



THE OSPREY

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International Federation of Fly Fishers*



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Climate Change and Ocean Ecology of Northwest Steelhead

by Kate Myers and Nate Mantua

— University of Washington, NOAA National Marine Fisheries Service —

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Climate plays a key role in steelhead habitat. This is true for steelhead in freshwater, estuaries, and even in the North Pacific Ocean. Most steelhead research has focused on freshwater ecology, for in streams and rivers steelhead are much more accessible than they are at sea. It is probably not a surprise then, that climate impacts on steelhead in their freshwater habitats have received a fair bit of attention from scientists. One of us (NM) co-authored an article in the January 2005 issue of *The Osprey* focused on global warming, steelhead freshwater ecology, and

steelhead fishing (Available at: <http://www.ospreysteelhead.org/archives/TheOspreyIssue50.pdf>). In the eight years since, we and others have focused new attention on the ocean ecology of steelhead, and how global warming might impact steelhead at sea.

*That steelhead have
been successful for 6
million years gives us
hope they will
be able to adapt.*

Knowledge of the entire life history of steelhead is fundamental to understanding the potential effects of climate change on this species. Steelhead exhibit a wide range of variation in freshwater and ocean life-history patterns. For example, degree of

anadromy (some mature in freshwater without migrating to the ocean), adfluvial (within-river) migration, freshwater residency of pre-smolts (1-7 years; smoltification is the physiological transition stage between freshwater and ocean habits, when juveniles become silvery and streamlined), ocean entry timing of smolts (early spring to mid summer), pre-spawning ocean age structure (typically, 1-3 years), maturity type (ocean-maturing or stream-maturing), seasonal races and run-timing of adults (winter, spring, summer, fall), fecundity (number of eggs, 2,500-10,000), and iteroparity (repeat spawning, 0-6 times, sometimes skipping a year between spawning events). This tremendous variation reflects the wide range of genetic adaptation and plastic response (ability of an individual fish to modify its physical characteristics) to environmental conditions.

These multiple life-history strategies enable steelhead to adjust rapidly to new environmental conditions, provid-

Continued on Page 4

IN THIS ISSUE:

**CLIMATE
CHANGE &
STEELHEAD**
— PAGE 1 —

**STEELHEAD
COUNTRY IS
FINITE**
— PAGE 3 —

**WILL STEELHEAD
SURVIVE CLIMATE
CHANGE**
— PAGE 8

**DESCHUTES
SALMON &
STEELHEAD**
— PAGE 9 —

**MT ST HELENS
GOLD MINE
THREAT**
— PAGE 13 —

**SOUTHERN
CALIFORNIA
STEELHEAD**
— PAGE 15 —



FROM THE PERCH — EDITOR'S MESSAGE

Surviving Climate Change

by Jim Yuskavitch

I like to think of this issue of *The Osprey* as one that offers reason for hope amidst the usual relentless flow of bad news when it comes to the state of the environment, and for wild salmon and steelhead in particular.

With recent news reports showing that 97 percent of climate scientists not only believe that climate change is real and that it is largely fueled by human activity, its long-term impacts on coldwater fish has kept many a wild salmon and steelhead advocate up at night.

But consider Kate Myers and Nate Mantua's cover story on climate change and steelhead, and how the fish could respond to changing climatic conditions. Their intriguing hypothesis suggests that steelhead range might ultimately expand into far northern and Arctic rivers that are now too cold and unproductive to support them as a warming climate makes their waters more hospitable. If that is the case, then it is feasible that as steelhead range shifts north, they may well find enough new habitat to colonize to make up for habitat lost to the south. In

his supporting article, Steelhead Committee member Pete Soverel gives additional insight, based on his extensive personal experience on Russia's Kamchatka Peninsula, into the possibility of steelhead colonization of far northern rivers.

On the other end of the spectrum is the story on efforts to restore southern California steelhead by Kurt Zimmerman, Tim Frahm and Sam Davidson — populations, though battered, are still hanging on. Already hard-pressed, these will be the steelhead populations that take the brunt of the effects of climate change. But the authors of this piece mention, as do Myers and Mantua, the steelhead's resiliency. Already adapted to the rigors of a warmer climate, perhaps with a little help from people — restoring habitat, providing coldwater refugia — there is enough adaptability left in those southern fish to survive a warmer earth.

It may all be wishful thinking on my part or, just perhaps, the future of wild salmon and steelhead may be less gloomy than is often predicted.



THE OSPREY



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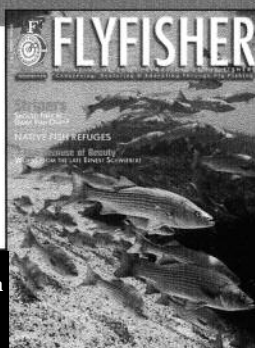


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Steelhead Country is Finite

by Will Atlas

— Chair, Steelhead Committee —

From 100,000 feet, steelhead country has always seemed so vast, an endless expanse of rivers ranging from the northern coast of California to the Aleutian Peninsula in Alaska. While we collectively mourn the rivers lost to dam building, development and the rest of the insults brought on by a century long onslaught of development and resource extraction, we always find solace in the fact that somewhere out there, there are hundreds of wild, unexplored rivers where all is right in the world. For decades, Americans and Europeans have counted on British Columbia as their reliably wild, abundant angling playground. Yes, we have all heard of the Dean, and the many legendary tributaries of the Skeena, but the assumption is always that there must be so much more. Just looking at the map, this is an understandable conclusion. British Columbia and Alaska are indeed blessed with vast, wild coastlines.

In 2009, I moved to British Columbia with all the enthusiasm one would expect from a mid-20s American steelhead bum who has suddenly been awarded the right to fish in BC as a legal resident. In my mind BC had long represented a sort of mythical Shangri-la of steelhead and salmon angling. An immensely wild country, laced with hundreds of unspoiled steelhead rivers just waiting to be explored. Flash forward four years and 100,000 kilometers on the odometer and my naively enthusiastic perspective has been changed irreparably.

In late March, I sat soaking in the glory of an early spring day angling with friends, chatting over burgers and beers at a favorite local watering hole in Squamish. Poul Bech, a retired biologist and master steelhead angler, joined us, and in the midst of a reflection of the days gone by when the Squamish produced world class fishing less than an hour away from

Vancouver, he put words to the feeling that had been growing in my gut, "I used to assume there were dozens more Squamish Rivers on up the coast, but over the years I've discovered there really is only one. And once you lose it, there's no going back." Poul's words perfectly captured a realization that had, in the past years of discovery and disappointment, been growing in my mind as well. That realization reflects the reality that the world's great steelhead and salmon rivers are precious and irreplaceable, and when we have destroyed what is before us, we truly have nowhere left to go.

*The world's great
steelhead and salmon
rivers are precious
and irreplaceable.*

Today, the perils of our cultural short sightedness are increasingly unavoidable and well understood. One need only witness the clearcut wastelands of Vancouver Island or the Oregon Coast, visit a now fishless river murdered by toxic mining waste, or consider for a moment the utterly insane proposal to pipe Alberta's toxic heavy crude through the heart of the Skeena — our planet's greatest remaining salmon sanctuary — to understand that rivers lost cannot simply be replaced. We live in a time when we must increasingly grapple with the reality, that resources once taken for granted,

once viewed as inexhaustible, are in fact finite. In this rude recognition we can also draw hope, from the growing and diverse chorus of citizens who have rallied around the greatest remaining salmon watersheds on earth, and from the remarkable resilience of salmon and steelhead.

Throughout their evolutionary history salmon and steelhead have recovered from catastrophic landslides, volcanic eruptions, floods and glaciations. Free from human meddling, salmon and steelhead have persisted for six million years in the most dynamic and at times inhospitable habitats imaginable. This resilience continues to buffer their populations from even the most devastating human activities, and in watersheds like the Eel, Wind, Wenatchee, Elwha, and upper Deschutes, salmon and steelhead have demonstrated their remarkable capacity for recovery, and self preservation. Despite all the destruction of the past century, the fish continue to do their part, undertaking an annual migration that remains among the most significant ecological and cultural forces in the Pacific Northwest. Now it's up to us to do our part to stop the bleeding and do everything we can to ensure not another watershed is sacrificed at the altar of greed and shortsightedness.



