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# Policy Analysis for Optimizing Native Fisheries on the McKenzie River

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**Index**

**Abstract**

The impact of hatchery fish on native populations has been extensively studied, especially as environmental management has generally moved toward a conservation focus. In Oregon, the McKenzie River native rainbow trout population has been the focus of recent interest groups attempting to induce a change in management practices to support native fisheries. The McKenzie River Chapter of Trout Unlimited is interested in learning more about the impacts that hatchery stocked rainbow trout have on native river populations. It is the group's intent to seek a rule change to management by the Oregon Department of Fish and Wildlife. A review of the historical and scientific information regarding fish stocking was needed to provide information for Trout Unlimited to make informed recommendations to the managing agency. Examples of successful management changes for conservation of native fish were used as case studies to examine the implications of stocking cessation on the viability of trout populations in Oregon. This paper provides details on the background information needed to understand the case studies, their relation to the situation on the McKenzie, and how those outcomes may support recommendations for fisheries management on the McKenzie. It is the intent that these recommendations and supporting details may provide Trout Unlimited with the information needed to make a meaningful recommendation to the Oregon Department of Fish and Wildlife regarding the native rainbow trout fishery in the McKenzie.

**Background and Importance**

Native fisheries in the McKenzie include a community of spring Chinook salmon, as well as bull, cutthroat, and rainbow trout species. Unfortunately, the continuous stocking of rainbow trout in the McKenzie River has reduced historic numbers of native rainbow trout. Currently, 93,000 hatchery trout are stocked annually in the McKenzie River. Hatchery fish out compete native fish for habitat and food. The large numbers of stocked trout, along with continued angling pressures have caused wild populations to decline, as evidenced by catch data from fishermen.

At this point it is important to distinguish the following terms: native, wild, and hatchery or stocked fish. A native fish is a species historically found in an ecological system without genetic influence from stocked fish. A wild fish is a fish spawned in the

natural environment, regardless of parental heritage. A hatchery fish or stocked fish is one raised in a hatchery facility and released into a natural system.

Recently conservation groups have taken interest in reducing this negative trend in native trout populations. Trout Unlimited (TU) suggests that the stocking program is economically wasteful and that wild fish will also provide better angler recreation. TU and other supporting groups have posed the management question: what is the appropriate balance for wild and hatchery trout in the McKenzie River? Oregon Department of Fish and Wildlife (ODFW), who oversees the stocking procedures, see no problem with the present ratio of hatchery to wild rainbow trout. This has lead to a disagreement between the managing agency and conservation interest groups.

To counteract the loss of native trout in the McKenzie River, TU and supporting groups like the McKenzie Flyfishers and Federation of Fly Fishers suggest that the solution is to cease stocking rainbow trout. TU intends to request an emergency rule change through the ODFW that would require ODFW to stop stocking hatchery trout in the belief that this would improve the numbers of wild trout.

Prior to requesting this cease-stocking rule, TU desires to provide ODFW with scientific data on how hatchery fish presently impact wild trout in the McKenzie River. This can be accomplished by evaluating trout data on a five mile stretch of the McKenzie River where stocking has already ceased. Other information needed to make an informed decision is data on angler interests and an examination into how similar decisions have impacted other rivers. The goal of the paper will be to provide information to TU that can be used in the development of a policy recommendation to ODFW towards the creation of a viable wild trout fishery on the McKenzie.

**Problem Statement**

Historic stocking of rainbow trout on the McKenzie River has created a trout fishery that is popular for recreational angling. In recent years, as ecological conservation has gained increased attention interest groups have become increasingly active in seeking regulatory reform for fisheries management. Specifically for the McKenzie, groups are hoping that stocking of rainbow trout will be reduced and eventually stopped. The

concerns about hatchery fish being input to the system revolve around the possibility of compromising unique native population viability.

**Methodology**

The goal of this project is to compile scientific information about rainbow trout stocking and policy information regarding cessation of stocking. To gather scientific information a literature review was completed in order to have a complete understanding of the biological and ecological impacts that fisheries management strategies have on fish and their environments. Background information about the physical attributes of the McKenzie River watershed, fisheries trophic structure, and past and current fisheries management strategies provided basic information for understanding the management policies implemented on the McKenzie River. The first step towards understanding the need for this research on the McKenzie was to attend a presentation about Trout Unlimited's goals for fisheries management in the McKenzie, and meeting with the individual who has been the backbone of the organization's public outreach for this issue.

The 2006 Oregon Department of Fish and Wildlife Oregon Angler Preference Survey was a starting point for examination of fisheries management policies on the McKenzie River. Reading the survey provided some insight into the motivations behind fisheries management on the McKenzie.

To accomplish the goal of examining policy information, case studies were completed in order to provide information that would be useful for preparing final policy recommendations for stocking practices on the McKenzie River. To complete the two case studies for the Metolius River and Lower Deschutes River information was gathered from agency documents and personal communication with agency officials. The Metolius and Lower Deschutes were chosen as case studies because fisheries management for each river has evolved over time and has recently seen cessation of stocking. First, the researcher interviewed biologists directly involved with the management of the fisheries resources in each river. The researcher met with the primary fishery biologist that manages the McKenzie River, and went to the area to better understand the physical attributes of the river. A phone interview, and much correspondence allowed the fisheries biologist for the Metolius River to explain the

management practices in place for that river. Second, the researcher reviewed records from the Oregon Department of Fish and Wildlife related to the fisheries management of the two rivers, to assess the research conducted that resulted in policy decisions being made for fisheries management. To review these case studies, the two rivers in the case studies were compared to the McKenzie River, to determine the similarities and differences between the ecology of the river systems and the management needs for each. This comparison allowed the researcher to make recommendations based on the outcome from fisheries management in the case study rivers.

While this research is being conducted for TU an organization with preference for native trout, the researcher will reduce bias by supporting the recommendations with scientific data and through peer review by an environmental scientist not associated with TU.

To provide a deliverable for this research policy recommendations were written based on the research findings of the literature review and case studies. The policy recommendations were made in a way that the community partner, Trout Unlimited, could provide Oregon Department of Fish and Wildlife with desired approaches to fisheries management, with supporting materials as to why these recommendations were made, as based on the case studies.

## I. Literature Review

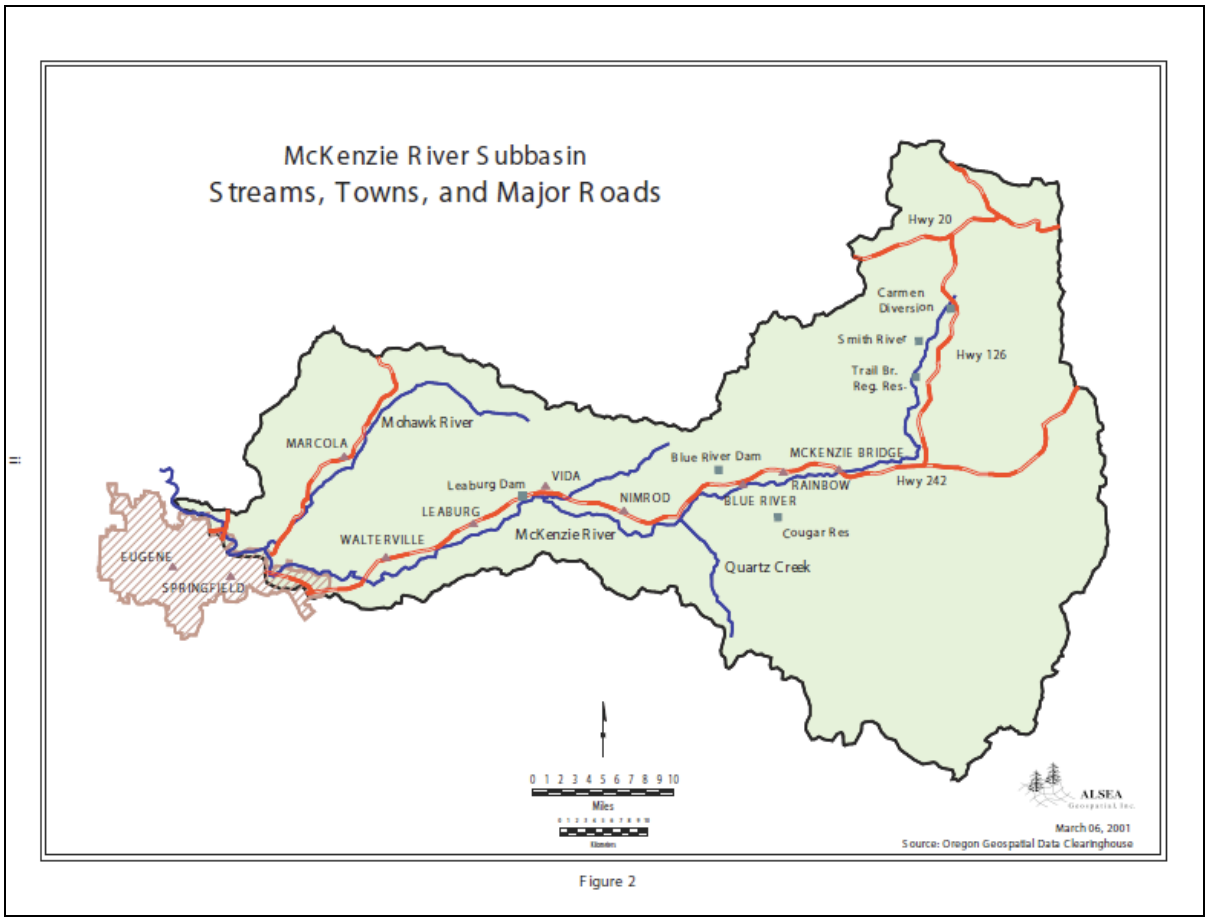
### Physical Description of the McKenzie River Watershed

