NRCS Natural Resources Conservation Service

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Bull Trout (*Salvelinus confluentus*)

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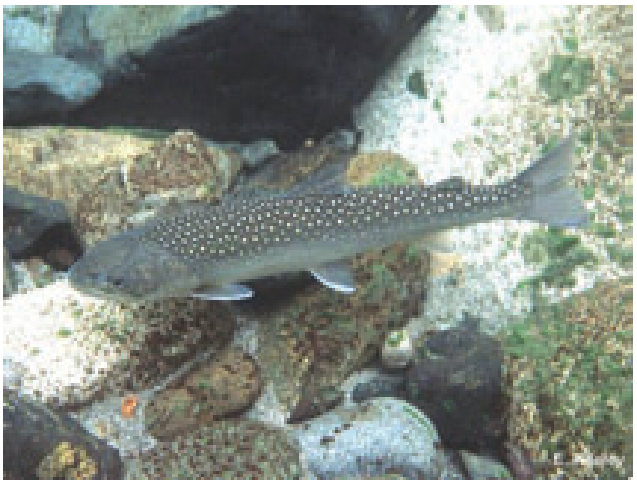
Introduction

Bull trout are members of the Salmonidae family, as are cutthroat and rainbow trout, salmon, whitefish, and grayling (fig. 1). Bull trout are not trout, but chars — members of the genus Salvelinus, which also includes brook trout, lake trout, arctic char, and Dolly Varden. Bull trout have large, broad heads, large mouths, and prominent jaws and teeth. Their bodies are slender, rounded, and dark with light-colored spots. While the bull trout and the Dolly Varden (S. malma) are often mistaken for one another, they are separate species. The size of a bull trout at maturity depends on its life-history. Some fish (resident forms) reside solely in headwater or tributary streams and tend to be smaller than migratory forms that spend most of their time in lakes or reservoirs (adfluvial), large rivers (fluvial), or the ocean (anadromous). Resident adults measure 8 to 14 inches in length, while migratory forms commonly exceed 24 inches.

In recent decades, both the distribution and abundance of bull trout have declined, likely due to a combination of degraded or fragmented aquatic habitats throughout its historic range and the introduction of non-native species. Bull trout habitat degradation is primarily due to actions related to land use and instream water use. Detrimental land uses include timber harvest, urbanization, road development, mining, and agricultural/livestock production. Such land uses often result in increased soil erosion, stream channel instability, and decreased water quality. Instream use of water for hydroelectric power generation and agricultural irrigation diversions negatively affects aquatic habitats by altering the timing and amount of instream flows and lowering water quality. Instream uses also may block or restrict access to critical habitat. Both types of instream installations can cause direct mortality to adult and juvenile fish. Physical barriers (dams), as well as environmental barriers (poor water quality) that prevent upstream and downstream movement are detrimental to all salmonids. Widespread introduction of non-native fish species, especially brook trout, lake trout, brown trout, northern pike, and walleye, is a significant threat to bull trout populations through direct competition, predation, and hybridization (particularly with brook trout). Declines in bull trout populations prompted the United States Fish and Wildlife Service to list the Klamath and Columbia River distinct population segments as threatened under the Endangered Species Act in 1998 and all other populations in the coterminous U.S. in 1999. Bull trout are considered to be a species of special concern in Canada.

Figure 1 Bull trout



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The purpose of this leaflet is to provide information to help landowners recognize opportunities to conserve or improve habitat for bull trout and assist with the development, implementation, and monitoring of a management plan for the species. The success of any fish/wildlife management action plan requires:

- a clear statement of management goals
- awareness of the habitat requirements of the target species or fish/wildlife group
- accurate assessment of habitat conditions

- effective tools and adequate resources to address habitat limitations
- follow-up monitoring of fish/wildlife responses and incorporation of results into the management plan

The leaflet also identifies resources and additional sources of information available to carry out management plans.

Range

Bull trout historically occurred in major river drainages in the Pacific Northwest, from the southern limits of its range in the McCloud River in northern California and the Jarbidge River in Nevada, to the northern limits of its range in the headwaters of the Yukon River in the Northwest Territories, Canada. Today in the U.S., bull trout are distributed throughout coastal and mountainous areas from southern Oregon and northern Nevada north to the Canadian border. Once common throughout this range, they have declined in overall distribution and abundance during the last century. For example, bull trout are extirpated from California and inhabit only one river system in Nevada. Many populations in Oregon, Washington, Montana, and Idaho are at high risk of extirpation. Table 1 describes the remaining bull trout populations in the coterminous U.S.

