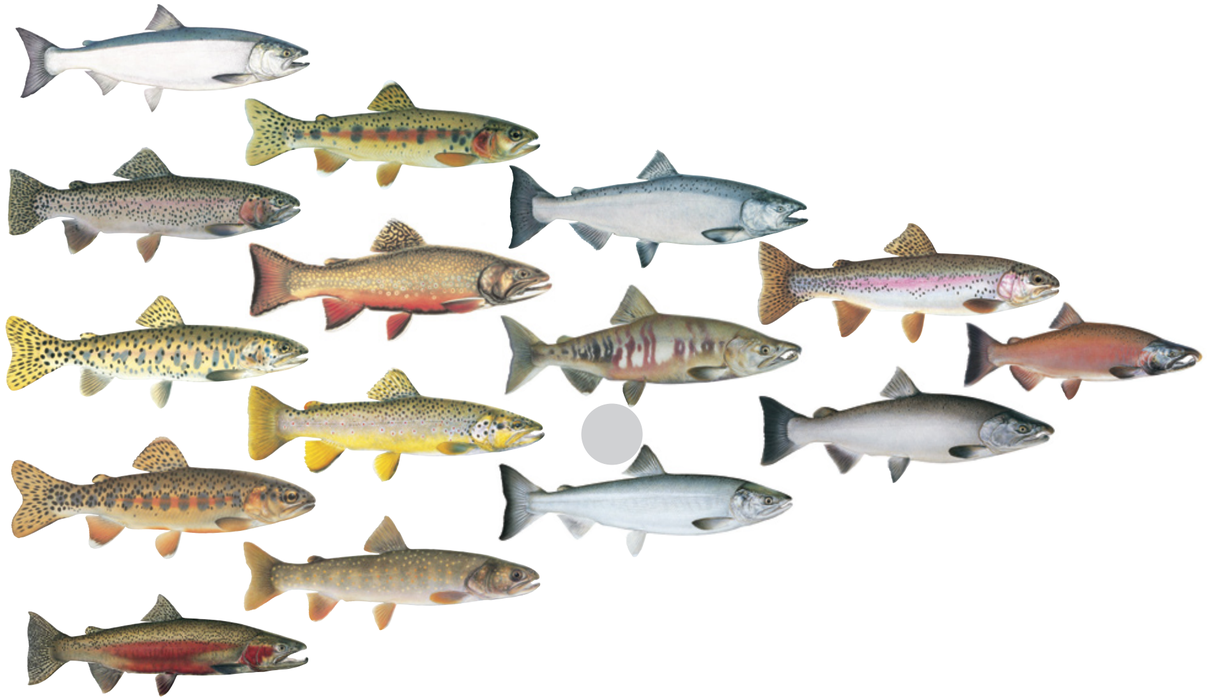
SOS: California's Native Fish Crisis

Status of and solutions for restoring our vital salmon, steelhead and trout populations

California Golden Trout
State Fish of California
ART BY JOSEPH TOMELLERI

Based on a report by Dr. Peter B. Moyle, Dr. Joshua A. Israel, and Sabra E. Purdy, commissioned by California Trout

CALIFORNIA TROUT
KEEPER OF THE STREAMS



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The foundation of *SOS: California's Native Fish Crisis—Status of and solutions for restoring our vital salmon, steelhead and trout populations* is based on 32 peer reviewed full life history accounts that were prepared by Dr. Peter B. Moyle, Dr. Joshua A. Israel, and Ms. Sabra E. Purdy, and have been published as *Salmon, steelhead and trout in California: status of an emblematic fauna*. These accounts, which have been subject to extensive peer review and comment, can be found on the attached CD. *Salmon, steelhead and trout in California: status of an emblematic fauna* can also be viewed and downloaded from California Trout's website (www.caltrout.org).

The mission of California Trout is to protect and restore wild trout and steelhead waters throughout California.

Acknowledgments

CALIFORNIA TROUT IS DEEPLY grateful for our many supporters whose financial contributions and "passion for the fish" have made this report a reality. Thanks to them for helping to chart a brighter pathway forward for our fish and for our environment.

SOS: California's Native Fish Crisis—Status of and solutions for restoring our vital salmon, steelhead and trout populations has been touched by dozens of individuals who have given tirelessly of their time, experience, patience, insight, and passion—all driven by a "love for the fish." What started as a series of rambling, random, and loosely organized thoughts and threads has, through the wisdom and guidance of the following, been woven into a tight and colorful tapestry that now hangs together and speaks with clarity and a sense of purpose: California Trout staff and board, Richard May, Resources Legacy Fund Foundation, Tim Sinnot and the GreenInfo Network Team, and Peter Walbridge and the Big Think Studios Team.