The McKenzie River flows for 90 miles, from its origin at Clear Lake to where it meets the Willamette River (see Map 1). The watershed supporting the McKenzie is within the Willamette River Basin, and is 1,342 square miles (Homolka and Downey, 1995). The City of Eugene lies just below the point where the McKenzie River joins with the Willamette River. Eugene's proximity to the river makes the McKenzie a significant resource for water, energy, and recreation to the city's residents and visitors. Use of the river as a resource for the City of Eugene has led to management through water conservation. The Eugene Water & Electric Board (EWEB) is a publicly owned utility, formed for the purpose of providing drinking water to the City of Eugene (Morgenstern,

Donahue, & Toth, 2011). In 2000, EWEB identified the McKenzie River as being the sole source of drinking water for Eugene, and prepared a plan to guide the environmental management strategy for protecting the water for drinking (Morgenstern et al., 2011). These are also protections beneficial to water quality needs for river wildlife.

The McKenzie is also a resource for hydropower (see Map 2). The Walterville, Leaburg, and Carmen-Smith Reservoir projects are Federal Energy Regulatory Commission (FERC) licensed hydropower facilities on the McKenzie (Runyon, 2000). Additionally the Cougar and Blue River dams are both US Army Corps of Engineers hydropower facilities located on the McKenzie (Runyon, 2000). Impacts from these dams include affects on river water temperature and flow rates, change to sedimentation in the river, impacts to riparian habitats, and alteration of fish rearing habitat (Runyon, 2000).


**Map 1.** State of Oregon, highlighting the McKenzie River watershed. The McKenzie watershed covers 1,342 square miles. (graphic from Runyon, 2000)



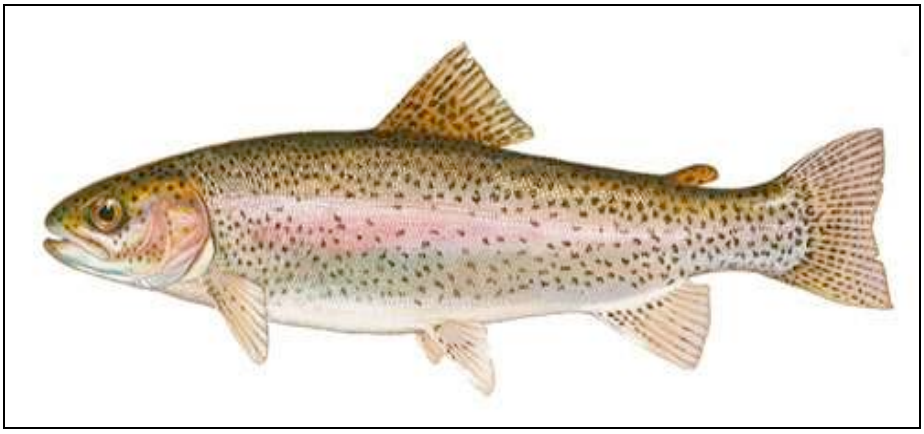

**Map 2.** Map of the McKenzie River subbasin, indicating the urban influences of the river. (graphic from Runyon, 2000)

**Fisheries of the McKenzie**

Of 39 fish species endemic to Oregon, many are present in the McKenzie subbasin. Native fisheries in the McKenzie River include populations of rainbow trout, cutthroat trout, whitefish, lamprey, cottids, three-spined stickleback, redside shiner, largescale sucker, speckled dace, and northern pike minnow. Native bull trout and spring Chinook salmon are listed as threatened species by the federal Endangered Species Act (Bonneville Power Administration, 2000). Other fisheries in the McKenzie have been introduced over time, including the brook trout and summer steelhead. Having a variety of fishes present in an ecological system is critical to maintaining the trophic system relationships between species. In a river system, two species of fish in the same genus

may occupy different habitat spaces. For example, cutthroat and rainbow trout occupy different niches in the McKenzie. In the mainstem of the McKenzie, rainbow trout is the dominant type of trout, meaning they are important to maintaining the structure of the trophic system (Jeff Ziller, personal communcation, November 19, 2010).

Rainbow trout, *Oncorhynchus mykiss*, (see Picture 1) are a widely distributed cold-water trout and popular sportfish (Behnke, 2002). Many variations of the species exist around the globe, which has required extensive terminology for proper classification (Behnke, 2002). The anadromous form of rainbow trout is known as steelhead. Rainbow trout that are landlocked and distinctive through regional differences are considered redband trout. Redband trout that are anadromous are considered redband steelhead. The introduction of hatchery rainbow trout, which may result from any genetic combination of stocks of these three classified rainbow trout, may result in hybridization between the subspecies.



**Picture 1.** Rainbow trout, *Oncorhynchus mykiss.* (Klotz, 2007)

**Stocking on the McKenzie River**

Stocking on the McKenzie began as a measure used to mitigate the effects of dams on fishing. Specifically, the Leaburg Hatchery runs what the Oregon Department of Fish and Wildlife considers a harvest program. A harvest program is a stocking program meant to mitigate the loss of fishing opportunities. A conservation program is maintained to conserve fish species for ecological reasons. Stocking plans identified as

harvest programs are meant to "enhance or maintain fisheries without impairing naturally reproducing populations" (Oregon Department of Fish and Wildlife, 2010a). Leaburg hatchery began operation in 1953 and is now responsible for the rearing of the rainbow trout which are stocked to the Lower McKenzie River. Currently the hatchery raises rainbow, cutthroat, and steelhead trout (Oregon Department of Fish and Wildlife, 2010b). The Leaburg hatchery provides 93,000 hatchery trout annually for stocking in the McKenzie River (Jeff Ziller, personal communication, November 19, 2010).

Historical large-scale stocking may contribute to changes in fisheries populations since hatchery fish are in some ways different than wild fish. Specific stocks are chosen for reproduction in hatcheries, meaning that little natural selection contributes to the make-up of the population that comes from the hatchery. Stocks may be chosen for their unique characteristics, but this can influence the composition of the population that is stocked in the wild. Hatchery-raised fish are reared in an environment very unlike a natural stream, giving them disadvantages to living in the wild. These rearing differences can contribute to less-natural behavioral exhibition by hatchery fish (Weber & Fausch, 2003). Both the genetic composition, influenced by the broodstock, and the rearing environment can impact these factors (Weber & Fausch, 2003) which may hinder hatchery survival in local wild conditions.

In the 2010 Leaburg Hatchery Operational Plan, one goal listed for the hatchery is that all rainbow trout reared for stocking will be triploid, meaning they will not be able to reproduce. This prevents hatchery fish genes from infiltrating into the native fisheries, and reduces competition from a reproduction perspective. According to Jeff Ziller, district biologist for the McKenzie River stocking occurs in about half of the river miles of the McKenzie. The Lower McKenzie has 40 miles unstocked, and the Upper McKenzie has 23 miles unstocked (Jeff Ziller, personal communication, November 19, 2010). Ziller attributes continuation of stocking to three reasons: 1) hatcheries are already established and federal government still funds hatcheries, 2) anglers expect to catch legal-sized fish, and 3) if there are no hatchery fish stocked in the McKenzie, angler use of the river declines, leading to reduction of contributions to the economy from recreational angling. Operation of Leaburg Hatchery is almost completely supported by federal funding (Jeff Ziller, personal communication, November 19, 2010).

