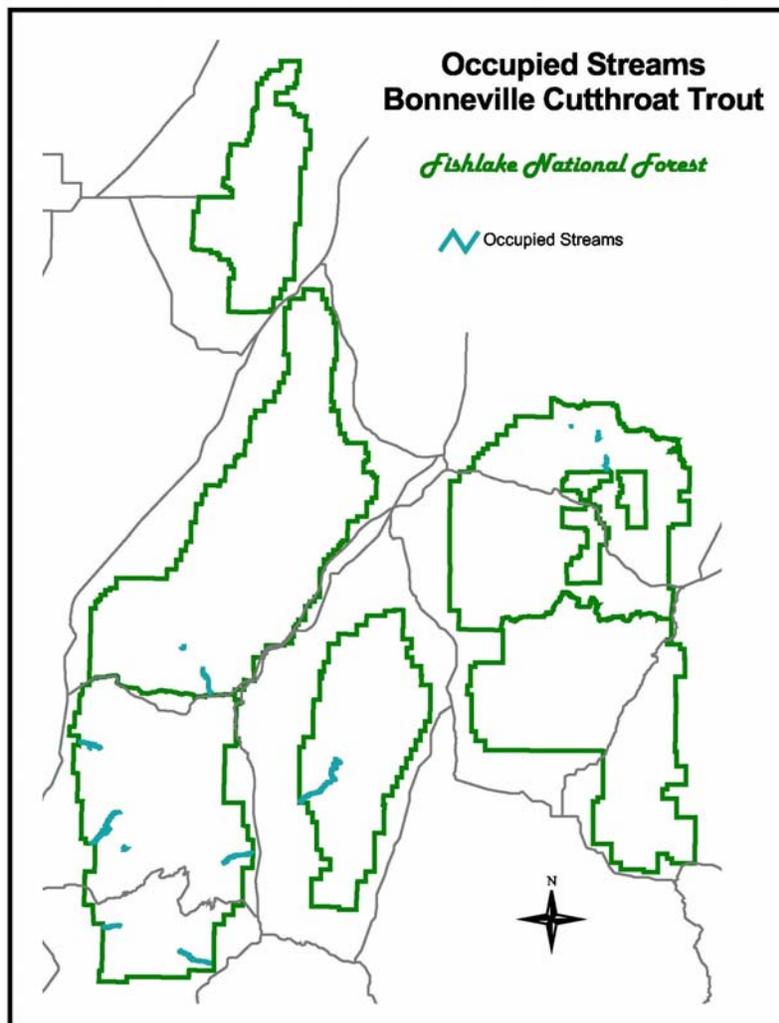


FISH

Bonneville Cutthroat Trout (*Oncorhynchus clarki utah*)

Bonneville cutthroat trout is one of three cutthroat trout subspecies native to Utah. Bonneville cutthroat trout historically occurred in the Pleistocene Lake Bonneville basin, which included portions of Idaho, Nevada, Utah, and Wyoming (Kershner 1995). The desiccation of Lake Bonneville into the smaller Great Salt Lake and fragmentation of other stream and lake habitats may have led to three slightly differentiated groups of Bonneville cutthroat trout. These groups are found in the Bonneville basin proper, the Bear River drainage, and the Snake Valley (Behnke 1992). There are five known populations of pure strain Bonneville cutthroat trout on the Fishlake National Forest inhabiting approximately 38 miles of stream habitat. There are several recently reintroduced populations, and several small potential remnant populations.



Habitat for the Bonneville cutthroat trout is widely distributed and variable. It ranges from high elevation (3,500 m mean sea level) streams with coniferous and deciduous riparian trees to low elevation (1,000 m mean sea level) streams in sage-steppe grasslands containing herbaceous riparian zones. As

such, Bonneville cutthroat trout have adapted to a broad spectrum of habitat conditions throughout their range (Kershner 1995).

Sexual maturity is typically reached during the second year for males and the third year for females (May et al. 1978). Both the age at maturity and the annual timing of spawning vary geographically with elevation, temperature, and life history strategy. Lake resident trout may begin spawning at two years of age and usually continue throughout their lives, while adfluvial individuals may not spawn for several years. Annual spawning of Bonneville cutthroat trout occurs in the spring and early summer (Binns 1981). May et al. (1978) reported Bonneville cutthroat trout spawning in Birch Creek, Utah beginning in May and continuing into June. The wild brood stock at Manning Meadow Reservoir (2,900 m elevation) spawn from late June to early July (Hepworth and Ottenbacher 1995).

Fry emerge in mid July through mid August (depending on time of spawn) and migrate to channel margin habitats associated with stream banks. Growth of resident fish is highly dependent on stream productivity. Growth rates of Bonneville cutthroat trout tend to be slower in headwater drainages than in lacustrine environments (Binns 1981).

Bonneville cutthroat trout require relatively cool, well-oxygenated water, and the presence of clean, well-sorted gravels with minimal fine sediments for successful spawning.

Both terrestrial and aquatic invertebrates are important food items for stream-dwelling Bonneville cutthroat trout (May et al. 1978). Dipterans and debris were the dominant food items for immature trout and terrestrial insects were the dominant prey for mature individuals (Kershner 1995).

There are numerous threats to Bonneville cutthroat trout. These include hybridization and/or competition with nonnative salmonids, degradation of habitat from diversions, livestock grazing, road building, fire, mining and timber harvest activities, as well as angling (Binns 1981).