Climate Change and Steelhead

Continued from page 1

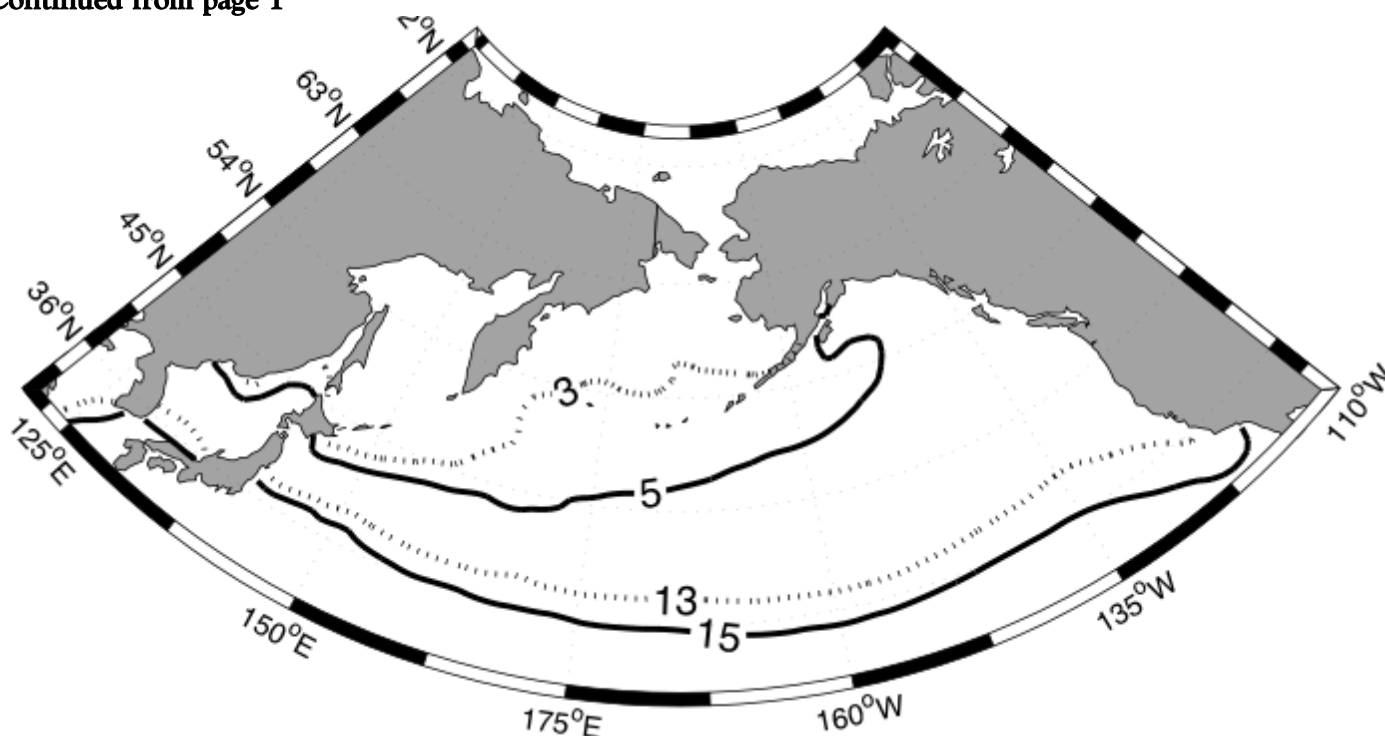


Figure 1. Average sea surface temperature in April-May-June for 1971-2000, with solid contours indicating steelhead high seas habitat between the 5 and 15°C isotherms. Actual temperatures vary between months, seasons, years and decades. Dashed contours for the 3 and 13°C isotherms indicate one scenario for steelhead high seas habitat in spring after a 2°C warming of the North Pacific Ocean, which is expected to happen sometime in the 2nd half of this century.

ing a survival advantage over other less adaptable species. The successful adaptation to artificial habitats (hatcheries, rearing pens, holding ponds, reservoirs), as well as its ability to establish anadromous runs in non-native oceans (southwestern Atlantic ocean off Patagonia) and in the Great Lakes, bears testimony to the ability of this ancient (~6 million years old) species to adapt to diverse and often unfavorable environmental conditions. In fact, unfavorable environmental conditions in freshwater and ocean habitats drive anadromy in this species.

While fly fishers are usually well versed in the freshwater life history of their favorite fish, the all-important ocean phase that produces the large adult fish of a steelheader's dreams is more of a mystery. There is still much to discover and learn, but nearly 60 years of marine research focused primarily on abundant species important to commercial fisheries (sockeye, pink, chum, coho, and Chinook salmon) have provided a basic scientific understand-

ing of steelhead ocean ecology, that is, the relationship between steelhead and their ocean environment.

In their natural habitat in the North Pacific Ocean, steelhead migrate and feed in the near-surface (epipelagic) and surface (neustonic) ocean layers. Limited data from electronic tags that record ambient temperature and swimming depths indicate maximum dives to depths of about 50 meters (164 ft) and most time spent in the top few meters. Upper ocean temperature is the primary physical factor influencing the distribution of steelhead in the open ocean. Thus, lines on a map connecting points with the same sea surface temperature, called isotherms, can be used to roughly approximate distribution. In general, steelhead distribution in the open ocean is located between the 15°C (59°F) isotherm (southern boundary) and 5°C (41°F) isotherm (northern boundary) (Figure 1). These boundaries shift between months, seasons, years, and decades. During all seasons, the main body of feeding-migrating steelhead is located

north of the Subarctic Ocean Boundary, defined by the vertical 34.0 (salinity) isohaline, and south of the Aleutian Island chain (Figure 2). However, steelhead do venture outside of these bounds seeking productive feeding grounds—southwards into the transition zone between subarctic and subtropical waters in spring and northwards into the Bering Sea in summer. The known northwestern extent of North American steelhead distribution, which extends into the Russian Exclusive economic (200-mile) zone in the western North Pacific, is in late summer-early fall. In winter, the distribution of both North American and Russian steelhead shifts eastward, and by the following spring the main body of feeding-migrating steelhead is at the southernmost extent of its open-ocean range in productive waters of the eastward flowing Subarctic Current and the transition domain (located just north of the Subarctic Boundary) in the central and eastern subarctic North Pacific. As first noted

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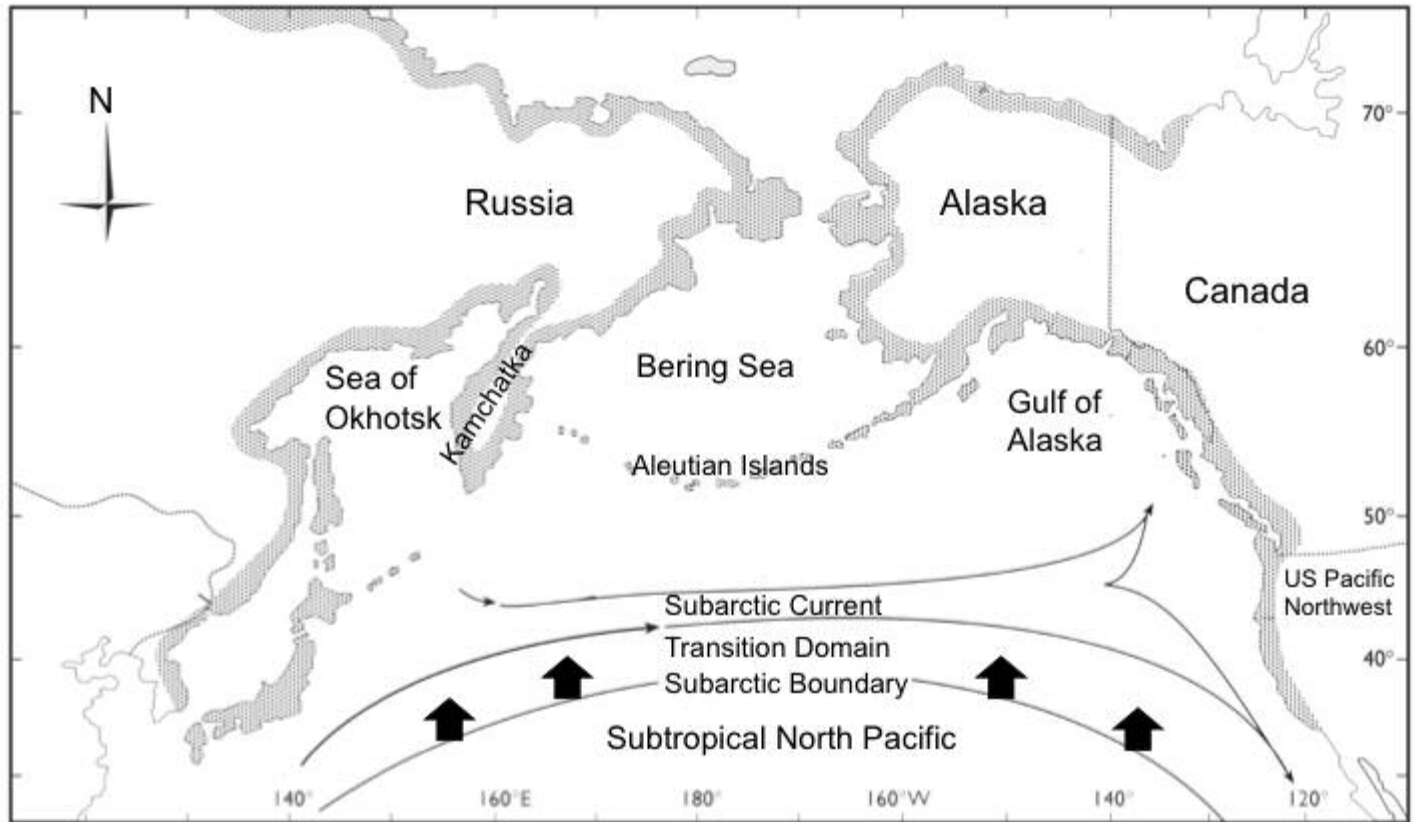


Figure 2. Map of the North Pacific Ocean showing the relative positions of oceanographic features that define steelhead habitat. The actual spatial locations of these features shift on decadal, annual, seasonal, and monthly scales. The main body of feeding-migrating steelhead is located north of the Subarctic Ocean Boundary (indicated by upward facing black arrows) and south of the Aleutian Islands chain. Source: Modified from base map in Quinn (2005); shading indicates the coastal range of all species of Pacific salmon and steelhead (*Oncorhynchus* spp.).