Broodstocks are chosen by hatchery managers for their adaptability to varied natural environments and for ease of rearing. The chosen broodstocks of fish raised for stocking can impact the characteristics that the stocked fish display in the wild. Genetic differences have been traced to be the most significant factor in characteristic differences seen between hatchery and wild fish (Weber & Fausch, 2003). In the case of the McKenzie, non-local broodstocks of rainbow trout are used to raise hatchery fish that are stocked in the river. Six rainbow trout broodstocks are used for stocking in rivers throughout Oregon. These are: native Deschutes rainbow, Willamette rainbow, Eagle Lake rainbow, Oak Springs rainbow, Roaring River rainbow, and Cape Cod rainbow (Kinunen & Moring, 1976). The Willamette rainbow broodstock was originally reared from native McKenzie River rainbow trout, also called redsides (Kinunen & Moring, 1976). Leaburg hatchery raises Cape Cod rainbow trout (Oregon Department of Fish and Wildlife, 2010a). In general, hatchery fish are larger than wild fish, as a consequence of genetics from the broodstock selection and of the limits of natural selection or predation that occurs on hatchery-raised fish (Weber & Fausch, 2003). Adaptations that may be present in local populations are not found in the non-local broodstocks, leading to differences in the populations.

Hatchery fish tend to be more aggressive than wild fish, resulting in competitive tendencies from stocked fish (Weber & Fausch, 2003). Competition as a negative impact of hatchery fish is further supported by Vincent's work (as cited in Moring, 1993) which determined that populations of wild trout decline in the presence of hatchery rainbow trout. Feeding patterns may be influenced by the hatchery environment in which the fish were raised. These hatchery environments may encourage specific behaviors, including how hatchery-raised fish tend to feed nearer to the surface once stocked (Weber & Fausch, 2003). Competition is often considered to be a negative impact of hatchery fish on wild fish. However, conflicting results from many research studies published on the subject lead to no conclusion about the significance of competition between the two groups. Although there is not enough evidence to make a conclusion, it is realistic that hatchery and native rainbows will compete for the same resources, leading to direct competition for food and space (Pearsons, 2008). This competition for space can lead to displacement. Displacement occurs when one group of fish are forced from their favored

habitat into less favorable habitat (Weber & Fausch, 2003). The 1997 Fish Management Plan acknowledges competition between hatchery and wild trout as a hindrance to wild trout viability (Oregon Department of Fish and Wildlife, 1997).

The release of hatchery fish can also introduce diseases to wild populations. For example, stocking of fish can enable the introduction of pathogens and parasites to native populations (Waples, 1999). To prevent the possibility of disease spread occurring at the hatchery, the Leaburg Hatchery Operational Plan specifies reactive and proactive strategies for managing disease spread (Oregon Department of Fish and Wildlife, 2010a). The ODFW has adopted a Fish Health Management Policy that guides the hatchery's programs for raising and releasing healthy fish (Oregon Department of Fish and Wildlife, 2010a).

According to Araki (as cited in Williamson, DeHaan, & Hawkins, 2010) hatchery origin rainbow trout could negatively impact the productivity of local native populations because of reduced fitness when reproducing in the wild. Since 2004 ODFW hatcheries have been producing triploid rainbow trout eggs, in addition to diploid eggs (Chilton, 2011). This approach is meant to reduce the impacts of genetic introgression between hatchery and native trout in Oregon streams, since triploid eggs result in sterile adult fish. Currently, not all hatchery fish are produced from triploid eggs, meaning that some hatchery fish still can reproduce in the wild. Even eggs manipulated to be triploid may result in fertile individuals as the process is not infallible. According to ODFW research, the triploid rate is variable through all methods used to produce triploids (Couture, Firmenich, & Noakes, 2008). The hatcheries are using a portion of triploid eggs in an effort to reach a goal of stocking only triploid fish in the near future.

**Hatchery Fish Economics**

Even though hatchery fish negatively impact native fish, Oregon hatcheries continue to provide 1,118,287 pounds of rainbow trout (Chilton, 2011). Leaburg hatchery produced 133,604 pounds of rainbow trout in 2010 (Chilton, 2011).

In 2010, annual operating costs for the hatcheries in Oregon totaled $23.6 million (Chilton, 2011). ODFW has 32 hatcheries raising, employing 171 permanent employees, to raise more than 90 stocks of fish (Chilton, 2011). More than 40,000 fish were released

from hatcheries into streams in 2010. ODFW hatchery programs are guided by the Fish Hatchery Management Policy, which outlines requirements for hatchery management by requiring each hatchery to be run by facility-specific operation plans.

**Fish Management Plans & Regulations**

Fisheries are managed by fish management plans developed by the Oregon Department of Fish and Wildlife (ODFW). ODFW requires each operating district to create basin plans for management of river basins in Oregon. The most current version of the McKenzie Fish Management Plan was adopted in 1997, and provides revisions to the 1988 version of the McKenzie Subbasin Fish Management Plan. The 1997 version of the Fish Management Plan focuses more on native fish conservation than the 1988 version had.

In the 1997 version of the McKenzie Fish Management Plan, introgression with stocked non-native rainbow trout and non-native summer steelhead is identified as the number one threat to wild rainbow trout populations in the McKenzie (Oregon Department of Fish and Wildlife, 1997). Introgression is the introduction of genes from one species into the gene pool of another species, and can lead to hybridization of two unique genetic populations. Even though the ODFW acknowledges the threat from introgression in the Management Plan, stocking of rainbow trout continues to take place in many Oregon streams, including the McKenzie River. The 1997 plan supports that there are enough spawners to sustain a viable population of native rainbow trout.

The fish management goals for each basin are codified into specific enforceable regulations through the Oregon Administrative Rules (OARs). The OARs relative to fish management provide the "legally enforceable elements of fish management plans" ("Oregon Administrative Rules," 2010). The rules outline the implementation strategies to reach the goals outlined in fish management plans. The OAR guiding the 1997 Fish Management Plan supports native fish conservation by stating "The overriding goal of fish management is to prevent the serious depletion of any indigenous fish species through the protection of native ecological communities, the conservation of genetic

resources, and control of consumptive uses such that fish production is sustainable over the long term." (Runyon, 2000). The 1997 Fish Management Plan that aims to enhance native trout populations is also supported by the state enforced fisheries management goals of the Native Fish Policy.

**Angling Regulations**

Additional conservation methods include implementing angling regulations on rivers where fish conservation is needed. Angling pressure can deter from the efforts of habitat or genetic conservation, making regulation of the sport critical to the success of these programs. Fishing regulations for sport fishes are also issued by the ODFW each year. Seasonal regulations are listed for each section of the McKenzie for trout angling. These regulations indicate when angling for trout is permitted and which type of bait is allowed. Regulations are listed for each species, related to catch limits, length limits, season and bait type (Oregon Department of Fish and Wildlife, 2011).

The type of bait used can be related to the survival rate of fish that have been caught and released by anglers. According to Schisler and Bergersen (as cited in Bartholomew & Bohnsack, 2005), the mortality rate of fish released after being caught on bait is higher than fish caught with artificial flies or lures. Currently sections of the McKenzie are designated as artificial flies and lures only and others allow use of bait. Definitions of these angling methods are published in the Oregon Sport Fishing Regulations (Oregon Department of Fish and Wildlife, 2011). Artificial flies are defined as "a hook, dressed with conventional fly tying materials" (Oregon Department of Fish and Wildlife, 2011). Lures are defined as "An artificial device, complete with hooks…excluding artificial flies" (Oregon Department of Fish and Wildlife, 2011). Bait is defined as "Any item used to attract fish which is not an artificial fly or a lure." (Oregon Department of Fish and Wildlife, 2011).