Trend

Based on discussions with Dale Hepworth, DWR Regional Fish Program Manager, Bonneville cutthroat trout populations are increasing throughout the Southern Region. When the DWR started to restore the native Bonneville trout about 25 years ago, there were approximately 5 miles of occupied stream habitat in the Southern Region. Based on information provided by the DWR through personal communication, there are currently more than 75 miles of occupied stream habitat throughout southern Utah. This success has been the direct result of stream restoration work occurring from cooperative relations between the DWR and the Forest Service. In addition to information collected by the DWR, the total number of miles of occupied habitat on the forest has increased since 1986 from approximately 13 miles of habitat to 38 miles of occupied habitat, a 25-mile increase.

As a result of cooperative state and federal actions, an increase of suitable and occupied Bonneville trout habitat has occurred on the Forest and in the Southern Region. The Bonneville cutthroat trout is experiencing an upward trend and is viable on the Fishlake National Forest.

Colorado River Cutthroat Trout (*Oncorhynchus clarki pleuriticus*)

Colorado River cutthroat trout is one of three cutthroat subspecies native to Utah. Historically, this subspecies occupied portions of the upper Colorado River basin in Wyoming, Colorado, Utah, and New Mexico (Behnke 1992). Though it is now restricted to headwater streams and lakes, its original distribution included portions of the Colorado, Green, Yampa, White and San Juan rivers (Young 1995). Although reduced in range and numbers, pure populations of Colorado River cutthroat trout still exist in their native drainages. There are three known populations of pure strain Colorado River cutthroat trout on the Fishlake National Forest inhabiting approximately 8 miles of stream habitat.

Colorado River cutthroat trout populations may be lake resident, fluvial, or adfluvial, and life history characteristics vary somewhat between these strategies. Colorado River cutthroat trout appear to be slower growing than other subspecies with few fish over 200 mm, probably because of the short growing season. However, Colorado River cutthroat trout transplanted to lower elevation ponds grew to nearly 400 mm in two years, and were commonly over 250 mm in tributaries to the Green River in Wyoming, especially where fish were associated with beaver ponds (Young 1995). Some individuals

from the wild brood stock of Colorado River cutthroat trout in Dougherty Basin Lake reach lengths of over 400 mm (Hepworth et al. 2002).

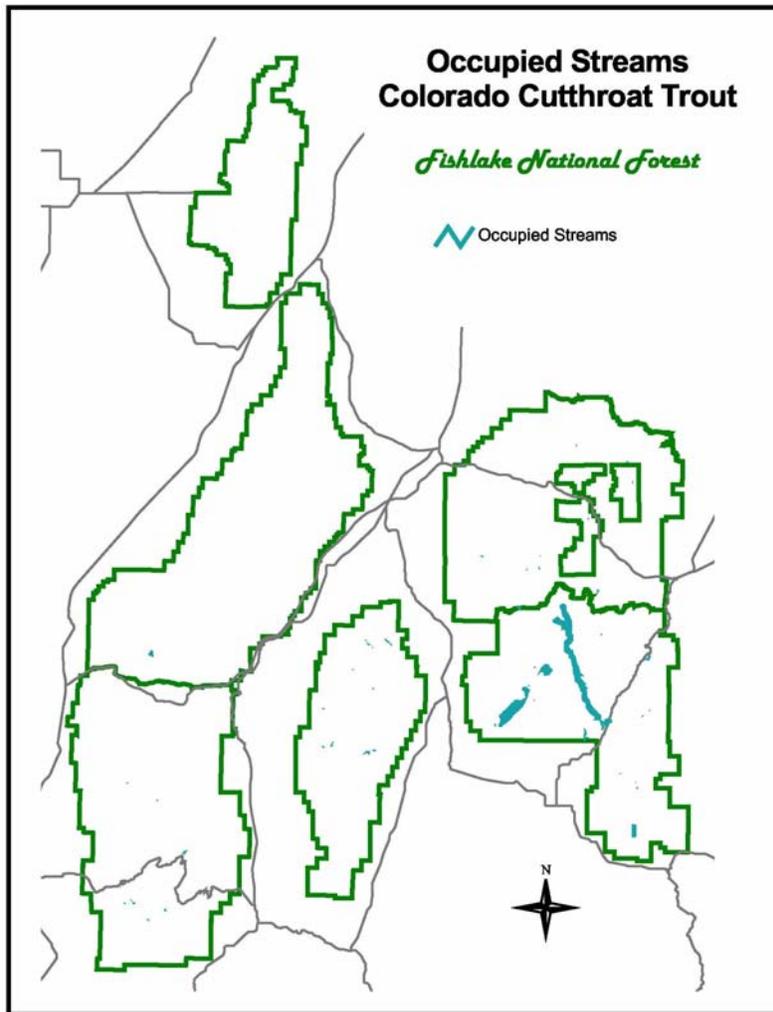
Colorado River cutthroat trout spawning usually begins when spring floods begin to recede in late spring and early summer, possibly cued by changes in water temperature. Fecundity varies with individual size and location as well as life history. Water temperature, elevation, and climatic variation determine fry emergence. In known populations, emergence usually occurs in late summer. Maturity is reached at approximately three years of age for fluvial populations (Young 1995).

Habitat requirements for Colorado River cutthroat trout are poorly understood, and results of studies are frequently conflicting. Typical of most cutthroat species, Colorado River cutthroat trout inhabit habitats with cold, clean water and spawn over gravel substrates with good water through-flow. Coarse woody debris, greater depth, and lower velocities are positively associated with Colorado River cutthroat trout presence; however, these conditions are not readily available within many streams containing Colorado River cutthroat trout. Small population size and restricted habitat areas confound most conclusions on habitat requirements (Young 1995).

Colorado River cutthroat trout do not compete well with introduced salmonids. This is possibly due to having evolved with the mottled sculpin and several endemic Colorado River minnows and suckers, and not with other salmonids (Young 1995).

Diets of subadult Colorado River cutthroat trout are comprised mainly of macroinvertebrates and plankton, whereas adults can be piscivorous with a larger proportion of large macroinvertebrates and terrestrial insects in their diets than that of subadults (Young 1995).