Life history

Bull trout exhibit both resident and migratory life-history strategies through much of their current range. Resident forms complete their entire life cycle in the tributary streams in which they spawn and rear. However, most bull trout are migratory and live in lakes, reservoirs, rivers, or oceans and return to tributary streams to spawn. Resident and migratory forms can be found together; it is believed that both forms can produce offspring that exhibit either resident or migratory behavior.

Bull trout may spawn every year or in alternate years. Migratory forms begin their spawning migration in mid- to late spring and enter tributary streams in mid-

Table 1 Remaining bull trout populations in the coterminous U.S.

Population	States/Provinces	Range
Klamath River population	Oregon	Bull trout occur only in isolated higher elevation headwater streams within the watersheds of Upper Klamath Lake, Sprague River, Wood River, and Sycan River
Columbia River population	Oregon, Washington, Idaho, Montana, British Columbia	Bull trout occur throughout most of the Columbia River basin and its tributaries, including its headwaters in Montana and British Columbia, Canada
Coastal-Puget Sound population	Washington	Bull trout occur in all Pacific coast drainages within Washington, including Puget Sound
Jarbidge River population	Idaho, Nevada	Bull trout occur in the East Fork, West Fork, and mainstem Jarbidge River and headwater tributaries and primarily in headwater streams above 7,200 feet elevation within the Jarbidge Wilderness Area (including Slide, Pine, Sawmill, Fall, and Cougar Creeks), as well as Dave Creek
St. Mary-Belly River population	Montana, Alberta	Bull trout east of the continental divide occur in the St. Mary and Belly Rivers and their tributaries, as well as in headwater lakes, mostly in Glacier National Park

to late summer. Spawning for both forms occurs from August to November, during periods of decreasing water temperatures.

Bull trout construct a typical salmonid redd (a pit in the stream substrate, excavated by the fish's tail) in which to lay eggs. The female chooses the spawning site and excavates the redd while the male defends the site. Eggs are deposited as deep as 10 inches below the streambed surface. Migratory adults move back downstream soon after spawning. Depending on the water temperature, hatching occurs in 100 to 145 days, usually in January. After hatching, fry remain in the substrate while they absorb their yolk sax, emerging from the streambed in April or May. Juvenile migratory bull trout stay in the tributary of their birth for 1 to 4 years before moving downstream. Bull trout typically reach sexual maturity in 4 to 7 years.

Habitat requirements

General

Bull trout require especially clean, cold water—temperatures above 59 ºF are thought to limit the survival of juveniles. They live primarily in cold headwater lakes and streams and rivers that drain high mountainous areas, especially where snowfields and glaciers are present. Like all salmonids, bull trout require diverse, yet well-connected, habitats with structural components that provide good hiding cover (boulders and large wood).

Headwater streams provide habitat for resident forms of bull trout in all their life stages and for migratory forms only in their spawning and rearing stages. Migratory forms can move great distances (up to 150 miles) between the ocean, lakes, reservoirs, rivers, and tributary streams in response to spawning, rearing, and adult life history needs.

Both juvenile and adult bull trout tend to remain near stream bottoms or closely associated with the substrate, submerged wood, or undercut banks. Adults use large cobble and boulder substrates, larger pools, and areas with accumulations of large wood. A complex habitat, characterized by a variety of pools, riffles, and water depths and velocities, is important to meet the diverse needs of all life stages of bull trout.

Food

Bull trout are opportunistic feeders, but are primarily piscivorous. Adults feed almost exclusively on other fish, including various trout and salmon species, minnows, suckers, whitefish, and sculpin. Juveniles feed on aquatic invertebrates, including mayflies, stoneflies, caddisflies, and beetles. Larger adults have also been known to eat frogs, snakes, mice, and ducklings. In coastal marine areas of western Washington, bull trout feed on Pacific herring, Pacific sand lance, and surf smelt. Declines in prey fish populations (salmon) are partly responsible for declines in bull trout populations. Healthy streams provide the variety and abundance of food necessary for all bull trout life-history stages.