**Angler Preference Surveys**

Because angling plays such an important role in how fish are managed, ODFW periodically surveys anglers to determine expectations for fishing. The Angler Preference Survey of 2006 was conducted by the ODFW to determine public views on

recreational angling. The 2006 survey followed a similar survey from 1986 to determine if there had been a change in attitudes toward angling in Oregon (Jeff Ziller, personal communication, November 19, 2010). Production of the 2006 survey was prompted by recent public interest in wild trout populations (Jeff Ziller, personal communication, November 19, 2010). However, results of the 2006 survey mirrored the 1986 results, which showed that there was no significant desire by the anglers for wild trout populations.

The 1997 Fish Management Plan was driven by public expectations for catchable sized fish, which supports the need for stocking. The plan calls for supplementary stocking of hatchery rainbow trout to meet the demands of the public. The plan states "the public is accustomed to fishing for hatchery trout in this section [mainstem McKenzie River, from Hayden Bridge up to Forest Glen boat ramp] of the McKenzie River and there is considerable angling pressure, especially early in the season." (Oregon Department of Fish and Wildlife, 1997).

In 2010 the ODFW began conducting another angler preference survey, targeting a more specific survey sample. The prior surveys in 1986 and 2006 were conducted statewide. To better understand that preferences of the population that most utilizes the McKenzie River subbasin, only licensed anglers in the geographic area including the McKenzie River valley and the metro area of Eugene are being contacted via phone (Jeff Ziller, personal communication, November 19, 2010). The hope is that this survey will garner more relevant results to help ODFW shape policies for the McKenzie River.

On the McKenzie, angler expectations seem to be a heavily weighted factor for determining stocking programs for the river. It is critical for fisheries managers to realize that favoring angler expectations too greatly can lead to a cycle of greater expectations. According to Wiley, Whaley, Satake, and Fowden trout stocking programs can result in unnecessary dependence on hatchery trout (Wiley, Whaley, Satake, & Fowden, 1993). Convincing anglers that wild fish conservation should take place, even if supporting evidence suggests that wild populations could be sustainable even for fishing, is difficult because of long-harbored expectations.

**Value of a Native Fishery**

Though fisheries management for the McKenzie is driven by public preference for catchable size fish, interest groups have recently spoken up with concerns about this type of management. The timeline for supporters of stocking cessation on the lower McKenzie is that stocking would be completely stopped in 2015. A gradual reduction in stocking is the preferred method for reaching this goal.

In addition to concerns about stocking practices, fishing regulations have become a topic of interest in recent years. Specifically, bait regulations on the McKenzie have gained interest. Interest groups are concerned about the connection between bait type and mortality of wild fish. In 2009 bait bans were proposed for the McKenzie River, or rule changes to angling bait methods were made, and were not changes accepted by ODFW. The ban would be on live bait

Several studies have recently been conducted to obtain fish population data specific to the McKenzie River. In response to concerns about stocking hatchery fish in the McKenzie, ODFW allocated a five-mile section of the mainstem McKenzie as a non-stocking zone beginning in 2009. This reach, between Hendricks bridge and Bellinger boat landing was identified as a section of the river suitable for growth of the wild trout population. Therefore, the section is being used as an experimental section where hatchery rainbow trout are not being stocked. This study section was maintained in this way to gather population data on the native rainbow trout. During the months of February to June in 2010, ODFW performed electrofishing and volunteers used creel survey methods, meaning they angle for fish in this section and keep a count of native rainbow trout, to track population numbers (Jeff Ziller, personal communication, November 19, 2010). Though little data exists on how native and hatchery fish migrate creel survey results are considered a good estimate of the wild population in the reach. The creel survey data have been extrapolated to show approximately 686 rainbow trout per mile in the test section in 2010. This results in a Chapman Modification estimate of 3,432 native rainbow trout in the length of the 5 mile test section. This is a significant increase from the approximate 94 trout per mile in that area for surveys in 1989 (Thomas, 2010). The study section was chosen for this survey because it was believed that a viable wild population was already residing in these waters. The type of habitat in this river

section included those elements conducive to trout raising, and included channel braiding, wild fish diversity, and habitat variability (Jeff Ziller, personal communication, November 19, 2010). Population monitoring in this section is planned to continue for the next five years in the absence of stocked rainbow trout (Thomas, 2010). Continuation of the survey should provide estimated population data that can assist ODFW in managing for wild rainbow trout in the McKenzie.

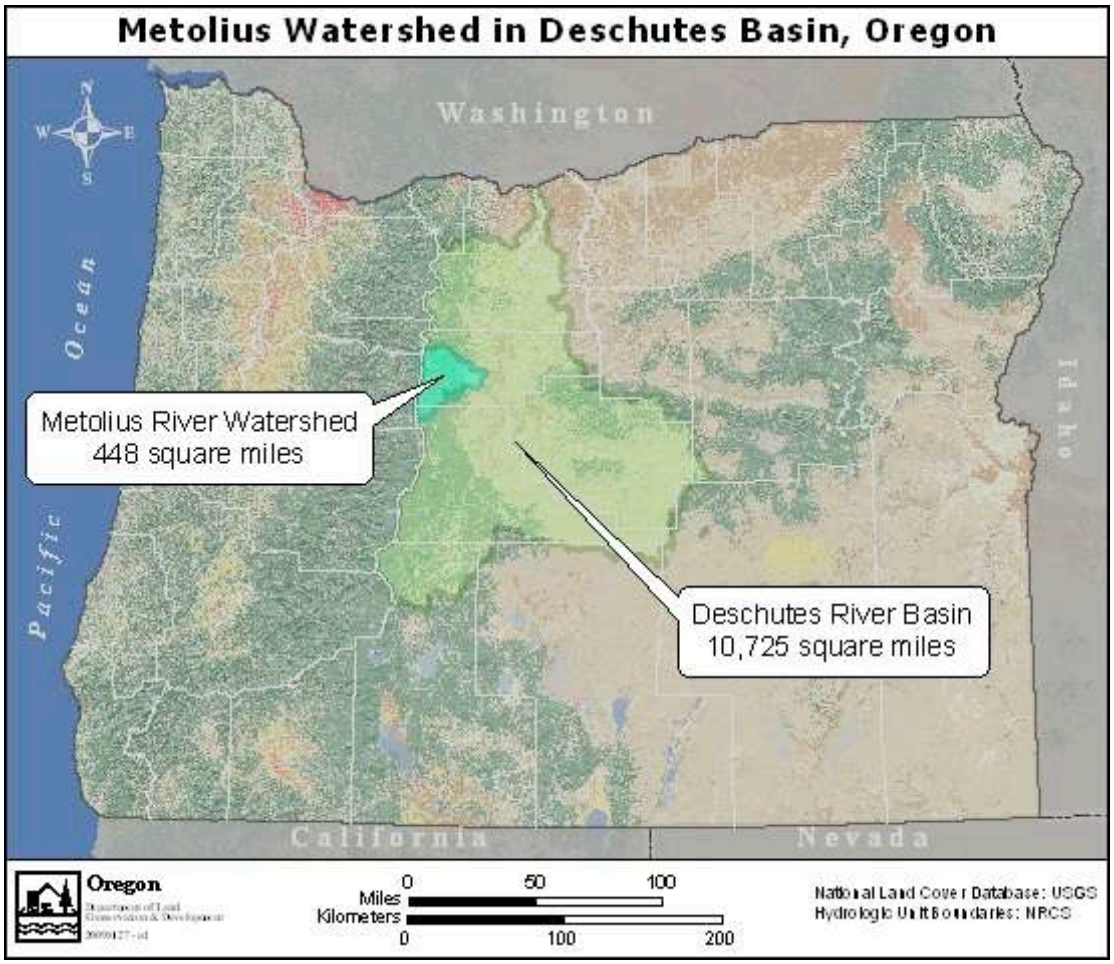
Valuing native fisheries is difficult and must consider more than economic values associated with fisheries. Consideration of the intrinsic value of the presence of native fish in a system along with the value of a natural trophic system can contribute to the valuation of a fishery. Without the native rainbow trout in the McKenzie, the trophic system would be incomplete. Native rainbow trout have adapted over a long period of time to survive at this trophic level in this particular ecosystem. Hatchery fish often come from broodstock which is not adapted to this ecosystem and may not be as resilient under environmental stress. Thereby if a stressor eliminated native rainbows hatchery fish may not fully fill the necessary void in the foodweb.