I especially want to thank Project Coordinator Cindy Charles whose steady, paced, dependable and even-keeled approach was just the tonic for keeping this mammoth undertaking on track and on schedule.

I would like to extend a special thanks to the following individuals who assisted in locating and acquiring the photographs that enhanced the visual excitement of *SOS: California's Native Fish Crisis—Status of and solutions for restoring our vital salmon, steelhead and trout populations*: Richard Anderson, Bill Bakke, Roger Bloom, Joseph Bogaard, Morgan Bond, Paola Bouley, Jeff Bright, Mark Capelli, Gerard Carmona, Ralph Cutter, Brock Dolman, Thomas Dunklin, Steve Edmondson, George Edwards, Joe Ferreira, Craig Fusaro, Dan Gale, Sean Gallagher, David Giordano, Mauricio Gómez, Stephen Rider Haggard, Andrew Harris, Allen Harthorn, Tim Hayden, Tim Heyne, Steve Howard, Tim Hutchins, Carson Jeffres, Ken Jensen, Jacob Katz, Doug Killam, Curtis Knight, Byron Leydecker, Aaron Martin, Andrew Maurer, John McCosker, Carl Mesick, Nathaniel Pennington, Phil Pister, Gary Reedy, Alexia Retallack, Tim Robinson, Jonathan Rosenfield, Matt Stoecker, Dana Stoltzman, Camm Swift, Thomas Taylor, Lisa Thompson, Brian Trautwein, Grant Werschkull, Tom Weseloh, The Wild Salmon Center, and Diane Windham. I especially want to acknowledge Joseph Tomelleri for the use of his magnificent artwork and illustrations which so dramatically enhanced the beauty of this report.

For those whom I have overlooked and inadvertently failed to mention, please accept my apologies. Finally, despite the numerous reviews and copy-editing that went into the report production, I am sure there remain errors and omissions, all for which I take full responsibility.

J. Scott Feierabend
Conservation Director, California Trout

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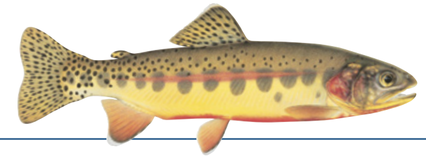


DESIGNED BY BIG THINK STUDIOS, SAN FRANCISCO

Foreword

Brian Stranko
Chief Executive Officer

I recently took my two daughters, Emma and Julia, out to a nearby stream for an afternoon of exploration and angling. We spent the day scouring the banks for reclusive salamanders and centipedes, and even made an occasional cast or two. The excitement that each new discovery brought to my girls was infectious and inspiring.

However, having studied the contents of this report, I knew all is not well with the natural world here in California that my girls will soon inherit. Yet, having witnessed such remarkable environmental comebacks for our state's fish and wildlife resources—such as the healing of Mono Lake and the promising restoration of our state fish, the Golden Trout—I have hope and a renewed sense of optimism for my daughters' future.

As detailed in the pages that follow, what's been suspected for years we now know for certain—California's native salmon, steelhead and trout are in unprecedented decline and teetering towards the brink of extinction. The collision of climate change with decades of water mismanagement have brought us to where we are today. If ever there was evidence of the crisis point we've reached, it is the collapse and closure of the commercial salmon season this past year. If present trends continue, 65 percent of our native salmonid species will be extinct within 50–100 years, with some species—such as coho, chum, pink salmon and summer steelhead—disappearing much sooner. Without our immediate and collective intervention we will steward and witness the decimation of California's fisheries on a scale and scope never before imagined.

I was five years old when California's last known bull trout was captured on the McCloud River in 1975. The disappearance of that fish was the final chapter for the species here in California, and is emblematic of what awaits our other native fish if we remain complacent and content with the *status quo*. While saddened by the loss of the last bull trout in California, rather than accept defeat and bemoan its passing, we should be inspired, forward-thinking and moved to action.

We can't afford to allow our remaining native salmon, steelhead and trout to go the way of the bull trout. The costs to all of us—business owners, recreational and commercial fishers, real estate developers, farmers, conservationists, municipalities, elected officials, and others—are simply too great to idly ignore. Proactively preventing the further decline of our state's remaining native fish and harnessing the opportunity to restore them to sustainable levels is a far more cost-effective, far less controversial, and far more progressive strategy that all Californians should enthusiastically embrace.