The Colorado River cutthroat trout only occurs on the Loa Ranger District of the Fishlake National Forest.



There are numerous threats to Colorado River cutthroat trout. These include hybridization and/or competition with nonnative salmonids, degradation of habitat from diversions, livestock grazing, road building, fire, mining and timber harvest activities, as well as angling.

Rainbow Trout (*Oncorhynchus mykiss*)

Because of the vast variation among rainbow trout populations, government agencies classify rainbow trout forms as Evolutionary Significant Units (ESU). This means that each ESU has an individualized genetic composition that is significant to the *Oncorhynchus mykiss* species as a whole.

Behnke (1992) describes four types of habitat that rainbow trout need during their life. The first is spawning habitat, which is typically small, cool-water streams. The spawning habitat must have adequate gravel beds. This means that there must be enough gravel for the redd, and the gravel must not be too fine or it will not let oxygen to the eggs. The water flow must not be too rapid. Very rapid water flow will carry the gravel of the redd, and the eggs, downstream.

The second necessary habitat type for rainbow trout is rearing habitat. This habitat must have adequate protective cover. At this stage of life, the fish is extremely susceptible to predation. The area must have water of low velocity. The fish are not yet strong enough to fight heavy currents for long periods of time. There must also be adequate food sources. A large amount of growth occurs during this time. Trout will usually stay in rearing habitat from birth to the second year of life.

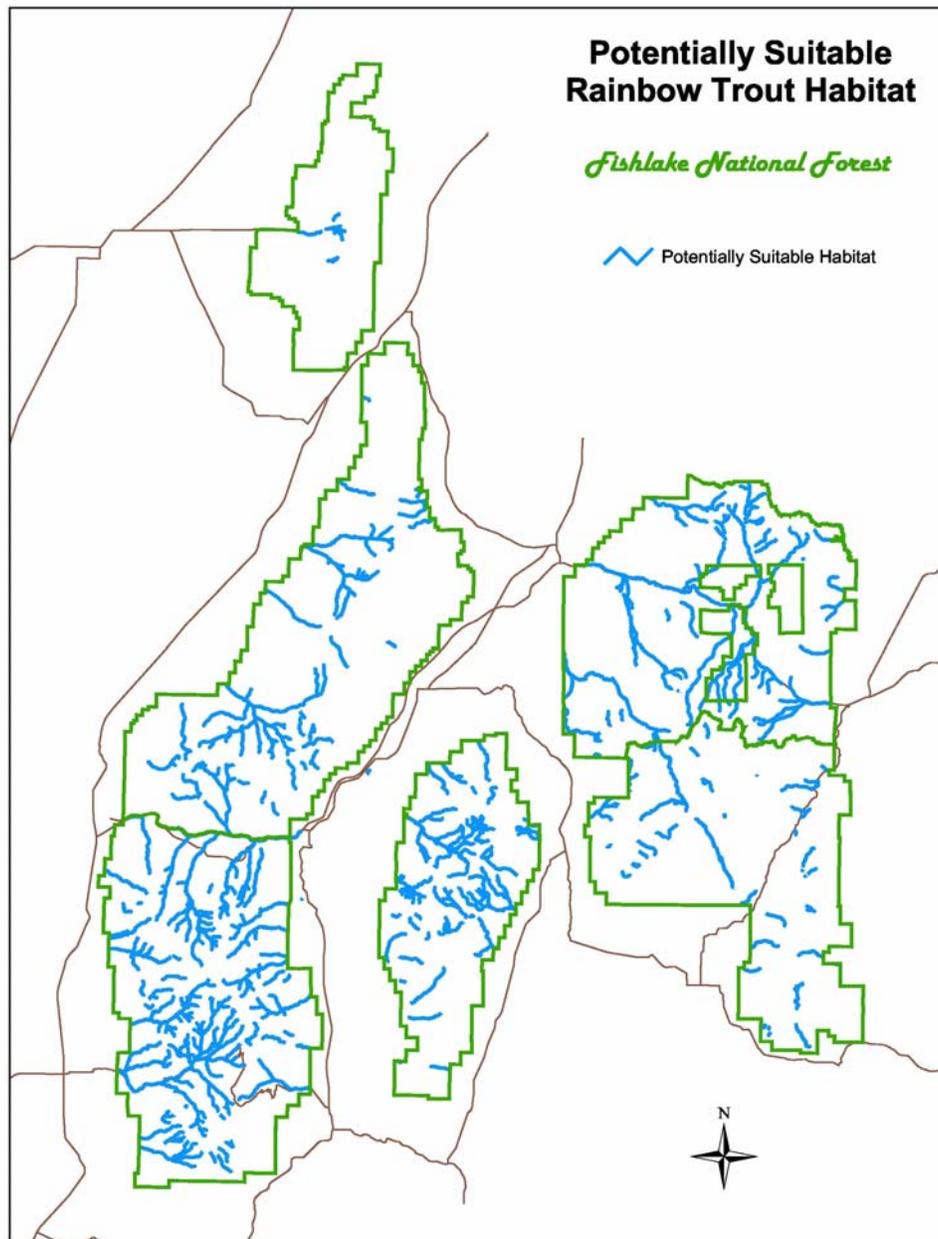
The third necessary habitat type is adult habitat. Trout tend to move to these areas during the second year of life. This habitat usually has water depths of 0.3 meters or greater. It is usually an area in which rapid-flow water meets calm water. This allows the fish to rest in the calm water and search for food and cover in the faster water. The cover in these areas often includes boulders, logs, vegetation, and undercut stream banks.