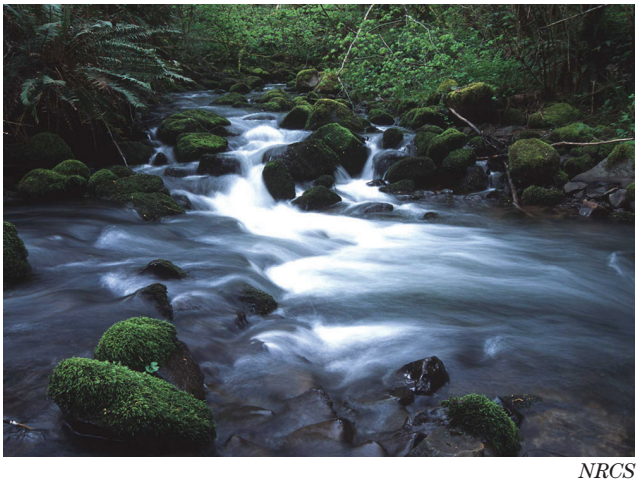
Cover

All life-history stages of bull trout are associated with complex forms of cover, including large wood, overhanging vegetation, undercut banks, boulders, and pools (fig. 2). Adults will often conceal themselves in deep pools with submerged wood or boulders during the day and move away from such cover at night.

Spawning habitat

Both migratory and resident forms of bull trout spawn in headwater or tributary streams. Spawning habitat consists of very cold water and loose, clean gravel from ½ to 3 inches in diameter, with less than 20 percent fine sediments around it. Spawning and rearing areas are often associated with areas of upwelling, such as cold-water springs or subsurface flows, because these streams are often cooler in summer and warmer in winter than other streams. While spawning can occur in water up to 46 °F, egg survival during incubation is highest at water temperatures of 35 to 39 °F. Spawning sites include runs, glides, and tail-outs of pools with water 4 to 18 inches deep. Because eggs incubate over the winter, incubation sites are particularly vulnerable to scouring, low flows, or anchor ice accumulations.

Figure 2 All life-history stages of bull trout are associated with complex forms of cover.



NRCS

Overwintering habitat
In the fall and winter, bull trout seek large, deep pools with abundant wood and/or rock cover (fig. 3). During this time, activity is generally reduced and survival depends on finding suitable food and shelter from predators, freezing water, and high flows.

Migratory habitat
While resident forms of bull trout live their entire lives in small headwater or tributary streams, migratory forms travel long distances. In the fall, migratory forms of bull trout move from spawning and rearing habitats to foraging and overwintering habitats. In the spring, they make the return journey back to spawning and rearing areas of headwaters. Migratory bull trout have been observed to move up to 150 miles between the ocean, lakes, reservoirs, or rivers and tributary streams in response to changing habitat needs. To complete this journey, migratory forms of bull trout require networks of interconnected streams, rivers, lakes, reservoirs, and the ocean, which provide them with access to spawning, rearing, foraging, and overwintering habitats. Migratory habitat also serves as foraging habitat for much of the year, so these networks must provide food and cover for bull trout. Barrier-free migratory corridors are critical for maintaining bull trout populations. Barriers to fish movement, such as dams, diversions, weirs, culverts, and elevated stream temperatures, can obstruct migratory pathways and cause declines in bull trout populations.

Figure 3 During the winter, bull trout seek large, deep pools with abundant wood and/or rock cover.

Mike Jakober

Habitat assessment

Interested landowners can inquire of local natural resource professionals whether bull trout presently occur or historically occurred in their area and, if so, in what life stages (spawning, rearing, foraging, overwintering, migrating). Landowners can then assess the availability of suitable bull trout habitat on their property. Table 2 is an example of an inventory chart for assessing bull trout habitat. For planning purposes, rate the habitat components for the designated planning area based on the descriptions given. Habitat and stream community components that are limited or absent are likely limiting bull trout habitat quality. Management plans should address the habitat components that are determined to be limiting bull trout habitat potential. Table 2 also offers management suggestions to raise the quality or availability of each habitat component that is considered limiting. Bull trout often exhibit a patchy distribution; therefore, they are not likely to occupy all available habitat simultaneously, even if it is of high quality.