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by a Canadian scientist, Dr. David Welch, the open-ocean latitudinal ranges of upper and lower sea surface temperature limits in spring and freshwater spawning distribution of North American steelhead are roughly matched, suggesting that thermal requirements of steelhead at ocean entry might drive freshwater distribution.

Within the broad range of thermal habitats, currents, and oceanic domains occupied by steelhead, the most important factor regulating steelhead distribution is the location of their preferred prey. At ocean entrance, juvenile steelhead feed primarily on small fish and zooplankton in inland and coastal marine habitats. In North America, juveniles migrate rapidly to open-ocean habitats beyond the continental shelf in the Gulf of Alaska, where they feed on larval and juvenile fish and small squid. Older age

groups of steelhead are capable of consuming a large variety of prey species in marine habitats. But food habits data indicate that steelhead prefer to feed on relatively few species of highly visible and abundant fish and squid. The single most important prey of steelhead in the open ocean is the minimal armhook squid *Berryteuthis anonychus* (Figure 3). While in pelagic habitats near or over the continental shelf, steelhead diets are often dominated by fish.

Analyses of two long time series of open-ocean steelhead food habits data by our graduate student Margaret "Megan" Atcheson showed significant year-to-year variation in primary prey, as well as stomach fullness, average prey energy density, and percentage of steelhead with empty stomachs, and higher year-to-year variation in far offshore regions. Variability in steelhead diets probably reflects changes in the availability of preferred prey. As

opportunistic predators, steelhead can readily switch their prey. When prey abundance is low, steelhead may feed non-selectively on prey of various sizes and species, while at high prey densities selection of a single species of large prey and high diet overlap with other species may occur.

Research led by a Japanese scientist, Dr. Masahide Kaeriyama, and expanded by Megan Atcheson's recent work, demonstrates that climate-driven changes in ocean conditions can affect diets, growth, and ecological interactions of steelhead migrating in the North Pacific Ocean. For example, strong climate changes related to El Niño and La Niña during 1997-1999 coincided with a large decrease in squid in the summer diets of steelhead in the Gulf of Alaska. The decrease in dietary squid was even larger in the central Subarctic North Pacific, where steelhead compete for food with pink

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salmon, particularly during odd-numbered years when the abundance of Asian pink salmon is extremely high. In 1997 steelhead diets in the central Subarctic North Pacific contained the highest proportion of marine debris, including potentially toxic plastic, observed over the 19-year time series of data. Recent decades have brought record high levels of pink salmon abundance throughout most of the North Pacific region, supporting the idea that late 20th century warming of the North Pacific Ocean and salmon rivers of the Pacific Rim was good for pink salmon.

Global warming and changes in the high seas distribution of steelhead

Pioneering research by Dr. David Welch predicted a substantial reduction in open ocean thermal habitats of steelhead by middle of the 21st century under a climate change scenario with doubled atmospheric CO₂ concentrations. New analyses by our Post-Doctoral student, Dr. Omar Abdul-Aziz, modeled reductions in potential

open-ocean thermal habit of steelhead in summer under 3 different scenarios representing relatively low, medium, and higher rates of climate warming. Each warming scenario results in a northward shift and east-west contraction in the southern (warmest) thermal boundary, particularly in the Subarctic North Pacific, Okhotsk Sea, and Gulf of Alaska by the 2040s and substantial reductions in these regions by the 2080s. In the 1980s, estimated potential thermal habitat of steelhead during winter covered an east-west band, including most of the Gulf of Alaska and Subarctic North Pacific; however, the Okhotsk Sea, Bering Sea, and Arctic Ocean did not provide any potential thermal habitat suitable for steelhead during winter. Modeled changes in potential winter thermal habitat by the 2040s and 2080s showed a northward shift of the northern (coldest) boundary in most of the Bering Sea and Okhotsk Sea; however, these habitat gains were almost completely offset by almost equal losses due to the northward shift of the southern (warmest) boundary. Thus, the total area of potential winter habitat in future periods was similar to the past

or reduced only slightly (1%–2%), which was less than typical year to year variations in 1980s potential habitat caused by short term climate changes. In Figure 1 we show the 3° and 13°C isotherms to illustrate how a 2°C warming in the North Pacific, which is expected to happen in the mid to late 21st century, could shift spring-time open ocean thermal habitat for steelhead to the north. In summary, a warming climate may result in a northward shift in steelhead distribution. As temperatures warm in the Bering Sea, conditions may be more favorable for steelhead in eastern Kamchatka and western Alaska streams, regions that currently host only resident rainbow trout.

Due to bioenergetic constraints, warming ocean temperatures may have a greater impact on older groups of steelhead. For example, bioenergetic model simulations by Megan Atcheson used to estimate tradeoffs between metabolic demands and growth potential indicate that optimal temperatures for growth in the open ocean are 14°C (57.2°F) for juvenile (ocean age-0) steelhead and 12°C

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As the worldwide climate warms, so do the world's oceans. For now, we can only speculate on what the long-term impacts might be for steelhead, salmon and other ocean life. Photo by Jim Yuskavitch.

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(53.6°F) for older (ocean age-1) steelhead. However, observed distribution of juvenile steelhead in the Gulf of Alaska at less than optimal temperatures for growth suggests that when temperatures are within the range of thermal tolerance, other factors may play an important role in open-ocean distribution of steelhead.

and perhaps in freshwater.

Ocean acidification, sometimes called global warming's evil twin, is a related threat that may cause dramatic changes in steelhead habitat at sea. Ocean acidification is likely to have a large impact on open ocean food webs, particularly in regions where epipelagic squid are the preferred prey of steelhead. Squid are very sensitive to

more disturbing is the fact that the ongoing rise in atmospheric and oceanic CO₂ has been compressed into a blink of geologic time, with no signs of slowing down. The bottom line is that the North Pacific Ocean is crucial habitat for steelhead, and climate change and acidification threats to habitat in the ocean may become as great as those in our most imperiled streams.



The stomach of this high seas hatchery-origin steelheaded included a minimal armhook squid and juvenile rockfish. Photo by R.V. Walker

In the 1990s and 2000s, summer sea surface temperatures (SSTs) did not reach optimal temperatures for open-ocean steelhead growth except during the El Niño summer of 1997. Modeled growth potential of steelhead under future SST scenarios showed reduced growth as temperatures warm beyond the optimum growth temperature for a given feeding rate and body mass of steelhead. The combined reduction in physiological maximum feeding rate and increasing metabolic costs prevent any potential increases in steelhead feeding rate or energetic prey quality from sustaining historical growth rates. The resulting growth decline might become a strong selective force in shifting the geographic distribution of steelhead in the ocean

acidic (low pH) conditions, which interfere with oxygen binding at the gills, reducing oxygen consumption and scope for activity. This is an extremely important area for future open-ocean research on steelhead, squid, and ocean food webs more generally.

On one hand, the fact that steelhead have been a successful species for 6 million years should give us hope that they will be able to adapt to the many environmental changes related to global warming predicted for the near and distant future. On the other hand, recent CO₂ measurements have documented atmospheric concentrations exceeding 400 parts per million, something that is estimated to have not happened for at least 3 million years. Even

Source material and additional reading:

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Will Climate Change Adversely Impact Steelhead?

By Pete Soverel

— The Osprey Editorial Committee —

Author Pete Soverel is a member of The Osprey editorial committee, founder of The Wild Salmon Center and President of The Conservation Angler. He is a long-time steelhead angler and wild fish advocate.

Conventional wisdom says that global warming/climate change is, or will, impact adversely on creatures we care about including steelhead. Is this necessarily so? Based upon various models, as described by Kate Myers and Nate Mantua elsewhere in this issue of *The Osprey*, the total area of the oceanic range of steelhead will change little in forecasted warming climate, at least over the remainder of this century. It seems to me that *Onchorynchus mykiss* may well respond positively to the predicted conditions.

Throughout much of the present range of steelhead, their overall abundance is far below historic levels mostly. In the lower 48, steelhead are probably less than 1% of their historic abundance. Gone forever, or at least irretrievably damaged, are huge swaths of their range – San Joaquin (1,000,000); Sacramento (1,000,000); Klamath (750,000); Columbia/Snake (at least 2-3,000,000); Puget Sound (800,000) and so on. I think it is reasonable to posit that these freshwater systems are not likely to be restored to their former levels of productivity in the near or even far distant future. This means that the freshwater habitat within current range of *O. mykiss* will never again produce sufficient smolts to fully utilize the oceanic prey base.