The fourth necessary habitat type is overwintering habitat. These areas are usually in deep waters. Stream fish move down to larger rivers, while lake fish move into deeper parts of the lake. The water tends to be low velocity in these areas. There has to be a large amount of protective cover. These areas also need to have an adequate amount of food.

Regardless of the habitat they are in, rainbow trout can utilize a high amount of dissolved oxygen in the water (up to 80% saturation) (Van Dam 1938 in Moyle and Cech 2000). Optimal temperature is between 7 and 17 degrees Celsius. Rainbow trout will die at temperatures above 28 degrees Celsius. Optimal pH for trout survival is between 7 and 8 (Mills 1971).

The native range of rainbow trout (*Oncorhynchus mykiss*) is the drainages of the United States Pacific Coast from Alaska to Mexico, the waters of the Pacific Ocean, and the eastern coast of Asia. Except for several small cases, rainbow trout are not native east of the continental divide.

On the Fishlake National Forest, rainbow trout occur on all four Ranger Districts. The map displayed below identifies approximately 1,053 miles of potentially occupied stream habitat and 4,680 acres of lake habitat across the forest.



The Fishlake LRMP (II-34) identifies 66 streams and over 380 miles of habitat, and 49 lakes and reservoirs with 4,200 acres of suitable habitat across the forest. Recent GIS analysis has estimated about 1,053 miles of potentially occupied stream miles and 4,680 acres of lake habitat. This new, more accurate estimate indicates that there is more potential habitat than originally estimated in the Forest Plan. Along with rainbow trout, the forest supports populations of Bonneville, Brown, Brook, Colorado, and Cutthroat trout.

Today, through extensive hatchery outplanting, rainbow trout (and many other species of trout) are found in all of the provinces of Canada, the majority of the U.S. states, and all of the continents except Antarctica. Most of the worldwide rainbows are stocks from Coastal rainbow trout (*Oncorhynchus mykiss irideus*) (Behnke 1992).

Rainbow trout are typically diurnal, opportunistic feeders. They are carnivores that feed in a rover-predator style. The majority of their diet consists of aquatic insects, although they will eat crayfish, grasshoppers, winged bugs, worms, salamanders, and other fish (including other trout). They will also

occasionally feed on benthic invertebrates when the benthic food supply is great and/or the competition for epipelagic food is increased (Behnke 1992).

Rainbow trout optimal feeding temperature is between 13-16 degrees Celsius. They will usually cease feeding between temperatures of 22-25 degrees Celsius. Rainbows in streams usually occupy a "station" which they have obtained through dominance and/or battle. This station usually has some sort of cover so the trout can hide from predators while it searches the water for food.

Dominance plays an important role in the feeding behavior of rainbow trout. Johnsson (1993) showed that larger rainbows tend to have dominance over the quantity and quality of food sources in limited food environments. He also showed that larger rainbows are more likely to feed in the risk of predation than smaller rainbows. He believes that this has to do with the increased ability of escape of the larger fish, which in turn may enable the fish to feed in more productive areas (high risk-high gain feeding). On the other hand, rainbow trout are preyed upon by a number of organisms. Squawfish (*Ptychocheilus* spp.), bass (*Morone* spp.), and pike (*Esox lucius*) are three well-known trout predators. The first two often feed on trout that are stopped by dams and other artificial barriers. Other salmonids, such as salmon, steelhead, and larger trout, will also prey upon developing rainbow trout. There are numerous predators on land and in the air as well. Bears, martins, fishers, otters, osprey, and eagles are just a few of the non-aquatic species that consider rainbow trout a food source.

Rainbow trout usually spawn from 2-4 years after their parents spawned. This age can vary greatly depending on size and genetics (Behnke 1992). Trout that have a territory that is very productive will usually have a large body size at an early age, and therefore will often breed sooner than a fish that lives in a less productive area. On the other hand, anadromous and lacustrine populations of rainbow trout have a genetic disposition for an older age at first breeding. Increased fecundity in these populations offsets disadvantages of later breeding. The relative fecundity ranges from 1,200 to 3,200 eggs per kilogram of body weight (Behnke 1992).

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Rainbow trout spawning behavior typically begins during the spring (December - April). The actual spawning times vary greatly among regions with temperature and water flow. Temperatures of 3-6 degrees Celsius often initiate spawning behavior, although actual spawning does not usually occur until temperatures reach 6-9 degrees Celsius (Behnke 1992). In lacustrine populations, this often means moving from the lake waters into the in-current stream in which they were hatched. If the lake is not stream-fed, the trout will usually move into shallow waters near the shore (Moyle and Cech 2000). In freshwater river populations, migration means moving from the feeding-grounds of a large river or stream into a smaller, cool-water tributary (Moyle and Cech 2000).

Mining, logging, and irrigation practices have contributed to the decline of rainbow trout in the Pacific Northwest. These practices increase stream sedimentation, increase water temperature by removing vegetation, add harmful chemicals to the water, and deplete the volume of water moving through the streams and rivers of the area.

Hatcheries were developed as an artificial propagation tool to supplement the dwindling native populations (DiSilvestro 1997). The idea seemed great in theory, but it had varied effects. There is a high mortality rate among hatchery strain of rainbow trout. If the hatchery strains do establish themselves in an environment, they will often displace the native trout species (Behnke 1992). Hatchery reared rainbows may also introduce disease and/or parasites to the native populations. And probably the most important factor, the gene pool of the native populations may be depleted through interbreeding with hatchery stock (Behnke 1992).

Conservation projects are being conducted to preserve the landlocked rainbow trout habitat. Stream restoration is currently the main emphasis. Regulations on logging, mining, and grazing practices are ever increasing to preserve riparian habitat and decrease sediment in the streams.

Utah's trout populations are managed by the DWR and season time frames and bag limits recommended to the RAC councils at public meetings and approved by the Utah wildlife board, a governors appointed board. Through this process all game fish regulations are established and codified.