Aquatic ecosystems and the processes they support are functionally interconnected throughout a watershed. Restoring stream conditions along a relatively small stream reach may not necessarily improve bull trout habitat if the rest of the watershed continues to be degraded. Depending on the size of the property in question and the watershed in which it lies, landowners may need to collaborate with neighbors to focus restoration efforts on a watershed scale. The best approach to bull trout habitat protection or recovery is to sustain a fully functional, well-vegetated (trees, shrubs, wetland plants) flood plain within a barrier-free watershed. This includes maintaining natural stream flows, minimizing erosion in uplands, protecting flood plains, wetlands, and riparian areas, and managing streamside forests and riparian areas for aquatic species.

Habitat management recommendations

Bull trout inhabit cold, clean water with complex instream cover. They are extremely sensitive to warm water temperatures, instream disturbances, and siltation. Protecting and enhancing their aquatic habitat is the most effective way to maintain or restore bull trout populations. Any management plan should attempt to minimize the physical, chemical, biological, and hydrological disturbances that land management activities may have on bull trout habitat or surrounding riparian areas. Landowners should also make every effort to maintain instream flows for bull trout and their food sources during all seasons of the year.

Table 2 Assessment of habitat components and management suggestions

Habitat Component	Optimal Conditions	Abundant	Limited	Absent	Management Suggestions to Improve Limited or Absent Habitat Component
General	Clean, cold water (temperatures not to exceed 59 °F) in complex, connected habitat				Limit activities in the watershed that may alter stream hydrology, increase fine sediments, alter the flood plain, or remove riparian vegetation, particularly in spawning and rearing streams Along streams, protect and restore native trees and shrubs to keep water temperatures below 59 °F Maintain a buffer of woody vegetation at least 80 to 100 feet or two channel widths between streams and agriculture fields to reduce siltation and non-point source pollution from fertilizer and pesticide runoff Fence livestock from streamside riparian vegetation
Food	Adults: Fish, including various trout and salmon species, suckers, minnows, whitefish, yellow perch, sculpin				Increase populations of forage fish and insects by carefully managing riparian buffers of native trees, grasses, forbs and shrubs, and protecting large woody debris in the stream
	Juveniles: Aquatic invertebrates, such as mayflies, stoneflies, and caddisflies				Increase populations of aquatic insects by keeping gravel beds from being embedded with fine sediment
Cover	Large wood, overhanging vegetation, undercut banks, boulders, and pools				Preserve and plant native trees and shrubs along streams Maintain woody material and/or boulders in the stream reach
Spawning Habitat	Very cold water and loose, clean gravel ½ to 3 inches in diameter, with less than 20% fine sediments				Protect spawning areas from trampling by livestock Reduce sediment inputs to streams. Maintain the streams natural hydrology (flow) Protect springs
Overwintering Habitat	Large, deep pools with abundant wood and/or rock cover; adequate sources of food				Maintain woody material or other habitat elements in the stream to create deeper pools
Migratory Habitat	Connectivity between headwater streams, rivers, lakes, reservoirs, and/or the ocean				Improve or eliminate human-created fish passage barriers by improving road crossings, maintaining or increasing flows, modifying diversion structures, and/or reducing contaminants to allow fish to move upstream and downstream during all times of the year

However, the construction of instream improvements requires technical expertise and experience. Poorly designed and constructed improvements usually lead to further degradation of habitat or loss of channel and watershed stability. Consultation with and assistance from Federal, State, or local fish and wildlife or land management agencies is critical in identifying appropriate management actions and permit requirements.

Riparian areas

Riparian areas naturally consist of a diverse mix of trees, shrubs, and/or grasses and occur next to streams, extending laterally from the streamside. Moist conditions along stream corridors and their flood plains provide the conditions necessary for growth of riparian vegetation. In managed areas, these riparian areas are often referred to as riparian buffers (fig. 4).