Global warming will not only shift the oceanic habitat northward (without significantly diminishing it), it will also create freshwater habitat favorable to the species. Currently *O. mykiss* are distributed around the Pacific Rim to about 59 degrees North latitude. As the climate warms, thousands of streams

and rivers in eastern Kamchatka, Chukotka, NW Alaska, as well as US, Canadian and Russian Arctic systems will open to colonization by *O. mykiss*. These systems provide pristine and largely uninhabited habitat that, in theory, should be capable of dramatic increases in total smolt production which will be able to benefit from the under exploited marine prey base.

O. mykiss are highly plastic and extremely adaptable with existing populations from LA to Shantar Island off the mouth of the Amur. The range of environmental conditions that support *O. mykiss* populations across their distribution is unmatched by other salmonids. We know that this ancient species has lived through and thrived in spite of numerous ice ages and thaws, Lake Missoula floods, volcanic eruptions and so on. In each instance, the species quickly reclaimed favorable habitat. Even in alien locations such as the southeast coast of Argentina, Sweden's Baltic coast, even the north coast of Kola, *O. mykiss* have or are colonizing their new environments. All of this suggests that southern populations will adjust their life histories to their new circumstances while in northern areas *O. mykiss* will do what they have done repeated over the last 5,000 millennia – colonize habitat that suits any of the life histories inherent within the species. In northern Pacific and Arctic, pink and chum salmon and Dolly Varden trout are rapidly colonizing the Asian and American Arctic, followed by Chinook and coho. It seems to me that steelhead are likely to be close behind.

Currently, *O. mykiss* are abundant in eastern Kamchatkan streams from the southern tip of the Peninsula up to the Ozernaya River (just north of the Kamchatka River). Based upon my personal experience and discussions with local commercial fishermen, these rivers currently produce small numbers of steelhead – i.e. individual

fish rather than “runs” which, nevertheless imply that anadromy is inherent in the species. With favorable oceanic conditions, it is reasonable to suppose that *O. mykiss* will respond with increased levels of anadromy. Simultaneously, it seems that colonization of more northern rivers is highly likely, especially since most of those rivers, especially those in eastern Kamchatka, Chukotka and the eastern Arctic are uninhabited and their upland resources, at least presently, unexploited.

In other words, steelhead are very likely to be moving to more friendly environs – ones much more able to produce many more smolts than the degraded systems in the current range. I see steelhead trading up:

- the Ventura River (population perhaps 50-100) for say Kamchatka's Snotalvayam (population 7,000-9,000);
- Carmel River (population perhaps a few hundred) for the Utkholok River (population 15,000-18,000)
- The hundreds of rivers and streams in North America where steelhead are permanently extinct for the thousands of Western Pacific, Bering Sea and Arctic systems with their cold water, pristine habitat and abundant ocean forage.

This doesn't sound too bad to me. So what can we do to help this process? I suggest we stay out of the way and let steelhead do what they have been doing for the past 5-7 million years – that is respond rapidly to climate change, taking advantage of their inherent life history diversity expand their fresh and marine range to encompass all habitat suitable to one or more of the many life histories. In short, don't try to help things along with hatcheries, which suppress the very characteristics necessary for the species' success.





Restoring Salmon and Steelhead to Oregon's Upper Deschutes Basin

By Megan Hill

— Portland General Electric —

Author Megan Hill is Native Fish Studies Team Leader for Portland General Electric. Her team conducts research to evaluate the reintroduction and fish passage program in the upper Deschutes basin, which is a requirement of the FERC license to operate the dams. The studies aim to provide PGE and the fish managers with useful information to improve the fish reintroduction and passage programs.

For more information about the project visit www.deschutespassage.com.

On September 14, 2012 the first adult steelhead was passed above Round Butte Dam on the Deschutes River in over 40 years.

The steelhead was one of the thousands of hatchery fry that were outplanted into the Deschutes and Crooked rivers and tributaries since 2007. The story of this steelhead began in 2005 when Portland General Electric (PGE) and the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWS) received a new FERC operating license for their three-dam project on the Deschutes. Among many other requirements, the new license required PGE and CTWS to build fish passage facilities and begin reintroducing Chinook, steelhead and sockeye upstream of the Project. Ultimately, the project seeks to restore self-sustaining and harvestable populations of native summer steelhead, spring Chinook salmon and sockeye salmon in the Deschutes River and its tributaries upstream from the Pelton Round Butte Project, and to reconnect native resident fish populations including bull trout that are currently fragmented by the Pelton Round Butte Project.

Project Overview

The Deschutes River is the lifeblood



Lake Billy Chinook is formed by Round Butte Dam constructed at the confluence of the Deschutes, Crooked and Metolius rivers. The Selective Water Withdrawal facility is visible on the left. Photo by Jim Yuskavitch

of Central Oregon. Originating in Lava Lake in the Cascade Mountains and joined by the Metolius and Crooked Rivers, it drops 4,589 feet on its 252-

Ultimately, the project seeks to restore self-sustaining populations of summer steelhead, spring Chinook and sockeye salmon.

mile journey to the Columbia River. The Deschutes is important habitat for Chinook salmon, steelhead, redband trout (rainbow trout), Pacific lamprey, and bull trout, providing a fish harvest for CTWS and a significant resource for recreation and tourism.

A three-dam project, The Pelton Round Butte project is located six miles west of Madras, Oregon. Built between 1957 and 1964, Pelton Round Butte is the largest hydroelectric project located entirely in Oregon. It generates 1.5 billion kWh per year, enough to power a city the size of Salem.

The lowermost dam is the re-regulating dam. It is used to steady downstream river flows even when the upstream dams discharge variable flows to meet peak power demands. Pelton, the middle dam, forms Lake Simtustus, a popular recreation location. The uppermost dam in the system is Round Butte, which forms Lake Billy Chinook, a 4,000-acre reservoir. Lake Billy Chinook is unique because it is created by the confluence of three rivers. As a consequence it has three arms: the Deschutes (9 miles long), the Crooked (7 miles long) and the Metolius (13 miles long).

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The three rivers upstream of Round Butte dam provide diverse habitat for reintroduced steelhead, Chinook and sockeye. Big Falls, on the Deschutes at river mile 132 near Redmond, is the upstream barrier to anadromous fish. Historically, the Deschutes was home to steelhead and Chinook. Whychus Creek, a tributary to the Deschutes just upstream from the reservoir, contains an additional 39 miles of historic steelhead habitat. The lower stream reaches may also support Chinook. The Crooked River, downstream of Bowman dam, offers 43 stream miles to anadromous fish. In addition, McKay and Ochoco creeks provide 35 miles of habitat for steelhead and Chinook. The Metolius River originates from a spring at the base of Black Butte, flowing north 27 miles to Lake Billy Chinook. Because the Metolius River is a spring-fed system, it is a relatively cool and stable. Suttle Lake, which feeds into the Metolius River via Lake Creek, was the historical origin of Lake Billy Chinook's kokanee population. In a sum, the fish passage program at Pelton Round Butte re-opens over 250 miles of stream to anadromous fish.

The History

The dams were originally constructed with both upstream and downstream fish passage facilities. However, once the dams were built, unforeseen changes in the river currents and water temperature led to confusing surface currents in Lake Billy Chinook, and salmon and steelhead smolts did not find the fish collector at Round Butte dam.

Water from the Metolius, being colder than the other two rivers, sank to the bottom of Lake Billy Chinook. The turbine intake was located at 270 feet below the water surface, and, as a consequence, the cold Metolius water was passed downstream during generation. To fill in the gap, much of the warmer water of the Crooked River and the upper Deschutes flowed over the top of the colder water and back up the Metolius. The water that did flow down toward the dam, where the downstream fish passage was located, ended up swirling in eddies with no distinct



Since 2007, more than 600,000 steelhead fry and 500,000 spring Chinook salmon have been released into mainstem and tributary streams above the Pelton-Round Butte Hydroelectric Project. Photo by Jim Yuskavitch



A Chinook salmon smolt captured at the collection facility at Round Butte Dam will be trucked downstream and released below the dams to continue its journey to the sea. Photo by Jim Yuskavitch

current. Smolts following the river currents did not find the downstream fish passage entrance.

Due to the failure of the downstream fish collector to attract fish, the fish passage program was abandoned in

1968. Round Butte Fish Hatchery was built below the dams to maintain the fish population in the lower Deschutes. Annually, 160,000 steelhead and 240,000 Chinook smolts are released

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into the lower river as mitigation for the loss of upper basin production. The majority of sockeye converted to a kokanee life history, rearing in Lake Billy Chinook and spawning in the Metolius River.