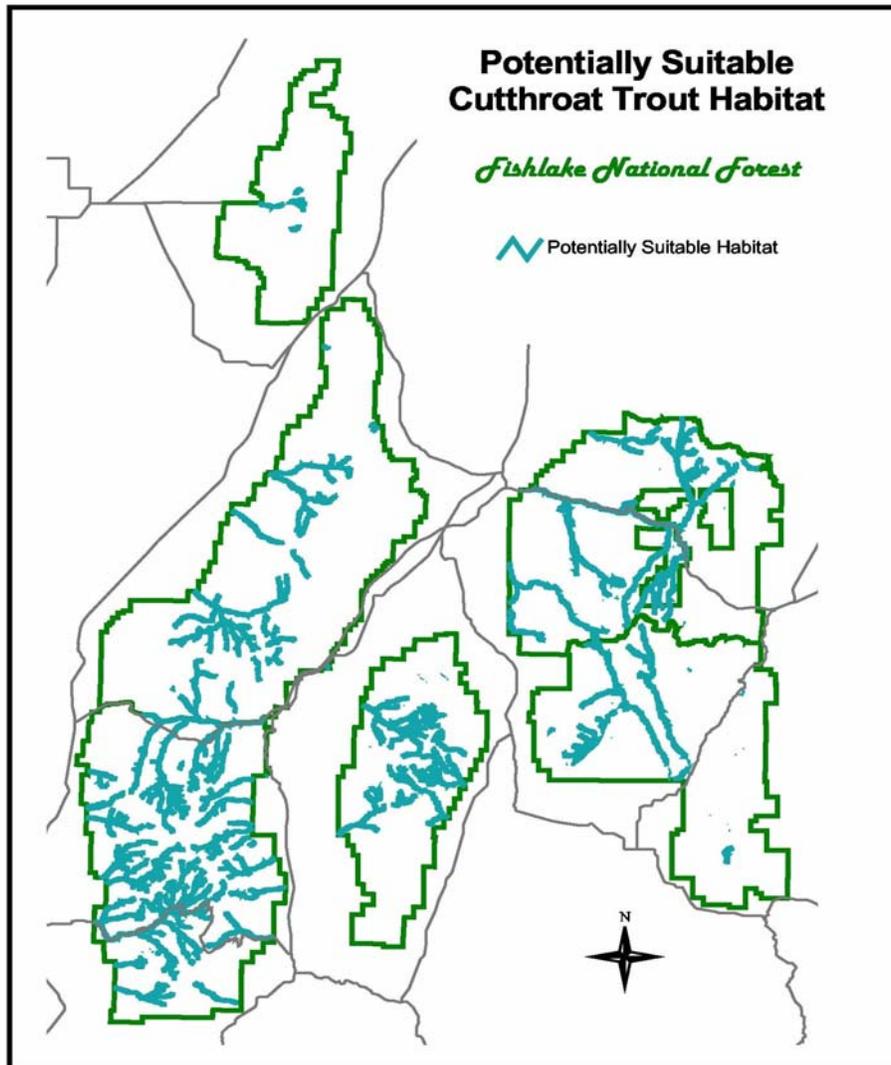
Trend

The population trend of rainbow trout on the Fishlake National Forest is stable. As a result of a good hatchery program in the DWR Southern Region, a very successful fish-planting program for recreational use is in place. Wild self-sustaining populations of rainbow trout also occur in many of the streams on the Forest. As a result of this, fish populations are always fluctuating slightly, but remain stable, and viable across the forest. Dale Hepworth, DWR Fish Program Manager, Southern Region, provided information and support for this determination.

Cutthroat Trout (*Oncorhynchus clarkii*)

Cutthroat trout are economically important over virtually all of their range. Their flesh is excellent for consumption and fishermen consider them a valuable prize. They are the only trout native to Utah. The range of the cutthroat trout extends from coastal streams of Alaska to northern California throughout the Intermountain area and east to the upper Missouri, Platte, Colorado, and Rio Grande Rivers. The cutthroat can be found in fresh, brackish, or salt water in North America mostly west of the Rocky Mountains. A central area in which the rainbow trout occurs separates the coastal and Yellowstone varieties. The inland form lives in western Alberta in the headwaters of river systems.

On the Fishlake National Forest cutthroat trout occur on all four Ranger Districts. The map displayed below identifies approximately 1,053 miles of potentially occupied stream habitat and 4,680 acres of lake habitat across the forest.



Cutthroat trout are the only species of trout native to the interior west of the United States. The species is characterized by the red cutthroat mark located below the jaw. Cutthroat trout are generally more colorful than rainbow trout, and can develop colorations of bronze to bright red. Additionally, dark spots located along the body are well defined and more concentrated towards the caudal fin. Cutthroat

trout spawn annually in the spring or early summer. Spawning generally occurs in cold, clear streams with ample clean gravel substrate. Loss of suitable habitat and competition with non-native salmonids are two major limiting factors facing cutthroat trout within their native range (Sigler and Sigler 1996).

Trend

The population trend of cutthroat trout on the Fishlake National Forest is stable. As a result of a good hatchery program the DWR Southern Region, has a very successful fish-planting program for recreational use. Wild self-sustaining populations of cutthroat trout also occur in many streams on the Forest. As a result of this, fish populations are always fluctuating slightly, but remain stable to slightly increasing, and viable across the forest. Dale Hepworth, DWR Fish Program Manager, Southern Region, provided information and support for this determination.

Brown Trout (*Salmo trutta*)

In 1883, the brown trout was introduced into the United States from Europe and soon adapted itself to trout waters throughout most of the country except some areas of the southeastern United States. The brown trout's ability to adapt itself to a wide variety of ecological conditions has helped to expand its range. Some of the best brown trout fishing waters in the United States are the larger coldwater streams of Utah.