Riparian buffers are beneficial to bull trout in a number of ways. The structurally and functionally diverse mix of riparian vegetation filters sediment in surface run-off during rains, thereby reducing siltation of spawning substrates. The buffer also filters nutrients and contaminants in surface runoff, thus protecting water quality. Vegetation roots and foliage also serve to stabilize streambanks, which is particularly important during high flow events. Trees and shrubs provide shade that maintains cool water temperatures and habitat for riparian species, including terrestrial insects that serve as food for juvenile bull trout and other fish. Lastly, riparian vegetation, especially trees and shrubs, provides wood and organic matter to the stream for use by fish and other aquatic species. For maximum effectiveness, riparian vegetation should extend 80 to 100 feet on either side of the stream. The wider and more structurally diverse the buffer, the more value it will have for bull trout and other species that live in the stream and the riparian area.

If riparian areas are degraded or no buffer exists, native grasses, sedges, forbs, shrubs, and trees should be planted. The ideal riparian buffer zone incorporates the native plant community appropriate to the site. Most bull trout habitats include riparian areas in forested watersheds. Managing riparian areas or buffers for mature stands of trees spaced sufficiently to allow an understory of grasses and shrubs will improve bull trout habitat over time. Trees should be close enough to the stream so that some of the roots are exposed to supply cover and allow stable undercut banks to develop. This proximity to the channel assures that some trees will fall into the stream, providing habitat complexity to the channel.

Landowners can take an active role in maintaining and restoring riparian buffers by planting native woody species as seedlings or saplings. On the other hand, the landowner may choose to take a passive approach to restoration, and simply allow natural recruitment of woody species along the streambank. If the landowner takes the more active approach, the following guidelines are recommended:

- Seek assistance in determining the appropriate mix of locally-adapted, native plant species and the current flood regimes of the stream and its watershed. Using plants adapted to the area will increase their survival and save time, money, and frustration. If it is not practical to plant the full complement of vegetation desired in the riparian area, plant the dominant species for the site, such as alder, willow, or conifer species, and other species will naturally be recruited over time.
- Typically, plant species at the edge of a stream are different from those farther away. The topography, aspect, soil, and hydrology of the riparian area provide diverse layers of different plant species. Landowners should seek the assistance of local soil and water resource professionals in choosing the species, number of plants, and location in the riparian zone for planting.

Large wood

Large woody material in the form of fallen trees, limbs, and branches plays a major role in providing instream cover for bull trout and channel complexity for stream processes, such as pool formation and sediment deposition. In forested streams, logs pro-

Figure 4 Riparian vegetation can improve stream health and bull trout habitat.

NOAA Fisheries

vide cover for bull trout when they fall into the stream from adjacent stream banks (fig. 5). In areas where logging has removed riparian forests, wood can be imported from outside the riparian zone and placed in the stream channel. Appropriately placed logs, especially those with intact root wads, will mimic the natural recruitment of fallen trees into the stream channel and will move and adjust to the stream channel and flood plain during rain events. Occasionally, logs are anchored in place, but in most situations it is best to simply place logs in streams and allow natural flows to adjust them over time. As with any instream structure, wood placement should be designed by technical specialists who understand the dynamics of stream systems. Projects should be implemented at the appropriate times to avoid impacts to bull trout.

Figure 5 Large wood in streams provides cover for bull trout and structural complexity in the channel for pool formation and sediment deposition.

U.S. Army Corps of Engineers

Fishways

Human-created instream structures, such as dams, weirs, diversions, and culverts, can hinder the ability of bull trout and other fish to move freely within a watershed and to access spawning areas. If possible, manmade fish barriers should be removed or modified to facilitate fish passage. If these actions are not feasible, fishways can be installed or constructed to facilitate the passage of fish through or over a barrier. Fishways can be as simple as developing a series of pools and small rock "steps" (fig. 6) over or around the barrier, which allow fish to swim into a pool, rest, and then swim up another step into the next pool, until they have cleared the barrier. Impassable culverts can be retrofitted with baffles, or replaced with new culverts that allow fish to pass. For more detailed information regarding fish passage, refer to *http://wdfw.wa.gov/hab/engineer/habeng.htm* or *http://www.salmonidaho.com/screenshop/*.

Figure 6 Step fishways can help fish move around a manmade barrier.

