Trout and biologists have found as many as several dozen young Bull Trout in Lake trout bellies.

In addition to direct predation, exotic fish often out-compete Bull Trout for habitat, as they are less sensitive to changes in water quality. Brook trout can also interbreed with Bull Trout, usually creating sterile offspring.

Additional threats to Bull Trout include mortality resulting from mistaken identity by anglers and deliberate poaching by outlaws. An increasing threat is found in the form of homesite and resort development. When done without consideration for riparian areas, such development threatens Bull Trout habitat. Numerous Bull Trout streams in Montana have already been affected with sites that have lawn grass right to the water's edge, with rip-rap added to stabilize the banks, turning the stream into a high-velocity, channelized ditch, mostly devoid of aquatic insect and fish habitat.

Another impact from rural homesite subdivision are the profusion of wells and septic systems. Wells can lower **groundwater** levels, an important component of Bull Trout habitat. Septic systems cause water pollution leading to algal blooms.

An unknown but increasingly mentioned threat comes in the form of climate change. Bull Trout have evolved with very cold water, and water temperature has been named as the most limiting factor on Bull Trout distribution. Biologists have found that Bull Trout populations were more than six times more likely to be classified as strong in areas with a mean annual air temperature less than 41° F. If average annual temperatures increase, biologists have predicted that Bull Trout distribution will be reduced significantly. With increased temperatures there may also be an increase in catastrophic events such as forest fires.

END OF PART II OF POWERPOINT PROGRAM

Ask some Qs of the students.

Why would it be important to restore Bull Trout to areas they once lived?

Why is it better to have several smaller, connected populations of Bull Trout in several streams within a watershed rather than one larger population in just one stream?

Why is fine sediment harmful to Bull Trout?

Can you name a leading source of fine sediments?

What are some ways that cattle grazing can have a negative effect on Bull Trout habitat?

How do you think climate change might affect Bull Trout?

Why is the Bull Trout considered an indicator species?

Can you name some examples of catastrophic events?

GLOSSARY

Algal blooms are sudden spurts of algal growth, which affect water quality adversely and indicate potentially hazardous changes in local water chemistry.

Bedload is the portion of the stream bottom materials that bounce and roll downstream, usually along the bottom. Catastrophic **bedload movement** is when virtually the entire bedload and larger rocks and gravels are scoured out and washed downstream.

Bull Trout are a large migratory fish native to the Northern Rockies and Pacific Northwest. They are actually a member of the **Char** family of fishes, related to the Arctic Char.

Breeding population

Catastrophic events are events outside the normal range of variation. These can include natural events including flash floods, landslides, forest fires, earthquakes and volcanic eruptions, or manmade events such as fuel spills and other environmental contaminants.

Culverts are rounded, metal structures placed underneath where a road crosses a stream.

Dissolved oxygen is the oxygen that is freely available in water. Dissolved oxygen levels are considered an important indicator of a water body's ability to support desirable aquatic life.

Distribution area is the geographic area occupied by a species.

Exotic species are non-native species from other regions which are introduced either intentionally or unintentionally into new territories.

Extirpation is the elimination of a species from a particular local area. This is different from extinction, in which the entire species is eliminated permanently.

Fine Sediment is the portion of the streambed material that is comprised of sediments less than 6.35mm in diameter.

The **Five Cs** represent the habitat requirements of Bull Trout. They are Cold, Clean, Complex, Connected and Comprehensive.

Foraging, Migrating, Overwintering (FMO) Habitat is typically downstream from spawning and rearing habitat and contains all the physical elements to meet critical overwintering, spawning migration, and subadult and adult rearing needs.

Gene flow is the uni- or bi-directional exchange of genes between populations due to migration of individuals and subsequent successful reproduction in the new population.

Genetic isolation is the absence of genetic exchange between populations or species as a result of geographic separation or of premating or postmating mechanisms (behavioral, anatomical, or physiological) that prevent reproduction.