For the past two years, California Trout has collaborated with a team of scientists led by the state's leading fisheries scientist, Dr. Peter B. Moyle of U.C. Davis, to prepare this ground-breaking report. Dr. Moyle's academic rigor has created the gold standard methodology for assessing the status and trends of our state's native salmonids. In Dr. Moyle's words, "The fish don't lie! The story they tell is that California's environment is unraveling. Their demise is symptomatic of a much larger water crisis that, unless addressed, will severely impact every Californian in the years to come."

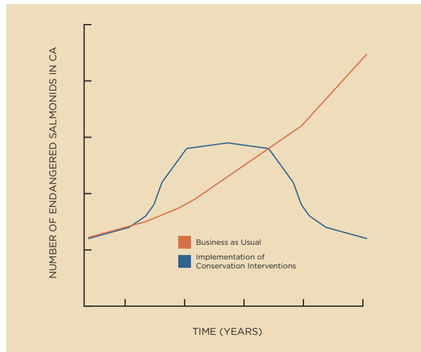
As you read our report you'll come to appreciate that Dr. Moyle's facts are stark and sobering. Our fish are telling us that California's aquatic ecosystems—its creeks, streams, rivers, estuaries, and wetlands—are under siege and faltering. The reason: failure to develop and embrace a common vision for how we value, conserve, use, and reuse our state's water resources. Our native salmon, steelhead and trout are the agents for change and, through their restoration and recovery, they provide a pathway forward. We must abandon the antiquated water policies of today and create a future founded on sustainable conventions and grounded in an ethic that guarantees every Californian and the fish access to abundant, clean, cool water.

As depicted in Figure 1, failure to address the water crisis by adhering to the *status quo* and continuing business as usual only promises long-term and irreversible impacts to our economy, our communities, our families, and our personal lives and well-being. To succeed requires rolling up our sleeves and bringing common sense and decency to the table. Re-thinking how we value and use our state's limited water resources must occur at all levels—local, regional and state—but begins at home with each of us taking personal ownership and responsibility for changing the system from the bottom up.

While the challenge of solving California's fish and water crisis may seem insurmountable, California Trout is hopeful and positive about our future. This is because our report provides a series of thoughtful and attainable recommendations for protecting and restoring California's native salmon, steelhead and trout, and charts a new course towards sustainable rivers and fisheries.

California's habitat and wildlife diversity is unequalled, and it is our state's natural grandeur and beauty that attract so many people to California and make us so proud to reside here. The nation has always looked to California for creativity and entrepreneurial leadership. Now, more than ever, we must set aside our differences and bring to bear the spirit and energy for which our state is known in order to solve the water crisis.

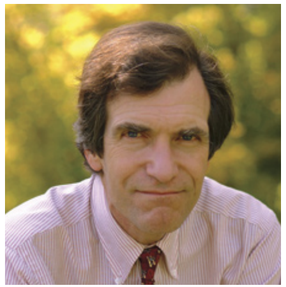
Figure 1. The Future of Our Fish: Business as Usual or a Pathway of Hope?



Please, join us on our journey in building a bright and sustainable future for California's creeks, streams and rivers. Our fish, our families, our health, our security—and, yes, Emma and Julia's future—depend on it.

Brian Stranko
Chief Executive Officer, California Trout

Letter from the Chairman



Jerome Yesavage
Chairman of the Board

California Trout has been working to protect and restore California's wild trout and steelhead waters since 1971. We began as a small group of volunteers committed to protecting the Trinity River from "killer dams" and who fought to restore Hat Creek's wild fishery. We lost the bull trout only a few years after we were founded. This was an historic moment in California and a watershed moment for California Trout—one of our native trout species had disappeared, and, with it, a unique part of our state's natural and recreational heritage. It was something we could not let happen again.

Since then, we have redoubled our conservation efforts and have gained increasing organizational momentum thanks to the generosity and commitment of our loyal board, staff, and members, our foundation and philanthropic supporters, and our conservation partners, both big and small. As this report shows, our native fish face unprecedented challenges and a daunting future, as do our state's rivers, streams, estuaries and coastlines. But none of our native salmon, steelhead or trout have gone extinct since 1975, and we have a promising chance to ensure they don't go the way of the bull trout.

None of us can accomplish this alone, however, so we will be reaching out to the broad community of stakeholders in California who can play an instrumental role in recovering our fisheries and waters and reinvigorating partnerships that will lead to recovery. We at California Trout are confident that our collective efforts will achieve positive change for our fish, our waters, and the future of California.