Economic valuation of a fishery could also be challenging. Presence of the fish contribute to local economies through tourism. This tourism surrounding the McKenzie is linked to angling on the river. South Willamette District Fish Biologist, Jeff Ziller, reinforced that angler expectations play a large role in decisions made by ODFW for fisheries management. Ziller says that stocking continues because the public expects to catch fish when angling for recreation, and that there would be a big impact if hatchery fish were removed from rivers by stocking cessation. Angling pressure is light on non-stocked sections, supporting ODFW's view that anglers want to catch hatchery fish. Ziller also says that ODFW understands stocking implications, but must answer to the public desires as a public agency. Ziller acknowledges that specific reaches of the McKenzie would be at carrying capacity for native populations if stocking were ceased. However, no study has been completed to examine how current economies are impacted by McKenzie River angling or to determine how cessation would impact the economies. Presently, the economic effects of ceasing stocking are mostly assumption.

## II. Case Study

### Metolius River

The Metolius River is located in Central Oregon, on the east side of the Cascade Range (see Map 3). The 41.2 mile spring-fed river is a tributary of the Deschutes River (United States Forest Service, 2004). Portions of the river, 28.6 miles total, have been designated as Wild and Scenic under the Omnibus Wild and Scenic Rivers Act in 1988 (Fies, Lewis, Manion, & Marx, 1996). The Wild and Scenic designation provides enhanced protection for river resources, including specifying protection of wild fish populations.

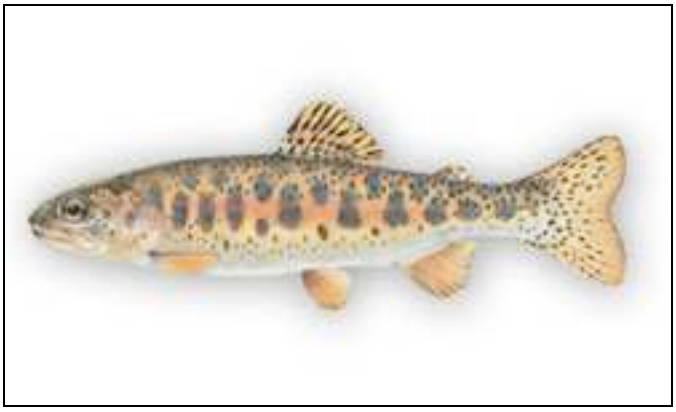



**Map 3.** Map of the Metolius River watershed and Deschutes River Basin. (Department of Land Conservation and Development, 2009)

Physical characteristics of the Metolius contribute to high quality trout habitat. Stable flows and good water quality is maintained throughout the river because the river is spring-fed. ODFW sampling shows that benthic invertebrate populations in the Metolius indicate high water quality (Fies, Lewis, Manion, & Marx, 1996). Historical removal of large woody debris reduced fish habitat, but restoration projects have taken place in the Metolius since 1983 (Fies, Lewis, Manion, & Marx, 1996).

The Metolius was chosen as a case study because the cessation of stocking of rainbow trout in the river has resulted in the growth of a viable redband trout population. The Metolius case provides a good example of success for native trout populations in a previously-stocked river system.

The rainbow trout population of the Metolius River is unique (see Picture 2). The population is considered redband trout, a subspecies of *Oncorhynchus mykiss*, because they are locked inland. Metolius River redband trout are part of the population of redband in the Columbia River basin, and are *Oncorhynchus mykiss gairdneri* (Behnke, 2002). Because of heavy stocking in regions where redband live, populations of pure *Oncorhynchus mykiss gairdneri* are rare, due to hybridization with hatchery fish (Behnke, 2002). The redband trout are indigenous to the Metolius (Fies, Lewis, Manion, & Marx, 1996).



**Picture 2.** Juvenile Columbia River Basin redband trout, *Oncorhynchus mykiss gairdneri*. (Tomelleri, 2009)

The Metolius River is a very popular spot for recreational angling. To manage the fisheries of the Metolius, ODFW has to balance the needs for conservation of redband and angling pressure, much like the agency must do in the McKenzie River.

Stocking of hatchery-reared rainbow trout on the Metolius was historically heavy. Stocking began in 1925, in response to angling pressures on the river (Fies, Lewis, Manion, & Marx, 1996). Other fishes have been stocked in the Metolius in addition to the rainbow trout.

The rainbow trout stocked in the Metolius were raised from Cape Cod and Oak Springs strains of stock, with few stocked from a Deschutes strain (Fies, Lewis, Manion, & Marx, 1996), meaning that few stocked fish were from a strain adapted for the environment. The hatchery rearing these fish was the Wizard Falls Hatchery, which began operation in 1947. Creation of the hatchery was a direct result of public desire for better angling opportunity on the Metolius (Fies, Lewis, Manion, & Marx, 1996).

Stocking of rainbow trout steadily increased from the beginning of the program until 1959, when more than 40,000 legal-size rainbow trout were stocked annually through the late 1980's (Fies, Lewis, Manion, & Marx, 1996). Numbers of stocked fish was reduced between 1988 and 1996, when the decision was made to cease stocking rainbow trout in the Metolius.

Fish Management Plans guide the management programs for the Metolius. The current management plan was developed in 1996 and the prior plan was effective beginning in 1981. The 1996 Plan includes significant changes to the management of wild fish in the Metolius. Most significant is the policy issued in the 1996 Plan that "No hatchery fish shall be stocked in the Metolius River and tributaries." (Fies, Lewis, Manion, & Marx, 1996).

The 1996 Plan states that at the time of the report, the redband trout population was not healthy. The Plan set forth policies, with outlined objectives, for addressing management issues. The rationale behind the objective to maximize abundance of redband trout (and other species) includes that the redband trout is classified as a sensitive species on the Oregon Sensitive Species List, and as a Category 2 candidate species under the Endangered Species Act (Fies, Lewis, Manion, & Marx, 1996). The term Category 2 candidate species is no longer used by the US Fish & Wildlife Service,

but was meant to identify a species for which there was not enough data to support a proposal for listing as endangered or threatened (United States Fish & Wildlife Service, 2010). The redband trout is still, at present, considered to be a sensitive species. Other issues that provide rationale relate to the genetic introgression between wild and hatchery fish, as well as pressures from competition by stocked fish. The driving assumption behind meeting this objective is that the redband trout population may increase with the cessation of stocking (Fies, Lewis, Manion, & Marx, 1996).

The 1981 Metolius River Fish Management Plan directs management of the fisheries to both wild and hatchery fish (Fies, 1988). ODFW began a study in 1981 to gather data about trout populations and habitat quality in the Metolius River (Fies, 1988). A second study that began in 1991 gathered data about the impacts of hatchery supplementation on native trout in the Metolius (Buchanan, Hemmingsen, & Currens, 1994). Both the 1981 and 1991 studies showed results indicating that on the Metolius there was introgression occurring between wild and hatchery fish. The studies also show evidence for negative spatial interactions, where hatchery fish have pushed natives out of certain river reaches. Combined, the results of the 1981 study and a 1991 study provided evidence to result in the decision to stop stocking.

A study completed by Williams et al. in 1997 explored the possibility and severity of genetic introgression between hatchery rainbow and native redband trout in the Metolius River system. The results of the study indicated that there are significant differences in the genetic makeup of the trout in the river (Williams, Leary, & Currents, 1997). Three reaches of the Metolius were sampled, and both allozyme analysis and mitochondrial DNA analysis were performed on trout from each site. These genetic analyses were performed to determine if genetic introgression, shown through mixing of genetics from interior and coastal rainbow trout, occurs between the hatchery and native trout of the Metolius. Two of the three sites resulted in fish that had genetic introgression, and the third was genetically pure, meaning there was no genetic introgression (Williams et al., 1997). Researchers concluded that the third site which hosts genetically pure trout has ecological factors that result in separation from the upstream hybridized fish found in the two other sites (Williams et al., 1997). The significance of this study to this case study is that with the cessation of stocking in 1996, just one year before this research was

concluded, there was the possibility that native redband trout could still persist to carry on unique characteristics on genetically pure individuals.

According to Brett Hodgson, Deschutes District Fish Biologist, ODFW biologists did not specifically follow other cases as examples on which the decision could be based for the Metolius. Instead, the decision to begin data collection studies that supported cessation of stocking came from the general focus on conservation in Oregon during the mid-1990s (Brett Hodgson, personal communication, April 5, 2011). Prior to this era when the first wild fish management policy and trout plans were developed the ODFW liberally stocked across the state for recreational angling purposes (Brett Hodgson, personal communication, April 5, 2011). Concerns about competition and wild fish spawning interference were the driving factors of completing the studies on the Metolius that led to the stocking decision in 1996.