The Solution

After several years of planning, PGE and CTWS settled on a solution to restore downstream fish passage: a rebuilt dam intake with an underwater tower and fish collection facility just upstream from Round Butte dam. The Selective Water Withdrawal (SSW) tower and associated fish passage facilities allow PGE to withdraw water from both the surface and bottom of Lake Billy Chinook. During the spring when salmon and steelhead smolts migrate downstream, the warmer surface water is withdrawn to modify the reservoir currents and water temperatures and attract fish into the collection facility. In the summer months a blend of warm surface water and cooler bottom water is withdrawn to manage the temperature of the Deschutes River downstream to about what it would be if the dams were not present. Both the surface and bottom withdrawals are 100% screened to protect fish.

Because Chinook and steelhead had been extirpated from the upper basin since 1968, Oregon Department of Fish and Wildlife (ODFW) and CTWS began a reintroduction effort in 2007. ODFW and CTWS began outplanting hatchery Chinook and steelhead fry from Round Butte hatchery into the upper basin tributaries. This annual effort, involving many volunteers, seeks to put between 325,000 and 430,000 Chinook fry and 574,000 and 994,000 steelhead fry into the upper basin tributaries. These fish then rear for 1-2 years before migrating downstream to the collector. The plan for steelhead and Chinook is to reduce and eventually eliminate fry releases as adults return to spawn naturally. The strategy for the establishment of a sockeye run is very different. Rather than stock hatchery fish, the plan is to convert a portion of the existing wild kokanee population back to anadromy, so that both the anadromous (sockeye) and adfluvial (kokanee) life histories are maintained in the Deschutes basin.

Beginning in December 2009, downstream migrating fish began entering the facility through two 40-foot tall by 45 feet wide entrances to V-screens, each capable of drawing 3,000 CFS of water. Primary, secondary, and tertiary screens reduce up to 6,000 cfs of flow down to 12 cfs. This 12 cfs delivers the fish to holding raceways. During transit, smolts pass through a PIT tag array before arrival in a small or medium fish raceway. At this point PGE staff can collect biological information on the fish such as length, weight, and tag IDs. Each fish is then given a right maxillary clip. This clip identifies that the fish reared in the upper Deschutes basin. Initially, only adult returns with maxillary-only marks, identifying them as upper Deschutes basin fish, are to be passed above Round Butte dam as adults. Within 24 hours, the fish are loaded onto a truck. Smolts captured and marked are then transported 15 miles downstream around Pelton and the Regulating dams and released into the lower Deschutes to continue their migration to the ocean. Since it became operable in December of 2009, the SSW has allowed PGE to transport 274,194 sockeye, 98,068 Chinook and 25,867 steelhead into the lower river. Survival through the facility exceeded 96% during all three years of operation.

The Research

The federal license to operate the Pelton Round Butte Project requires PGE and CTWS to conduct many test and verification studies to study the efficacy of the reintroduction and fish passage program. In one study, we are measuring the percentage of steelhead and Chinook to successfully migrate downstream to the collector; we are also studying their migratory routes and travel time through Lake Billy Chinook. To do this we implant PIT and radio/acoustic tags in a sample of Chinook and steelhead captured at tributary screwtraps. The PIT tags allow us to tag a statistically significant sample of fish to measure survival. The radio/acoustic tags allow us to track their movement. During the past 3 years, we have found that between 20.6% and 64.5% of PIT-tagged Chinook and 11.2 and 31.1% of PIT-tagged steelhead are collected at Round Butte Fish Capture Facility. The proportion of fish collected appears to vary with river arm and stream flow. In all three years, the Chinook from the Metolius River have lower survival than the Chinook originating in the Crooked River system. We have also observed that a higher percentage of Chinook and steelhead

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Upstream migrating Chinook salmon and steelhead are captured at a fish trap below the dams, and hatchery fish are separated from upper basin origin fish which will be trucked and released above the dams. Photo by Jim Yuskavitch

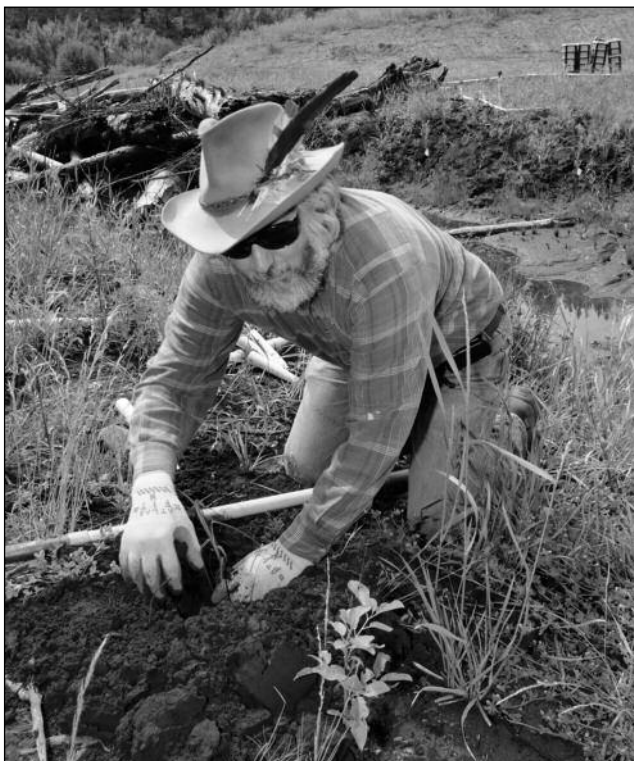
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reach the collector during springs with relatively high river flows. Our radio data indicates that many Chinook and steelhead are “wanderers.” For example, many steelhead move quickly down the Crooked River; however, when they reach Lake Billy Chinook they slow down significantly and make excursions up the Deschutes or Metolius reservoir arms before entering the forebay and/or collector. Because of this wandering behavior and relatively long forebay residence times, in 2012, we began an acoustic study to better understand these fishes’ behavior in the immediate vicinity of the collector.

We are also investigating the potential issues that smolts face during their trip through Lake Billy Chinook including: predation, disease and harvest. Bull trout, northern pikeminnow and smallmouth bass are all identified as potential predators. Currently, we are conducting three years of a bull trout study, which will be followed up by a second year of smallmouth bass study. Bull trout are collected during the spring and fall, and their stomach contents are non-lethally sampled by gastric lavage. The stomach contents then are identified in the laboratory by the use of diagnostic bones. During the past two years of study, the bull trout diet has consisted primarily of kokanee/sockeye and invertebrates. No identifiable steelhead have been found in the stomachs, and a very few juvenile Chinook have been identified. Northern pikeminnow are not very numerous in Lake Billy Chinook and do not appear to be a major threat to smolts.

With the passage of adult Chinook, sockeye and steelhead starting in summer 2012 our adult migration study began. Of the returning Chinook and steelhead, half were passed upstream to spawn naturally and half were taken to ODFW’s Round Butte Hatchery to provide brood for next year’s upper basin fry releases. Of the adults passed upstream, we tagged approxi-

mately half with radio tags. These tags allowed us to track the adults to the spawning grounds. Total returning adults to date are 50 Chinook, 86 sockeye and 130 steelhead. The 2012 Chinook and sockeye runs are complete, while the steelhead run is ongoing. Of these, 25 Chinook, 86 sockeye and 70 steelhead were passed



A volunteer plants native vegetation along Whychus Creek, an important historical spawning stream for salmon and steelhead. Habitat improvement is an integral part of the restoration project. Photo by Jim Yuskavitch

upstream. Last summer we radio-tagged 14 Chinook and 34 sockeye. Thirteen of the Chinook headed up the Metolius River arm of Lake Billy Chinook, one was detected in the Deschutes River near the confluence with Whychus Creek. An additional, three Chinook (without radio tags) were reported in the Crooked River. One radio-tagged Chinook was detected upstream of Prineville in the Crooked River. All of the radio-tagged sockeye headed up the Metolius arm of Lake Billy Chinook. Six fish were detected in the Metolius River, the uppermost sockeye was located near the Camp Sherman store (river mile 39). In addition to radio-tag tracking

data, 7 sockeye were spotted during redd surveys. Steelhead begin returning to the Pelton trap in August and continued to return into April. To-date we have radio-tagged 34 steelhead. The majority of the steelhead were located in the Crooked River. Four have been detected in the upper Crooked River near Prineville, one has been detected in McKay Creek. Two of the steelhead entered the Deschutes River, and possibly Whychus Creek. We continue to track steelhead in the upper basin.

This year has been busy and exciting in the Deschutes basin. This spring, we are continuing to work on our juvenile studies. One change for 2013 is that we are looking more closely at fish behavior in the vicinity of the collector. We positioned a 3-dimensional acoustic array in the forebay to monitor Chinook and steelhead response to the collector and hopefully identify options to increase collection efficiency. In addition, we will tag bull trout with acoustic tags in the forebay. This will help us determine if bull trout are residing in the vicinity of the collector and preying on smolts or inhibiting their entrance. In addition, bull trout diet samples continue to be collected throughout Lake Billy Chinook to monitor their potential impact on the Chinook, steelhead and sockeye populations. And we look forward to the second year of returning Chinook and sockeye this summer. In 2013, all returning adults will be passed upstream, and we will radio-tag a higher percentage of fish. The first Chinook returned this April. Because it had a PIT-tag we know that it was a 3-salt Chinook; it had been PIT-tagged as a smolt at our Metolius screwtrap in 2010. Another noteworthy milestone this year will be the second round of Pelton Habitat Fund grants. Approximately \$6 million will be available for agencies and non-profits to complete habitat improvement projects to benefit reintroduced salmon and steelhead in the Deschutes basin.