Brown trout are brown to gold on their back with a cream to slate colored belly. Most fish have black, gray, yellow, and occasionally red spots all surrounded by a white halo. This species has a prominent

spotted adipose fin between the dorsal and caudal fin. There are no spots on the squarish tail or vermiculation --wormy marks-- on the back. The average brown trout ranges from 10-13 inches in size. The state record brown trout weighed 14.65 pounds and measured 25.25 inches in length (Sigler and Sigler 1996).

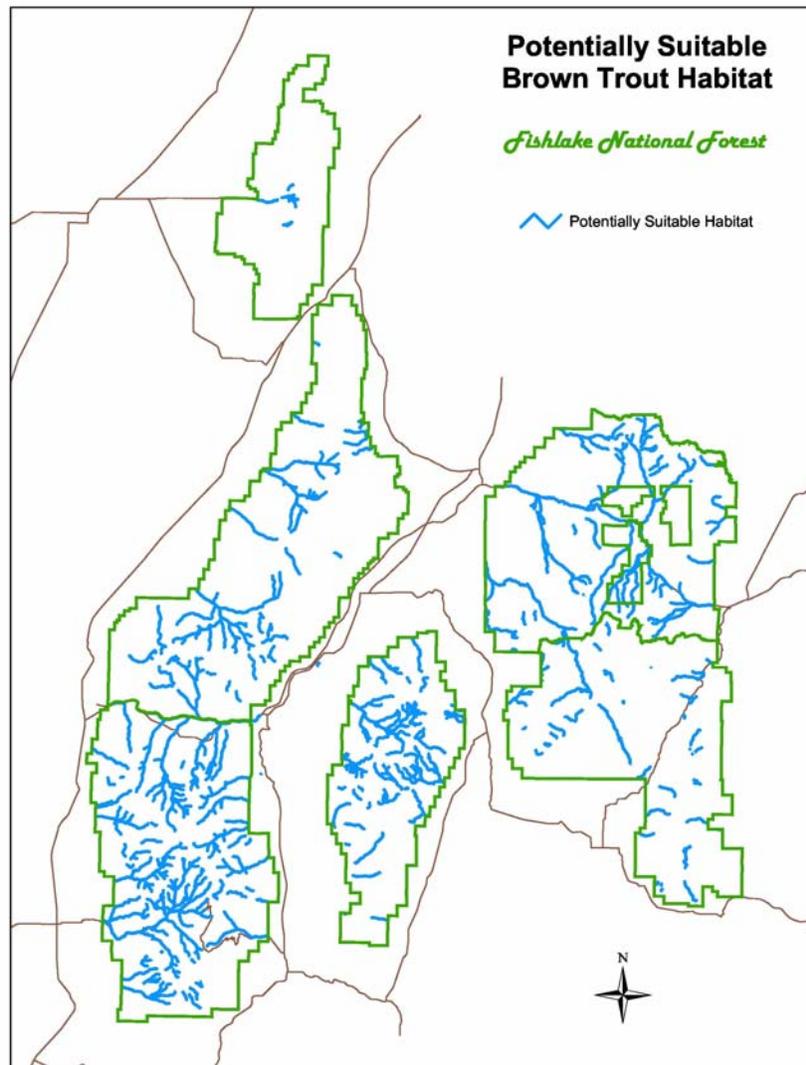
They prefer cold water with temperatures ranging up to 26°C. Preferred habitat includes areas of boulders, cobble, logs, rootwads and overhead cover. Brown trout will feed in riffles containing rock as small as gravel.

They feed actively in the morning and evening. The smaller brown trout, less than 2 pounds, prey primarily on insects. The larger brown trout readily feed on fish, both game and non-game.

Brown trout prefer cool lakes and streams, though they are present in many of the lower elevation waters which are at times quite warm and in some cases polluted. Since they are able to withstand warmer and less-clear waters, brown trout have effectively established strong populations in areas that are not occupied by other trout species.

Brown trout populations are managed by the DWR in Utah, as are all fish and wildlife on the Fishlake National Forest. All regulations for the management of this species are developed through an interagency process, presented to RAC committees, and then approved by the Utah wildlife board. As a result of this process the Forest Service does not have direct control over the fate of brown trout on the forest. However, this species has stable populations across the forest. Drought conditions are serious and the effects to fish are still unknown. However, the above normal precipitation received during the winter of 2004 has begun to replenish depleted aquifers that all trout species.

Below is a map displaying potentially suitable habitat for the brown trout on the Fishlake National forest. On the Fishlake National Forest brown trout occur on all four Ranger Districts. The map displayed below identifies approximately 1,053 miles of potentially occupied stream habitat and 4,680 acres of lake habitat across the forest.



Trend

The population trend of brown trout on the Fishlake National Forest is stable. As a result of a good hatchery program the DWR Southern Region, has a very successful fish-planting program for recreational use. Wild self-sustaining populations of brown trout also occur in many of the streams on the Forest. As a result of this, fish populations are always fluctuating slightly, but remain stable to slightly increasing, and viable across the forest. Dale Hepworth, DWR Fish Program Manager, Southern Region, provided information and support for this determination.

Brook Trout (*Salvelinus fontinalis*)

The brook trout is one of the most popular game fish in the United States. They are native to the eastern United States and have been widely introduced in the western United States (Sigler and Sigler 1996). The brook trout has been studied more than almost any other trout. The small fish are readily caught on both live baits and artificial lures; the large ones are exceptionally wary. Spinning and fly-casting are the more popular methods of catching them.

The brook trout has a streamlined, somewhat compressed body, which is about five times as long as it is deep. The color of the brook trout ranges from olive, blue-gray, or black on the back to white on the belly. Red spots, with or without bluish rings around them, are evident on side though they are not numerous.