Monitoring of the Metolius redband trout population has been continuous since stocking was ceased in 1996. The general trend in the redd surveys shows a steady increase in redd counts since stocking was ceased. The population increase may be attributed to decreased interference by hatchery fish, angling regulations, and habitat restoration projects.

Redband trout redds have been surveyed since 1995, and show a pattern of success for rebuilding the population since stocking of rainbows ceased in 1996 (see Graph 1 in Appendix). In the year prior to stocking cessation, there were 141 observed reband redds. In the three most recent reporting years, 2007-2009, the redband redd counts have been consistent at 923, 922, and 958 respectively. The monitoring has continued regularly into 2011, but counts have not yet been reported since 2009. The recent consistency suggests that the redband trout population has reached a sustainable population level, near or at carrying capacity for the Metolius River. ODFW suggests that the dips in redd counts seen in the data reported could be related to low water years in the Metolius (Brett Hodgson, personal communication, April 5, 2011), and that future cycles of redd counts may occur based on fluctuations of water level or other habitat changes.

Redband trout redd counts have been used as the monitoring method for the Metolius River for several reasons. Originally snorkeling was used as a method for

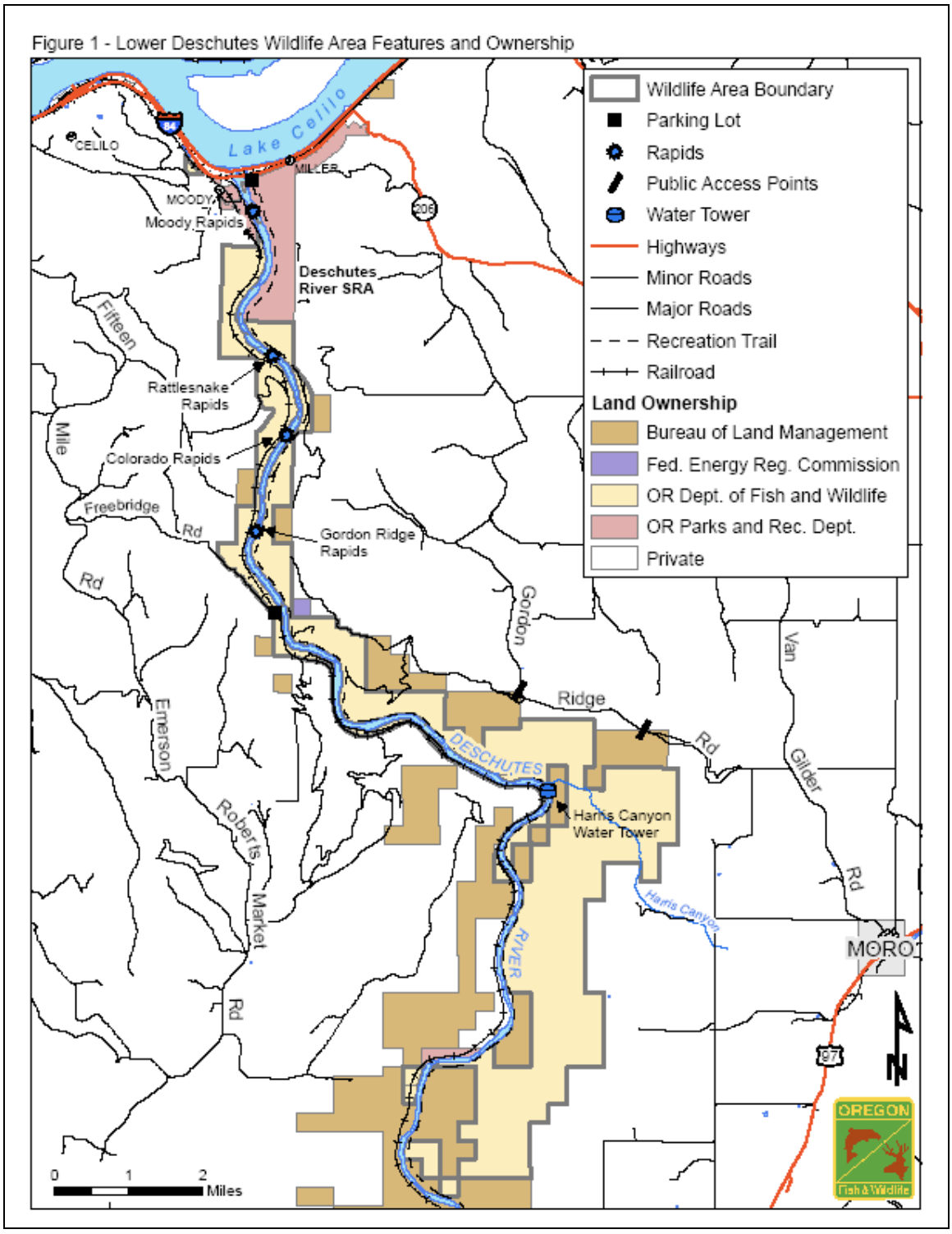
collecting data on redband trout and other fishes in the McKenzie. This method allowed for observation of size class and species of adult fish. The intensity of labor and logistics required for this method, paired with the variable nature of the observations reported, led to the discontinuation of this methodology (Brett Hodgson, personal communication, April 5, 2011). Instead, ODFW turned to redd counts, which provide an indication of the adult population by associating the redds with the number of spawning adults in the population. The reasons for relying on observational methods for redd counts include that it is the least intrusive method for fish monitoring, because there is no handling of fish, surveying requires relatively little labor, and the counts are considered a reliable index of annual trout spawning in the river. Validity of observational studies is always a concern, but ODFW uses methods that reduce the possibility of double reporting. The use of this method in this particular river is feasible because the high-flow events are rare since the Metolius is a spring-fed river. Therefore, redd counts are the best method for tracking redband trout poulations in the Metolius River, and monitoring is continuous for the sensitive species.

Management of the native redband trout fishery in the Metolius includes regulating angling to fly-fishing with artificial flies and catch-and-release practices. These angling regulations on the Metolius have been enforced since the cessation of stocking went into effect as a method to reduce taking and decrease mortality from angling. Angling opportunities have increased since initial cease stocking regulations were implemented, but redd counts indicate that the population is sustainable enough to handle angling pressure (Cotter, Riehle, & Wise, 2003). Had taking of the redband trout been allowed on this popular recreational angling river, the population may not have been able to sustain with the loss of stocked individuals.

**Lower Deschutes River**

The Lower Deschutes River is a second example of a river where stocking was prevalent until research was completed and a policy decision was made to cease stocking. The ODFW conducted research studies in the 1980s and determined that hatchery fish were not fulfilling the angling needs for which stocking was intended to meet.

The Deschutes River is lake-fed (see Map 4) and covers a 10,500 square mile basin of Central Oregon (Schroeder & Smith, 1989). The Lower Deschutes River is identified as the portion of the Deschutes below the Pelton Dam at river mile 100 and Pelton Reregulating Dam. These dams were completed in 1964 by Portland General Electric Company in 1964 (Schroeder & Smith, 1989). Because the Lower Deschutes is regulated by a dam the river has uniform flow and temperature manipulated by reservoir releases (Schroeder & Smith, 1989). Other river conditions are influenced by the semiarid Central Oregon climate, variable geology and elevation, and public and private land management (Schroeder & Smith, 1989). Valued for its recreational opportunities and abundant fisheries, most of the Lower Deschutes was designated a scenic waterway under the Oregon Scenic Waterways Program in 1970 (Schroeder & Smith, 1989). Many salmonids and other native fishes occupy the Lower Deschutes, but the fisheries most valued for recreational angling are the rainbow trout and steelhead.




**Map 4.** The Lower Deschutes River, shown with land ownership details.

(Department of Fish and Wildlife, 2009)

To better understand the fish population in the Lower Deschutes the ODFW studied rainbows from 1971 through 1988 with focuses on fisheries interactions, life histories, and angling regulations. The 1989 Information Report Number 89-6 by the Fish Division of the ODFW contains the majority of information published about the Lower Deschutes rainbow trout fishery.