One Crater, Not Two

Proposed exploratory drilling threatens Mt. St. Helens area

By Jessica Walz Schafer

— Gifford Pinchot Task Force —

Jessica Walz Schafer is Conservation Director for the Portland, Oregon-based Gifford Pinchot Task Force. Visit their website at: www.gptaskforce.org

Prospecting and mining in the West has seen a resurgence with gold prices sky rocketing and investors scrambling to be in on the next big find. There is no place immune to this threat, including the iconic Mount St. Helens. After several failed attempts in the past few years to secure a mining lease to an area 12 miles from the crater of Mount St. Helens, a Canadian company, Ascot Resources Inc., took the gamble and is seeking the right to conduct exploratory drilling less than a mile from the clean waters of the Green River, historic Ryan Lake, the Green River Horse Camp, and 12 miles from the Mount St. Helens volcanic crater itself.

This is not the first time this area has been threatened by a mine. In March of 2005 Idaho General Mines, Inc. (now known as General Moly, Inc.) submitted a Hardrock Mineral Lease Application for minerals (gold, copper and molybdenum) located within the same deposit. IGMI acquired a 50% interest in the deposit in 2004, and was seeking a lease to begin mining in the area based on that interest. At that time, spokespeople for IGMI stated that the only economically feasible mine in this location would need to be close to 3,000 acres.

In April of 2008, after 3 years of organizing by the Gifford Pinchot Task Force (GPTF) and over 33,000 public comments, a majority of which were in opposition to this mine lease, the BLM released a "no decision" on the IGMI application based on the public interest criteria, effectively ending IGMI's bid to begin mining. Unfortunately, the BLM's decision for this lease application did not stop mining interests

from continuing to seek opportunities in the future.

At that time General Moly opted to not pursue the mineral lease further and GPTF celebrated this success. However, that celebratory mood was short lived, because in 2010 a Canadian company, Ascot Resources Inc, in the midst of the sky rocketing gold prices, sought an option for General Moly's interest in this land and began the most recent project to dig.

Exploratory drilling poses a major threat to the clean waters of the Green River and its wild salmon and steelhead.

In 2010, the United States Forest Service (USFS) permitted Ascot's exploratory drilling project without undergoing an Environmental Assessment (EA) process, which blocked the access of the public to comment on this project. Ascot, a foreign owned company, was allowed to drill a dozen holes in this area, reopen roads closed in by regrowth, block public access to our public national forest land, and pump water without undergoing a public environmental review of the project. When Ascot Resource sought to conduct more drilling in 2011, the GPTF filed suit in federal district court to oppose drilling in this landscape without undergoing an environmental review. Upon our filing the USFS rescinded the original permit and the project went under an EA review.

In 2011, the Gifford Pinchot Task Force was successful in forcing the Bureau of Land Management (BLM)

and the USFS into taking a deeper look at this project and conducting an Environmental Assessment. During this time, GPTF gathered a coalition of 15 conservation groups and submitted detailed comments on the project. Our members and supporters rallied and sent the BLM and FS approximately 5,500 comments expressing deep opposition. On December 20, 2012, despite our work, the BLM and FS issued permits to allow limited exploratory drilling to continue. Although this is a setback, we continue to fight for this landscape and the clean waters that flow through this valley. Just recently GPTF filed a complaint against the BLM and USFS opposing this project for the environmental effects it will have on the public's land and water.

The exploratory drilling proposed by Ascot is an exploratory drill project intended to pull rock cores for analysis of minerals. The project proposes to include a total of 63 rock core holes from 23 drill pads. The drills will operate 24 hours a day 7 days a week, creating both noise and light interference for birds and wildlife in the area. Previously decommissioned roads will be reopened to allow the drill rigs to pass, and up to 5,000 gallons of water a day (potentially more) will be used along with chemicals to lubricate the drill rigs. The total overall area affected is not large, but the potential effects to the environment are great.

Exploratory drilling, even in a limited capacity, poses a major threat to the clean waters of the Green River. The area proposed for drilling is a highly reactive environment with approximately 22 seismic episodes a month due to the volcanic nature of the region. The Environmental Assessment that looked at this project failed to address many relevant factors associated with the Green River and the clean water that it provides for downstream users as well as valuable

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fish stock.

The Green River starts its journey in the valley and flows downstream to the Toutle River, bringing with it cold, clean water that is home to a vast array of fish and aquatic insects and providing drinking water for downstream communities. The Green River has a healthy population of cutthroat and non-native brook trout, as well as several species of aquatic insects, including mayflies, caddis, stoneflies, and midges, and contains important current and potential habitat to candidate and listed winter steelhead, fall Chinook and coho. It has also been designated by the Washington Department of Fish and Wildlife as a "Wild Stock Gene Bank" for salmonoid species. Sediment and chemicals from the exploratory drilling have the ability to affect approximately 2.4 miles of cutthroat and steelhead habitat. Exploratory drilling, even in a limited capacity, would cause tremendous damage to this system.

Two major concerns from this exploratory drilling project for aquatic species in this area are: (1) the impacts that road building and drilling will have on sediment loading in rivers, streams, and other water bodies close to the proximity of the drilling site and groundwater usage for drilling needs that could affect the water table in this area; and (2) the

drilling will use a large amount of water, approximately 5,000 gallons per day, from an aquifer less than ½ mile from the Green River. The reduction in flow due to this water withdrawal may cause an increase in water temperatures, which could greatly affect the current fish habitat. The drilling could also cause increased run-off into the river from road use and potentially lead to contamination with chemicals not properly contained in the sumps. Increased sediment and chemicals in watersheds can have severe effects on the aquatic habitat and spawning areas needed for fish survival. Chemicals to be used during the drilling process and potentially produced during the process including acid mine drainage can, in large quantities, be lethal to fish populations. If not properly contained in the sumps or due to extreme weather, chemicals can run off into the streams, contaminating the river's habitat and the water that flows downstream to Washington communities.

The Gifford Pinchot Task Force has a long history of working to protect and conserve our special places in the Pacific Northwest. Over the last few years, the GPTF has continued to oppose this project to protect the public's valuable resources. We have filed lawsuits to force the EA process, worked to inform the public about the issue, gathered over 5,500 comments in opposition to drilling in this location, and organized a coalition of environ-

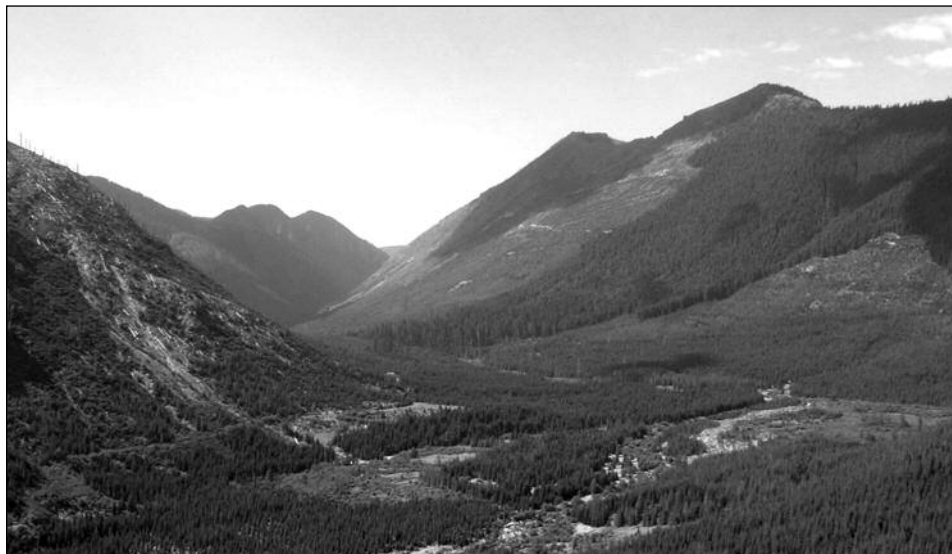
mental non-profits helping to protect this landscape and oppose drilling and mining near Mount St. Helens. GPTF just recently filed a complaint in federal court to stop the current process because of the inadequate EA that failed to take a hard look at all issues, including gathering baseline data on the true effects of drilling on the watershed. We remain committed to fight this drilling threat through all means necessary and to monitor the project should it move forward to ensure our clean waters are untainted by drilling and mining waste, our recreational opportunities are not curtailed by foreign investors, and our public lands remain open to us all. Please join us in protecting our wild places.