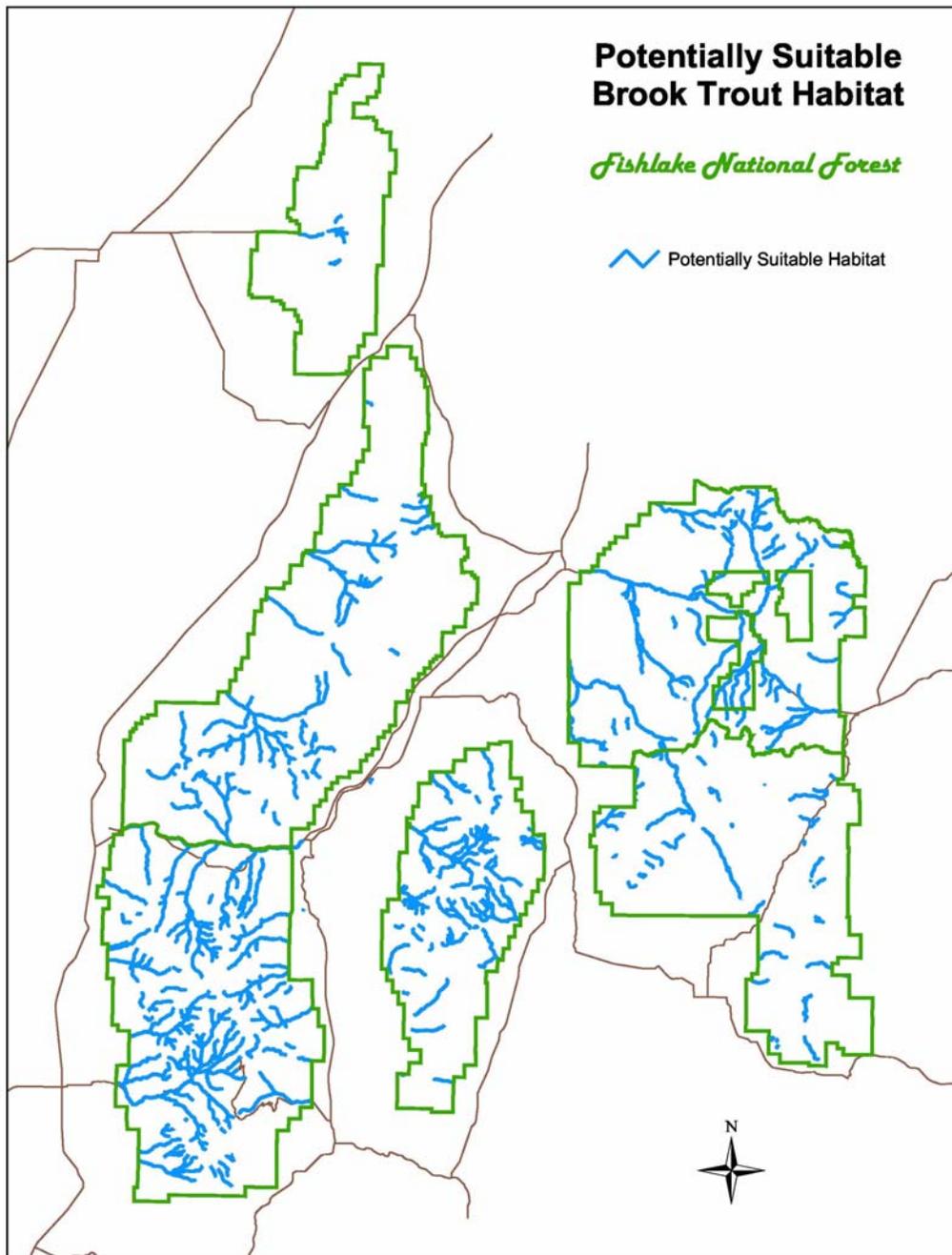
Brook trout growth rates are highly variable. Under favorable conditions (moderate temperatures, ample food supply) the species can grow very rapidly (Sigler and Sigler 1996). Brook trout attain the best growth from streams with an abundant supply of spring water, which keeps the stream relatively warm in the winter. In lakes, the growth rate may also be fast with lengths of 18 inches possible in 4 years.

These trout are voracious feeders. They feed primarily on insects throughout their lives. Occasionally, brook trout eat worms, mollusks, crustaceans, or other fish.

The spawning season occurs as early as late summer in the northern part of the range and as late as early winter in the southern portion. As the spawning season approaches, brook trout seek gravel riffles in spring-fed tributaries or spring seepage areas in lakes.

Brook trout attain their greatest abundance in cool, clear, headwater ponds and spring-fed streams. The species has been successfully stocked in lakes having cool, well-oxygenated lower layers of water. Stocking has occurred in lakes on the Richfield and Loa Ranger Districts with good success. However, during drought years and low water, winterkill is a problem. There are also stream populations on the Richfield and Loa Ranger Districts.

Displayed below is a map of potentially suitable habitat across the forest. On the Fishlake National Forest brook trout occur on all four Ranger Districts. The map displayed below identifies approximately 1,053 miles of potentially occupied stream habitat and 4,680 acres of lake habitat across the forest.



Trend

The population trend of brook trout on the Fishlake National Forest is stable. As a result of a good hatchery program the DWR Southern Region, has a very successful fish-planting program for recreational use. Wild self-

sustaining populations of brook trout also occur in several Forest streams. As a result of this, fish populations are always fluctuating slightly, but remain stable or slightly increasing, and viable across the forest. Dale Hepworth, DWR Fish Program Manager, Southern Region, provided information and support for this determination.