Wild trout of the Deschutes are an inland rainbow trout known as redband trout (Schroeder & Smith, 1989). Local populations of redband have been identified within the mainstem Deschutes and studies have shown little genetic migration between the groups. There are 46 wild populations of redband within the Lower Deschutes, making it the strongest population of resident redband anywhere in Oregon (Kostow, 1995 as cited in *Deschutes Subbasin Plan,* 2000).

Management strategies for the Lower Deschutes emphasize the need to manage all fisheries, since all populations may impact redband trout. The 1989 report suggests that management of redband trout should take into consideration the management for steelhead, since the two populations are influenced by one another and breeding between the two could have dramatic effects on the unique populations of redband trout.

Stocking of the Lower Deschutes has occurred since 1911 (*Deschutes Subbasin Plan*, 2000). Historical stocking data is limited, but what is known is that between the 1940s and 1978, 60,000 rainbow trout of Roaring River broodstock were stocked into the Lower Deschutes from Oak Springs and Wizard Falls hatcheries annually (*Deschutes Subbasin Plan*, 2000). Deschutes River redband broodstocks were started at Oak Springs Hatchery in the hope that it would be successfully stocked in the Deschutes River subbasin. Genetic studies of the Deschutes broodstock show that the original individuals were not representative of the entire redband population, and have built a stock that is genetically varied from wild redband (Schroeder & Smith, 1989). This stock is no longer raised.

Management of redband trout populations has also included angling regulations for conservation of specific groups of the population. River-wide regulations have been in place since 1971 and have included size limits, gear restrictions, and bag limits over the years (Schroeder & Smith, 1989). Current angling regulations for the Lower Deschutes prohibit boat fishing and restrict angling to the use of artificial flies and lures

(Oregon Department of Fish and Wildlife, 2011). These regulations are meant to conserve redband trout in order to increase the size of the population (*Deschutes Subbasin Plan*, 2000). The ODFW has employed these regulations for conservation, but acknowledges in the 1989 Information Report that conservation efforts should "focus more on habitat protection of the watershed than on angling regulations that minimize harvest." (Schroeder & Smith, 1989). The management goal described in this report is to "provide a harvestable surplus of wild fish into the future" (Schroeder & Smith, 1989), iterating that angling is supported on the river and that management should be for a recreational fishery of redband trout.

The 1989 report sets out recommendations for management of the redband trout fishery in the Lower Deschutes. The first recommendation is to manage for wild fish, in accordance with the Oregon Trout Plan of 1987. The date indicated in the Deschutes Subbasin Plan shows that the last year that rainbow trout were stocked in the Lower Deschutes was in 1978. The sequencing of stocking history is not clear, so it is unknown whether stocking officially ceased in 1978 as the second document supports, or ceased by recommendation in the 1989 report.

Data in the 1989 report support that there was an abundance of catchable-size redbands in the Lower Deschutes supporting recreational fishing. The 1989 report also supports the implementation of section-specific angling regulations to provide all anglers the ability to catch rainbow trout. Additional recommendations from 1989 suggest that angling regulations be more liberal since the population is productive enough to sustain higher catch and size limits. Size management and density monitoring recommendations were also made to aid in redband trout management on the Lower Deschutes. The Deschutes Subbasin Plan suggests that habitat restoration could assist in sustaining the native redband populations.

Since stocking ceased on the Lower Deschutes the redband population has been described as "robust" (*Deschutes Subbasin Plan*, 2000). Viable population numbers are attributed to cessation of stocking and angling regulations and currently support a popular redband fishery. Abundant data is not documented for the Lower Deschutes alone. One example of the success of cessation for the native population is that in one Lower Deschutes reach in 1979 there was an estimated 639 redband and in 1981, several years

after cessation this same reach held 1,845 redband (*Deschutes Subbasin Plan*, 2000). Even with limited data published on the native redband population post-cessation, the Lower Deschutes is known as an example of fishery management success.

**Comparison of the Rivers**

The case studies were chosen based on the result that cessation of stocking of trout had on the native populations in the rivers. A comparison of the McKenzie River to both the Metolius and Lower Deschutes Rivers is meant to determine how the fisheries management practices used in the case studies may be applied to the management of the McKenzie rainbow trout.

Each of the rivers is different in some regards, especially in the way that each has individual climate, geological, and ecological characteristics. Specific factors that contribute to trout health can be examine to find similarities between the rivers.

A comparison of the McKenzie River to the Metolius River indicates these similarities:

1) Both rivers have been extensively stocked for an extended period. Stocking began in each in the early 1920s.

2) High water quality contributes to great conditions for trout spawning, rearing, and maturing. The McKenzie has protections on the water quality because it is used as the source of drinking water for the City of Eugene. The Metolius has high water quality because it is spring-fed, and is in a rural area where much of the land surrounding the river is managed by state and federal government.

3) Scarcity of large woody debris on both rivers is being compensated for through restoration programs. Other habitat restoration programs focus on other aspects of trout habitat that can assist native populations in recovering.

4) Both rivers are highly valued and utilized for recreational purposes. Angling is a popular recreational pursuit at each river, and contributes to the local economies and elevates the need for fisheries management.

5) Angling regulations have been implemented as a tool for managing angling pressure on the fisheries. The Metolius has a regulation that is not currently in place for the McKenzie. On the Metolius angling is with artificial lures only, to reduce mortality from bait angling.

A comparison of the McKenzie River to the Lower Deschutes River indicates these similarities:

1) Historic stocking of rainbow trout has occurred on both rivers. Information about both rivers suggest that stocking was begun to meet angler expectations.

2) Both the McKenzie and the Lower Deschutes boast unique populations of trout. These are indicators of healthy native populations that have adapted over time to the local conditions of their home river.

3) Again, the two rivers are popular angling destinations that get heavy angling traffic. Angling regulations that should be enforced on the Lower Deschutes may be considered when management determines how best to regulate angling on the McKenzie.

4) Dams influence the habitat qualities of each of these rivers. The flow on the Lower Deschutes is known to be fairly stable, as is temperature, because these are regulated by the dam releases. The McKenzie River Subbasin Assessment suggests that changes to dam management may result in temperatures better suited for fish.

The overall similarities between the McKenzie and the two case study rivers allow application of the information gained from past fisheries management practices to the current considerations for changes in the McKenzie.

**Summary of the Science**

The McKenzie River supports a population of native rainbow trout that has historically been supplemented with hatchery rainbow trout. Research studies support that competition and genetic introgression are a concern for all systems where hatchery trout and native trout exist together. One year of creel survey data from one reach of the McKenzie River show that native rainbow trout achieve increased population viability in the absence of hatchery rainbow trout. Additional examples from the Metolius River and the Lower Deschutes support higher populations of redband trout in the absence of hatchery rainbow trout. Cessation of stocking of hatchery fish has been linked to the increase in populations in these rivers. Research also shows that reduced mortality from

angling is achieved through use of artificial flies and lures when bait angling is prohibited.

## III. Policy Recommendation

If the goal is to create viable populations of native trout in the McKenzie River to sustain ecological and angling needs, the following policy changes are recommended.

**Action 1:** A slow progression of cessation of stocking will commence for the McKenzie River. Cessation of stocking can increase native population viability, as shown by success in the Metolius River case study. A process of slowly ceasing stocking, by a sectional approach is suggested in order to provide fishing areas for the recreational anglers and guide services that depend on the trout fishery. The process will take into consideration the least and most heavily fished sections of river. Ranking of river sections by angling usage and habitat quality will occur before the process begins in order to determine the order in which to proceed with cessation. The least-pressured sections will be the first to stop stocking. Monitoring of these sections will continue, following the methods used by creel survey on the current test section. If monitoring suggests that after several years these sections have sustainable populations, which can sustain angling pressure, more heavily fished sections will be targeted for progressive cessation.

> **Rationale:** Limited creel surveys have shown that there is a significant population of rainbow trout in the section where ceased stocking was tested to sustain itself and be viable as a fishery for recreational angling and ecological needs over time.

**Action 2.** Angling regulations on the McKenzie will be changed to reflect conservation of wild rainbow trout. When progressive cessation of stocking has begun, those sections will be regulated as catch-and-release angling only to reduce mortality associated with angling. Once monitoring has indicated that the wild population is viable, certain sections will be re-opened for size-regulated taking of fish.