Morrison Mine Rejected

In a landmark decision last fall, British Columbia's Liberal government denied an environmental certificate to Pacific Booker Minerals for a proposed mine in the Morrison Lake in the headwaters of the Babine watershed. The Babine is the largest single producer of sockeye in British Columbia and sustains the majority of the commercial and indigenous fisheries in the region. A new open pit mining project would have spelled disaster for the Babine Lake ecosystem and the Skeena more generally, prompting even the pro-mining liberal government to conclude the risks far outweighed the benefits. Now in what is among the most outrageous, and obnoxious developments yet, the company has opted to sue the province over their decision on the project. This represents a troubling theme in Canadian resource development, with decision making power increasingly being taken away from local governments, and consolidated in the hands of the companies which profit from environmentally destructive resource extraction.

Will Atlas and Ken Rabnett covered the Morrison Mine controversy in the September 2012 issue of *The Osprey*.



The Green River's clean water, along with its populations of salmon and steelhead, are at risk from proposed exploratory drilling near Mount St. Helens. Photo courtesy Gifford Pinchot Task Force



Recovering California Steelhead South of Santa Cruz

By Kurt Zimmerman, Tim Frahm and Sam Davidson

— *California Trout, Trout Unlimited* —

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Many anglers consider the steelhead trout (*O. mykiss*) the “perfect fish.” Steelhead are widely revered for their power and grace in the water, and for the high challenge of actually catching one. Sport fishing for steelhead is a major contributor to many local economies along the California coast.

Steelhead are rainbow trout exhibiting an anadromous (i.e., migrating to and from the ocean) life history. Unlike salmon, however, steelhead do not perish after the first spawning season, and may complete the cycle of anadromy multiple times.

Steelhead populations have declined precipitously across much of their range along the west coast of North America. Yet, steelhead are a remarkably resilient salmonid, and even in the most degraded habitats, remnant populations still persist. This fact, and the legal status of steelhead, have led to a multi-party effort to recover the species south of San Francisco Bay by restoring habitat, improving stream-flows and fish passage opportunities, and even rescuing juveniles, as river segments dry up or become disconnected during summer. For more than two decades, steelhead advocacy groups such as California Trout (CalTrout) and Trout Unlimited have driven this effort, working in partnership with local steelhead conservation organizations, resource agencies, municipalities, agricultural interests, and water providers.

Steelhead genetics evince unique characteristics region-by-region (and even watershed-by-watershed), as the fish adapted to the particular conditions and climate factors of coastal streams from the Baja Peninsula to Alaska. Today, steelhead south of San Mateo County in California are categorized by the National Marine Fisheries Service (NMFS) into two “Distinct Population Segments” (DPS): the “South Central California Coastal”

Steelhead have declined across much of their range along the West Coast, but they are a remarkably resilient fish.

(SCCC) DPS and the “Southern California Coastal” (SCC) DPS’s. Genetic studies suggest that steelhead from these DPS’ are the progenitors of all steelhead on the west coast of the United States. These DPS’s tolerate warmer water and more episodic stream flows — traits that could contribute to their long-term survival in the face of global climate change.

In 1997, the SCCC DPS was “listed” as Threatened (still persisting across some of its historic range but with sub-optimal population numbers and management intervention probably necessary) and the SCC DPS as Endangered (at serious risk of extirpation) under the federal Endangered Species Act (ESA). The ESA requires the agency with jurisdiction over the listed species to prepare a Recovery Plan for restoring that species within its native range. Recovery Plans are “guidance”

documents, intended to help achieve recovery goals by describing strategies and recommended actions likely required to restore viable wild populations.

In early 2012, after years of public and agency input, NMFS released the Final Southern California Recovery Plan for the SCC steelhead. Later that year, the agency released for public comment a Review Draft of the Recovery Plan for the South Central Coastal steelhead. These two Recovery Plans identify area-wide threats as well as threats specific to particular watersheds. Common threats are the three “Ds”: Dams, Diversions and Diminished Aquatic and Riparian Habitats. According to NMFS, successful implementation of actions leading to recovery “depends on the voluntary cooperation of multiple stakeholders...at the local, regional, state, and national levels.”

The South-Central California Coastal DPS

Steelhead that populate central California streams from the Pajaro River in Monterey County south to Arroyo Grande Creek in San Luis Obispo County are included in the South-Central California Coastal DPS. Rivers here are of two types: short streams which drain coastal mountain ranges; and rivers which flow through gaps in the coastal mountains along broad inland valleys. Some of the rivers in this DPS feature productive lagoons, where juveniles rear and grow; others have no functional lagoon at all. Each watershed has its own “personality” in terms of steelhead habitat.

Carmel River

The Carmel River originates in the Ventana Wilderness of the Los Padres

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National Forest and drains the wine/golf mecca of Carmel Valley before flowing into Monterey Bay near Carmel. The main channel of the Carmel is 28 miles long, but the mainstem is fed by seven significant perennial stream tributaries.

A severely diminished run of native steelhead persists in the Carmel River. As many as 5,000-10,000 steelhead may have returned each year to this river prior to construction of San Clemente Dam in 1921 and Los Padres Dam (1949) upstream of San Clemente. Today, steelhead returns vary from an estimated 300-900 adults. Due to loss of access to spawning habitat in the upper watershed and low streamflows at times during the winter and spring, it is estimated that 50% of Carmel River steelhead spawn below San Clemente Dam in sub-optimal habitat.

Carmel River steelhead have been the focus of an intensive, multi-decade restoration effort by the Carmel River Steelhead Association (CRSA) and resource agencies. CRSA and the Monterey Peninsula Water Management District rescue juvenile steelhead from disconnected pools in the tributaries and mainstem each year and relocate them to a rearing facility or to segments of the mainstem which remain watered. This effort may have prevented extirpation of wild steelhead from this river during recent multi-year periods of drought.

The biggest impediments to steelhead recovery in the Carmel River are the four dams within this watershed and water diversions. The four dams impede or prevent access to approximately 50% of the watershed, while surface and groundwater extractions cause the lower portion of the mainstem to dry up during the summer.

Trout Unlimited and CRSA are working to remove and reduce these impediments to recovery, most importantly to support the long political and planning process which recently produced an agreement to remove San Clemente Dam. This historic project (it will be the largest dam yet removed in California) commences in 2013, and will restore access for steelhead to 25 miles of good spawning habitat. In addition, local water purveyors are developing alternative sources for



Although beleaguered from a host of threats, southern California steelhead are a resilient fish. With enough help they will make a comeback. Photo by Tim Frahm/Trout Unlimited

municipal water which will reduce demand on the river, and CRSA and the water management district will continue to rescue stranded steelhead as the lower river dries up each summer.

Salinas River

The Salinas River watershed is the fourth largest watershed in California. This river has an axis of 170 miles and flows north from its headwaters in San Luis Obispo County through one of the most productive row crop regions in the world. The watershed encompasses nearly 4,600 square miles and includes the San Antonio River, the Nacimiento River and Arroyo Seco River as tributaries. The Salinas is the biggest watershed south of San Francisco supporting a persistent steelhead population.

Trout Unlimited is working with local angling groups such as the Salinas Valley Fly Fishers to advance steelhead recovery in the Salinas River. Due to significant manipulation of the river, the Salinas now requires mechanical breaching to ensure timely opening of its mouth. Unfortunately, steelhead requirements have not been the trigger for such action; rather, agricultural field inundation has been the impetus. The result has been irreg-

ular river/ocean connectivity for use by migrating steelhead. In addition, for the last century the riparian corridor has been 'managed' by adjacent landowners to reduce flooding on farmlands. The result has been substantial depletion of vegetative and stream bed structure needed to create adequate steelhead habitat and cooler water temperatures. To address these issues, NMFS has instituted a working group of stakeholders to begin integrating the needs of steelhead into river mouth management, and recently a Draft River Channel Maintenance Program Environmental Impact Report (EIR) was released. The EIR proposes changes in river management that will benefit steelhead, and food safety audit requirements are being modified to reflect "co-management" of food safety and natural resource concerns.

Pajaro River

The Pajaro River is the most northerly river in the SCCC DPS. In 2006, American Rivers designated the Pajaro as America's most endangered river, due to flood control levies along its lower 22 miles and severe runoff into the river from agricultural fields. Despite its degraded condition, steel-

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head consistently enter this watershed and migrate to spawning habitat in the upper tributaries. A 1966 memo from the California Department of Fish and Game estimated the run from 500 to 2000 spawning pairs (although most current authorities believe present steelhead numbers in the Pajaro are well below these numbers).

Trout Unlimited is working with CHEER (Coastal Habitat Education and Environmental Restoration) and sportsmen's groups to bolster steelhead recovery in this watershed. Specifically, the two groups are working with farmers and homeowners in the Little Arthur Creek drainage. Little Arthur Creek is one of the last remaining "inland" central coast steelhead streams with viable runs of fish and it is one of only a few tributaries to the Pajaro with effective summer rearing habitat. NMFS introduced TU to CHEER and local landowners to address low streamflow, which the agency considers "the most significant limiting factor to the Little Arthur steelhead fishery." TU and CHEER are currently in discussions with landowners about installing farm ponds and as many as 10 sets of residential water tanks as a way to take pressure off summer diversions.