Washington Department of Fish and Wildlife

Livestock fencing

Fencing to exclude livestock from streambanks, riverbanks, and lakes can reduce the collapse of undercut banks and reduce soil erosion and siltation in the water resulting from livestock trampling. Fencing livestock from waterways can also reduce the amount of livestock waste entering a water body, and thus protect water quality. If fencing is not an option, consider seasonally rotating livestock and grazing patterns to avoid impacts on bull trout habitat during critical times of the year (spawning season). Providing attractants such as salt blocks and watering tanks at some distance from the surface water may also help. If livestock use the stream as a water source, a fenced chute can be built to allow livestock to access a limited section of the stream or water can be pumped to a holding area that is accessible to the livestock rather.

Bull trout in the Little Lost River system: an evolving success story

The Little Lost River watershed is located in central Idaho, where activities limiting recovery of the bull trout include inadequate streamflows and fish barriers associated with irrigation diversions. Landowners and local biologists in the Little Lost River drainage have made great strides in tackling difficult stream flow restoration and tributary reconnect issues to accommodate the habitat needs of bull trout. Trout Unlimited (*http://www.tu.org*) has partnered with Federal and State agencies to complete a comprehensive fish barrier and diversion assessment in the area. Collaborative relationships have been developed with landowners to resolve fish passage problems identified in the assessment. Trout Unlimited is working with landowners on nearby creeks to develop stream flow restoration and tributary reconnection projects to reconnect important bull trout habitats to the mainstem Little Lost River. Many of these tributaries have been historically diverted and all or most of the water taken for agricultural operations. Working with landowners and the NRCS, Trout Unlimited has developed funding and implementation strategies that combine efficiency measures and innovative water use plans to ensure more water is available in the stream. Because of these collaborative efforts, the Little Lost River system is one area where bull trout recovery efforts are making a difference.

For more information, visit *http://www.tu.org/*.

Available assistance

Technical and financial assistance for management of fish and wildlife habitat is available to landowners through a variety of government agencies and other organizations. Landowners and managers should enlist the expertise of State and local natural resource professionals to help assess habitat quality and management practices for sustaining bull trout populations and enhancing habitat. Some Federal assistance programs available through various sources are listed in table 3. State fish and wildlife agencies or groups such as Trout Unlimited may have additional assistance programs, publications, or other useful tools with a more local focus.

Table 3 Assistance programs

Program	Bull Trout Habitat Improvements	Land Eligibility	Type of Assistance	Contact
Conservation Reserve Program	Plant riparian buffers	Cropland (including field margins), riparian pastureland, highly erodible land	50% cost-share for establishing permanent cover, annual rental payments in return for establishing long-term, resource-conserving covers, additional financial incentives are available for some practice	NRCS or FSA state or local office
Environmental Quality Incentives Program	Conservation practices to improve water quality, reduce erosion and sedimentation	Cropland, rangeland, grazing land, and other agricultural land in need of treatment	Up to 75% cost-share and incentive payments to implement conservation practices to a maximum term of 10 years	NRCS state or local office
Partners for Fish and Wildlife Program	Plant riparian vegetation, install fencing and off-stream livestock watering facilities, remove exotic plants, restore instream habitat, reestablish migratory fish passageways	Most degraded fish and/or wildlife habitat, especially for listed species	Up to 100% financial and technical assistance to restore wildlife habitat under minimum 10-year cooperative agreements	U.S. Fish and Wildlife Service local office
Waterways for Wildlife	Develop watershed-level habitat management plan, plant riparian buffers, improve in-stream habitat, improve water quality, reduce erosion and sedimentation	Private land	Technical and program development assistance to coalesce habitat efforts of corporations and private landowners to meet common watershed level goals	Wildlife Habitat Council
Wildlife at Work	Develop habitat management plan, plant riparian buffers, remove exotic plants and animals, improve in-stream habitat	Corporate land	Technical assistance on developing habitat projects into a program that will allow companies to involve employees and the community	Wildlife Habitat Council
Wildlife Habitat Incentives Program	Develop habitat management plan, plant riparian buffers, improve in-stream habitat	High-priority fish and wildlife habitats	Up to 75% cost-share for conservation practices under 5- to 10-year contracts	NRCS state or local office

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The mission of the Wildlife Habitat Council is to increase the amount of quality wildlife habitat on corporate, private, and public land. WHC engages corporations, public agencies, and private, non-profit organizations on a voluntary basis as one team for the recovery, development, and preservation of wildlife habitat worldwide.

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