> **Rationale:** Because the McKenzie River is heavily relied upon by anglers and angling guides as a recreational fishing river, regulations will be built around a

compromise for protecting wild trout and allowing catchable-size trout to be taken from the river. Creating this compromise will include angling regulations which will follow the sequence of stocking cessation so that the recent un-stocked sections shall have the most strict angling restrictions. The stocked sections shall remain least regulated so that guides and anglers may continue to benefit from catchable size trout. These sections may reverse in regulatory influence if monitoring shows that after several years that non-stocked sections have built a sustainable wild population.

**Action 3.** A bait-ban will be placed on the McKenzie River. Angling on the McKenzie River will be restricted to the use of artificial flies and lures as defined in the Oregon Sport Fishing Regulations.

**Rationale:** Previously, bait bans requested by interest groups have been denied due to pressure from guide associations and other anglers. As supported by research studies, live bait angling has higher mortality rates than artificial lure angling. Regulating bait is an inexpensive way to have a large impact on fish mortality prevention in a heavily angled area.

**Action 4.** A comprehensive habitat restoration plan will be developed and implemented for the McKenzie River to support wild trout populations. Currently there is no master plan for the restoration efforts taking place on the river. A comprehensive plan can help direct restoration programs and improve communication between participating groups for the best interest of the McKenzie fisheries.

**Rationale:** Habitat restoration is a tool currently used in many rivers, including the McKenzie. As the management plan for the Lower Deschutes River supports, habitat restoration will be utilized to support the development of viable wild trout populations in the McKenzie. Additional restoration should be supported with the resources diverted from stocking programs in order to help the wild populations to rebuild in the ceased-stocking sections of the McKenzie. When possible,

restoration should precede cessation of stocking on each section, to prepare the habitat to the best conditions for supporting wild production. Desirable habitat for wild rainbow trout includes channel complexity, channel braiding, and adequate cover. As suggested in the McKenzie River Subbasin Assessment, rearing habitat is the limited factor for wild trout populations. Therefore, channel diversity is recommended as a restoration focus in the McKenzie River.

**Action 5.** A long-term plan for a phased approach for stocking cessation will be developed. As suggested in Action 1 a phased approach to stocking cessation will be used on the McKenzie. Development of a master plan for the fisheries management can help convey ODFW plans to interest groups and gain public awareness for changes to angling regulations.

**Rationale:** Environmental factors can contribute to variability in timing needed to restore a wild trout population. Therefore, overestimation for the length of time to rebuild native populations will allow for sufficient monitoring of non-stocked sections. Changes to angling regulations will occur based on monitoring results. Public expectations may be altered if a long-term plan is established and publicized, and may elicit cooperation with the angling community.

**Action 6.** An economic study is to be completed in order to assess the value of the McKenzie River fisheries resources and the value contributed from this resource to the local economy.

**Rationale:** Parties interested in stocking policies for the McKenzie often cite that economic decline will be seen with cessation of stocking of rainbow trout in the river. To date no economic study has been completed to evaluate the influence of the McKenzie fisheries on the local economy or to evaluate the monetary value of the ecological function the fisheries contribute to the river. The economic study will supply supporting evidence to make management changes that include considerations for the economic valuation of the rainbow trout fishery.

**Summary of Results**

Science supports that hatchery fish are not necessary in the McKenzie, but public desires drive the management decision to continue stocking. Discussions with ODFW biologists suggest that ODFW implement stocking programs to meet the expectations of the public. The indicator population of native fish surveyed in the test-section where stocking was ceased for the prior year shows that native rainbows can build viable populations in the McKenzie with the absence of hatchery rainbows. The two case studies completed were examined to determine if cessation of stocking might be successful on the McKenzie. Comparing the two case study rivers to the McKenzie is important, because all river systems have ecological nuances that may impact the viability of native populations.

The Fish Management Plan for the McKenzie, in effect since 1997 states that there are five wild trout populations in the McKenzie Basin that are in good habitat and probably have enough spawners to comply with the Wild Fish Management Policy. The plan also states that the largest threat to these populations is introgression with stocked fish, yet includes stocking as a listed action to meet angler needs.

The policy recommendations were designed after completing the literature review and case studies. The case studies provided models for cessation of stocking, and input from interest groups desiring stocking cessation were considered when formulating the recommendations. These recommendations may assist the interested groups in working with ODFW to change stocking programs on the McKenzie River to meet both scientific needs and angling expectations.

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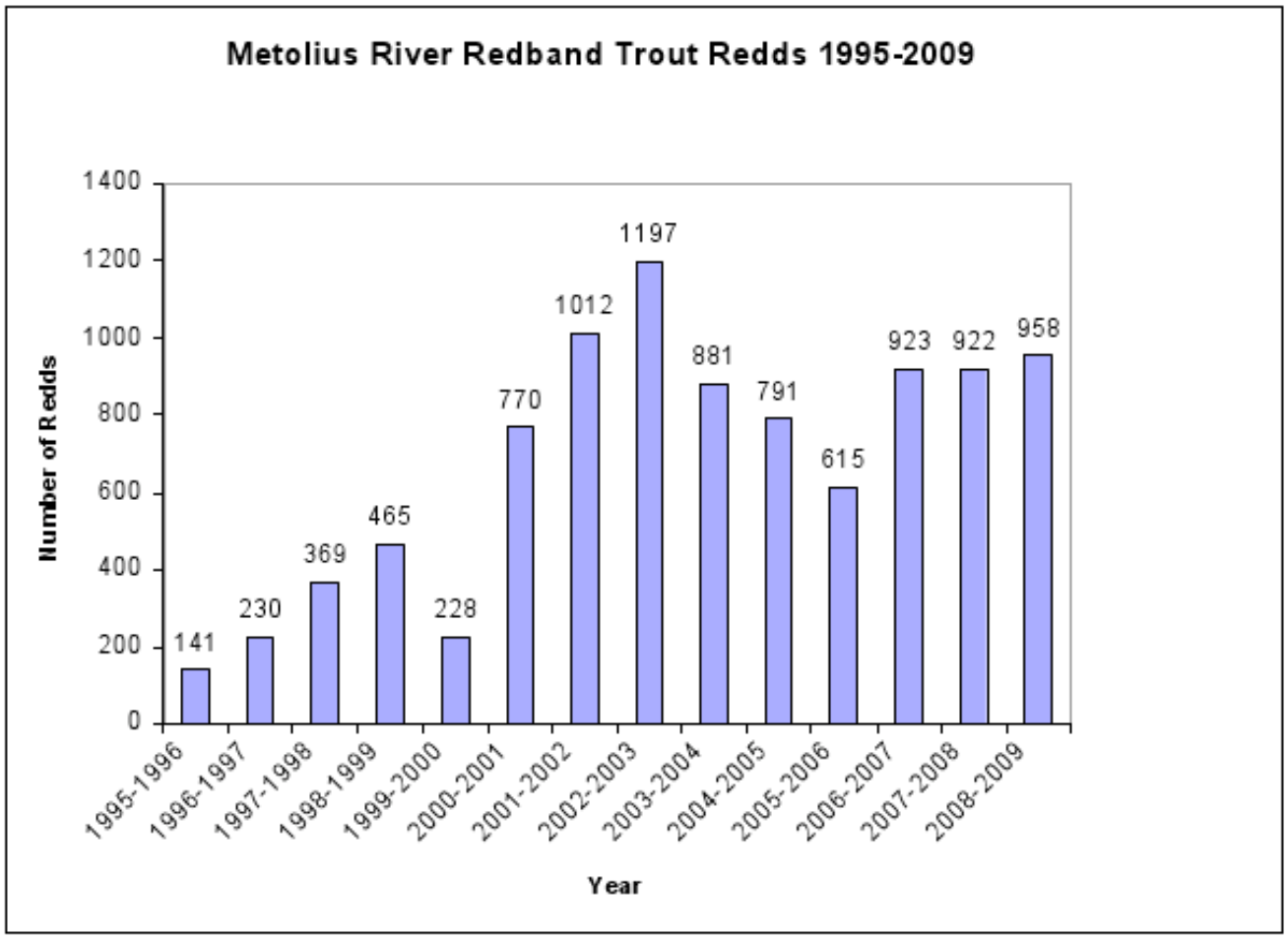
## Appendix




**Graph 1.** Graph showing redd counts for the observed reaches of the Metolius River, reported from surveys conducted by the Oregon Department of Fish and Wildlife between the years 1995-2009. Methods for survey outlined in Cotter, Richle, and Wise, 2003. Surveying has continued through 2011, but data has not yet been reported. (Graph provided by Brett Hodgson, ODFW)