Groundwater is the supply of fresh water underground, often found in aquifers, which feed springs and wells. Upwelling groundwater is associated with Bull Trout spawning habitat.

Habitat Connectivity refers to habitat that is linked together whereby Bull Trout have free access of movement from one area to another.

Habitat fragmentation is the process of reducing larger contiguous areas of habitat into smaller, disconnected areas.

Heavy metals and toxic metals, including "heavy metals," are individual metals and metal compounds that negatively affect people's health. In very small amounts, many of these metals are necessary to support life. However, in larger amounts, they become toxic.

Inbreeding is the mating of individuals who are more closely related than by chance alone.

Inbreeding depression is a reduction in fitness and vigor of individuals as a result of increased homozygosity through inbreeding in a normally outbreeding population.

An **Indicator Species** is a species used as a gauge for the conditions of a particular habitat, community, or ecosystem. For example, due to their stringent habitat needs, Bull Trout are an indicator of water quality and watershed health.

A **metapopulation** is a network of semi-isolated populations with some level of regular or intermittent migration and gene flow among them, in which individual populations may be extirpated, but then be recolonized from other populations.

Migration is a life history strategy whereby fluvial, adfluvial and anadromous Bull Trout move back and forth from feeding, migrating and overwintering habitats to spawning and rearing habitats.

Native species refers to species which are endemic to the region in which they are located. They have naturally evolved with conditions in that area. A non-native species is one from a different ecosystem and is most often introduced by humans, both intentionally and unintentionally.

Range refers to the geographic area occupied by an entire species. It also known as a **distribution area**.

Redd is a nest constructed by female fish of salmonid species in streambed gravels where eggs are deposited and fertilization occurs.

Redd counts are annual counts made by biologists to track Bull Trout population trends and reproductive success.

A **Riparian Area** is defined as the area adjacent to or beside a river, stream or lake. Riparian areas also include a variety of different types. Willows, alder, sedges and rushes are typically found within a riparian area but seldom found in upland areas.

Salmonids are from the Salmonidae branch of fishes that include the various trout species, salmon and char.

Source population is a population in a high-quality environment where the birth rate exceeds the death rate and excess individuals leave as migrants.

Spawning & Rearing (SR) Habitat is typically headwaters streams where spawning and rearing of migratory or resident fish occurs. These areas contain the physical elements for Bull Trout (cold, clean, complex habitat) necessary to meet critical egg incubation and juvenile rearing needs.

Stream pH is a measure of the intensity of the basic or acidic condition of the water. Ranging from 0 to 14, where 0 is the most acidic and 7 is neutral, most natural waters have a pH between 6.5 and 8.5.

Superfund is the federal program operated under the legislative authority of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and Superfund Amendments and Reauthorization (SARA) that funds and carries out the U.S. Environmental Protection Agency's solid waste emergency and long-term removal and remedial activities. This includes establishing the National Priorities List and conducting and/or supervising cleanup and other remedial activities.

Threatened Species is a legal designation under the federal Endangered Species Act. It means that any species listed as Threatened is a species that is likely to become endangered in the foreseeable future throughout all or a significant portion of its range.

A **viable population** refers to a population's ability to maintain genetic variation and be self-sustaining in perpetuity. Population viability analysis is a comprehensive analysis of the many environmental and demographic factors that affect survival of a population, usually applied to small populations at risk of extinction.

Watershed is an area of land from which rainfall (and/or snow melt) drains into a stream or other water body. Watersheds are also referred to as drainage basins or drainage areas. Ridges of higher ground generally form the boundaries between watersheds.

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Links to Bull Trout & Watershed Education Sites

<http://www.cfwep.org/>

<http://www.fws.gov/pacific/bulltrout/>

<http://fwp.mt.gov/education/fishingeducation/default.html>

<http://www.streamnet.org/>

<http://www.epa.gov/owow/watershed/wacademy/training.html>

<http://www.swrcb.ca.gov/waterwords.html>