Big Sur River

This beautiful river pours out of the Santa Lucia mountains in a watershed that is predominately public land, exiting to the ocean at Andrew Molera State Park. Steelhead habitat in the Big Sur River is characterized as 'good' by NMFS and the small steelhead streams along the Big Sur coast are considered the best preserved within the entire DPS. However, high volume groundwater extraction in the lower portion of the Big Sur impacts streamflows and essential habitat for juvenile steelhead. Trout Unlimited and other stakeholders are actively negotiating with water rights holders and the State Water Board to modify the pattern and magnitude of extractions to minimize impacts on steelhead.

Each of the rivers within this DPS has the potential for improved conditions for steelhead, and there is a growing group of conservation-minded

sportsmen, land-owners, NGOs and governmental agencies committing time and effort to the recovery of steelhead here.

The Southern California Coastal DPS

The range of the SCC DPS extends from the Santa Maria River in the north to the Tijuana River (the U.S.-Mexico border) in the south. NMFS estimates that historic steelhead numbers in this DPS were over 45,000 fish, and anglers were still catching stringers-full of steelhead in the 1940s. Human development, in particular the construction and operation of dams and other water diversions, has caused this steelhead population to decline nearly 99% percent. Today, only about 500 adult fish survive in the DPS.

There are reasons, however, to be optimistic about this endangered fish's chances. NMFS, the California Department of Fish & Wildlife, and organizations like CalTrout and Trout Unlimited are collaborating to save the Southern California steelhead from extinction.

The San Diego/Orange Counties Watersheds Steelhead Recovery Coalition

San Diego and Orange Counties (SanDOC) encompass the largest stretch of undeveloped coastline in southern California. A complicated ownership picture, coupled with the surrounding urban and suburban sprawl, present complex jurisdictional issues and impose huge demands on resources, particularly water. Many streams here, including the Santa Margarita and San Luis Rey Rivers, and San Mateo, San Juan, and Trabuco Creeks, historically supported steelhead runs.

In 2012, with funding from the California Department of Fish & Wildlife's Fisheries Restoration Grant Program (FRGP), CalTrout and Trout Unlimited laid the groundwork for successful implementation of restoration projects in this region, and the first-ever San Diego and Orange Counties Steelhead Restoration Coalition took shape. (In addition to CalTrout and Trout Unlimited, SanDOC Coalition members include the Golden State

Flycasters, the San Diego Chapter of the Audubon Society, San Diego Coastkeeper, and the Chaparral Lands Conservancy.) SanDOC Coalition members are finalizing a strategic plan and have identified multiple steelhead restoration projects. Coalition members are actively working to fund these projects. CalTrout recently received a \$50,000 grant from Wells Fargo's Environmental Solutions for Communities Grant Program. The grant, administered through the National Fish & Wildlife Foundation, will fund a water quality monitoring and public outreach program in the San Luis Rey River.

CalTrout has also submitted grant proposals to the FRGP to fund other Southern California steelhead projects, including removal of an 'Arizona Crossing' to restore fish passage on the Los Alamos Creek; removal of small dams to restore fish passage to tributaries of Trabuco Creek and San Juan Creek; removal of invasive species to restore steelhead habitat in the Santa Margarita River; and a study to identify sources of the invasive species and long-term solutions to the threats these species pose to steelhead. Trout Unlimited has also submitted an FRGP proposal to evaluate habitat, fish passage barriers, water quality and quantity in Trabuco Creek.

The Santa Clara River Watershed Steelhead Coalition

The Santa Clara River watershed straddles Los Angeles and Ventura Counties and encompasses more than 1625 square miles. The main stem of the Santa Clara and its principal tributaries, Sespe Creek, Santa Paula Creek and Piru Creek, contain exceptional steelhead habitat. Unfortunately, dams and diversions block access to historic spawning habitat as well as out-migration of juveniles and adults. CalTrout has been working with the United Water Conservation District and resource agencies to implement fish passage solutions at Vern Freeman and Santa Felicia – two of the largest dams in the watershed.

Funding from the FRGP also laid the groundwork for successful implementation of restoration projects in this watershed. Under CalTrout's leader-

Continued on next page

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ship, the Santa Clara River Watershed Steelhead Coalition took shape — which also includes the Nature Conservancy, Friends of the Santa Clara River, Keep the Sespe Wild, Ventura Coastkeeper/WishToyo Foundation, the Santa Clara River Conservancy, and Stoecker Ecological — and has identified multiple steelhead restoration projects. CalTrout has submitted grant proposals to the FRGP to underwrite some of these projects, including elevation of the creek bed at the Harvey Diversion by insertion of ‘H’ beams to provide interim fish passage until the diversion can be notched; and a monitoring program addressing upstream migration, fry and juvenile rearing, smolt outmigration, overall steelhead abundance and steelhead habitat suitability. In addition, the Coalition is finalizing a strategic plan to identify and implement even more steelhead restoration projects in the coming years.

Santa Ynez River Restoration

The Santa Ynez River in the Santa Barbara area once supported the largest steelhead run south of San Francisco. In the 1950s, steelhead lost access to roughly half of the watershed, and more than two-thirds of historic spawning habitat was blocked by construction of Bradbury Dam. When the SCC DPS was listed in 1997, CalTrout filed a water rights challenge at the State Water Board to obtain adequate flows and fish passage at



Many streams in Orange and San Diego counties, such as the Santa Margarita River, once supported steelhead runs. Photo courtesy California Trout

Bradbury. This process was stalled for several years. In 2012, however, State Board hearings resumed, with the Environmental Defense Center (EDC) now representing CalTrout. Because steelhead continue to utilize habitat below the dam, EDC and CalTrout are monitoring the environmental review process for the proposed installation of municipal wells that could negatively impact this lower watershed. In addition, the Bureau of Reclamation will be issuing a Biological Assessment analyzing effects on steelhead as part of the proposed relicensing of the Dam, and NMFS will issue a more detailed Biological Opinion. CalTrout and other advocates will closely monitor and comment on these evaluations as well.

Ventura River Restoration

Matilija Creek is a major tributary of the Ventura River. Historically, both waters provided miles of high-quality steelhead habitat. Matilija Dam is a 190-ft. structure with a reservoir that is now filled with 6 million cubic yards of sediment. In its current state, the dam poses seismic risks and completely blocks fish passage.

CalTrout helped launch an initiative to remove Matilija Dam through formation of the Matilija Coalition and the Matilija Dam Technical Advisory Committee (TAC). Over the past year, the TAC has completed a draft work plan addressing preliminary tasks for the removal of the dam. In March 2013, a Request for Qualifications was sent to consultants seeking their qualifications to perform critical functions associated with dam removal, including selecting feasible removal methods, generating cost estimates, sediment transport modeling, and creating a mitigation plan to address sediment that would be deposited temporarily into Matilija Creek and the Ventura River during the dam removal process.

Another major passage barrier for steelhead in the Ventura River watershed is the Robles Diversion on the Casitas Water Diversion Canal. CalTrout helped secure construction of the Robles Fish Ladder on the

Canal, and subsequently, NMFS mandated minimum flows to ensure fish passage. Casitas sued the United States claiming that the government was illegally ‘taking’ its water. CalTrout was an Amicus party in this case. In a significant victory for steelhead, the trial court ruled in favor of the United States, and its decision was affirmed on appeal. This is a significant, precedent-setting decision that will benefit steelhead in this and potentially other watersheds.

Santa Monica Mountains Restoration

Steelhead historically populated creeks that drain the Santa Monica Mountains (between Santa Monica and Oxnard), but as in other waters in this DPS, these populations are now a tiny fraction of their historic average. In 2006, CalTrout released the Santa Monica Mountains Steelhead Habitat Study, which laid the scientific foundation for a steelhead recovery campaign in this area. Since then, stakeholders have been working to implement critical restoration actions including restoration of Malibu Creek lagoon, restoration of the Topanga Creek rodeo grounds, the proposed removal of Rindge Dam, and California Trout’s proposed removal of an ‘Arizona road crossing’ on Zuma Creek to restore fish passage.

Conclusion

Although sport fishing for steelhead is not allowed in the southern steelhead DPS (due to its Endangered status), fishing for steelhead is allowed in some streams of the South-Central Coastal DPS. This is a catch-and-release, barbless hook, limited season fishery with low flow closures as further protection in some streams.

Despite these limitations, there are dedicated local anglers that continue their quest for the SCC steelhead, which can reach 36 inches and 20 pounds. Hearing old-timers’ stories of steelhead fishing on the Arroyo Seco, or of the push of fish into the Foster Hole on the Pajaro and the active grab at the turn of the tide, now keeps us at the vise, crafting the perfect pattern for this perfect fish.



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Sorry about that

We inadvertently left several donors names off our 2012 Honors List in the last issue of *The Osprey*. They are:

- The Steamboaters
- Hugh Clark
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