Lake trout (*Salvelinus namaycush*)

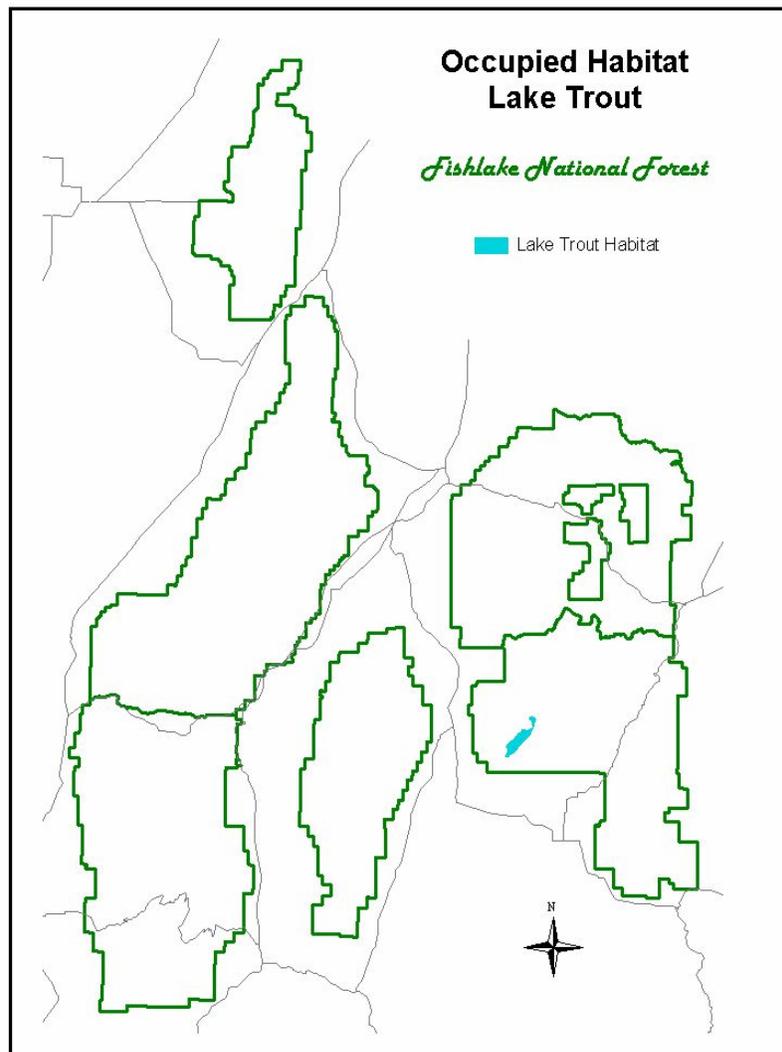
Lake trout are a medium to dark gray or olive color with white worm-like wavy marks on their backs and on top of the head. Occasionally, they have bars or spots along the side mainly tinged with red.

This species is native to the Great Lakes and prefer deep, coldwater lakes throughout North America. They are usually found offshore in deep, well oxygenated water. In Lake Erie, lake trout are usually not found in Ohio waters, but can be found in low numbers in the East Central and Eastern basins. These populations are maintained by annual stockings in Pennsylvania and New York.

On the Fishlake National Forest, they spawn on reefs in the fall. Eggs hatch in the spring and young lake trout usually move to deeper water after a short time. Adult fish are opportunistic feeders their diet consisting of aquatic insects, crustaceans, and a range of fish species, including small lake trout and other trout species. The lake trout is a slow growing, long-lived species that does not become sexually mature until age seven or eight. Lake trout populations in Fishlake have been present since the early 1940's

Lake trout average between 20 and 24 inches and 3 to 6 pounds, but are capable of reaching in excess of 50 pounds.

Displayed below is a map of occupied habitat that only occurs in Fish Lake.



Trend

The following information is from Chamberlain (Utah Division of Wildlife Resources fisheries biologist, personal communication 2002), which will be released in a UDWR publication in the near future. Lake trout were first stocked into Fish Lake shortly after the turn of the century. Lake trout numbers were maintained by periodic stocking until about 1991. The original prey species for lake trout in Fish Lake was the Utah chub. Two changes have occurred since lake trout were introduced which has changed the ecology of this species. The first was the accidental introduction of Eurasian milfoil, which has choked out the native bottom growing weed bed that occurred around the lake. The second was the illegal introduction of yellow perch to Fish Lake in the early 1970s. Towards the end of the 20th century yellow perch began to out compete and displace the Utah chub, reducing forage biomass for lake trout (which do not eat the spiny fish). This was likely exacerbated by the thick, non-native weed growth that protects perch from other fish predators in the lake.

Stocking was ceased in about 1991. Data to that date indicated stocking was unnecessary to maintain lake trout numbers. Due to concern about the reported decline of large lake trout and to ensure a viable

lake trout fishery, trend netting (fall gill netting over spawning reefs) by the Utah Division of Wildlife Resources has continued every other year since then. Some food analysis work has also occurred. This work has shown that there are still high numbers of smaller lake trout below 22 inches that primarily feed on aquatic insects and crustaceans. There are few lake trout from 22-26 inches, which is a critical size where lake trout switch to feeding on fish. Suitable sized Utah chub needed for prey are now limited. The fewer number of lake trout which are able find sufficient smaller fish prey to grow to 26 inches then do quite well, as lake trout over 26 inches are large enough to prey on the stocked rainbow trout.

In summary, lake trout numbers have remained relatively stable, but a reduced number make it through the 22-26 inch bottleneck to become trophy lake trout. The Utah Division of Wildlife is analyzing the data to determine if management changes, such as increased harvest of smaller lake trout, could increase numbers of larger trophy lake trout in Fish Lake. Dale Hepworth, DWR Fish Program Manager, Southern Region, provided information and support for this determination.