Sincerely,

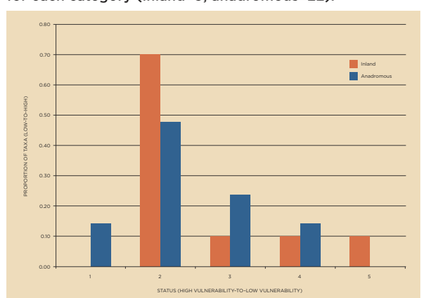
Jerome Yesavage
Chairman of the Board, California Trout

Executive Summary

The diversity of salmon and trout species in California is among the highest in the nation, due in large part to the state's scale, expansiveness and its wide range of habitats. California also contains the southernmost runs of salmon and steelhead, uniquely adapted to the highly variable nature of the state's climate. From the rugged Sierra Nevada, to the great Central Valley, to the coastal plains and towering old growth forests, these magnificent fish are part of an amazing natural heritage which defines California as a state and as a unique region. However, California's salmon, steelhead and trout are in serious trouble (Figure 2). One species, the bull trout, is already extinct in the state and 65 percent (20) of the 31 remaining species may become extinct in California within the next century if present trends continue.[1] Of the 31 taxa, 65 percent (20) are found only in California, with an additional 16 percent (5) shared just with Oregon. Of the state's 22 anadromous fish species, 13 (59 percent) are in danger of extinction, while seven (78 percent) of the nine living inland taxa are in danger of extinction. All of these species support, or previously supported, major recreational and commercial fisheries and provide enormous economic and cultural value to the residents of California.[2]

These fish are strong indicators of the condition of California's streams and rivers, with large self-sustaining populations of native salmon, steelhead and trout found primarily where our streams and rivers are still intact and pristine. It should not be a surprise, then, that our native salmonids are in steep decline because of increased competition with humans for resources, primarily water. Climate change is also exacerbating the problem because it will ultimately reduce the amount of cold water habitats that our salmonids require. Bringing California's native salmon,

Figure 2. Status of California salmonids (N=31), where orange bars represent inland taxa and blue bars represent anadromous taxa, expressed as a proportion of the total for each category (inland=9, anadromous=22).



Status Categories

1. Highly vulnerable to extinction in native range in the next 50 years
2. Vulnerable to extinction in native range in next 100 years
3. No immediate extinction risk but populations declining or small and isolated
4. No extinction risk; populations are large and appear to be stable
5. Populations expanding

[1] These include, Central CA Coast Coho Salmon, CA Coast Chinook Salmon, Central Valley Late Fall Chinook Salmon, Central Valley Spring Chinook Salmon, Sacramento Winter Chinook Salmon, Upper Klamath–Trinity Rivers Spring Chinook Salmon, Upper Klamath–Trinity Rivers Fall Chinook Salmon, Central Valley Fall Chinook Salmon, Northern CA Coast Summer Steelhead, South-Central CA Coast Steelhead, Southern Steelhead, Central CA Coast Steelhead, Central Valley Steelhead, Northern CA Coast Winter Steelhead, CA Golden Trout, Eagle Lake Rainbow Trout, Kern River Rainbow Trout, Little Kern Golden Trout, McCloud River Redband Trout, and Paiute Cutthroat Trout.

[2] For additional information on the value of recreational fishing in California see, Alkier, C. 2008. The value of recreational fishing in California—direct financial impacts. California Trout. San Francisco, CA. 24pp.

steelhead and trout back from the brink of extinction will not be easy but it is possible, thanks to the inherent ability of these fish to adapt to changing conditions; they have already demonstrated remarkable resilience in the face of human changes to their streams.

This report provides a series of recommendations that can turn the tide for our fish, our water and our economy. Among other things, California Trout will:

- Call for a comprehensive restructuring and revitalization of the California Department of Fish and Game;
- Look beyond government institutions to harness the creative power of the private and academic sectors in order to successfully protect and recover California's native fish;
- Reinvigorate efforts to partner with local communities in our regions to initiate and pursue efforts to protect regional fish populations and their habitats; and
- Take immediate action on salmon, steelhead and trout recovery needs that are highlighted by this report, such as for the Trinity River and dams removal on the Klamath River, and continue our work seeking protection of ground and surface water resources at the local and state level.

DEFINING THE PROBLEM	ARTICULATING THE NEED	FRAMING THE SOLUTION	REASON FOR HOPE
• California's native salmon, steelhead, and trout are in steep and drastic decline • The decline is being manifested by species listings, fishing closures, and continued litigation and controversy • The decline is being caused by a variety of factors—climate change, water mismanagement, habitat destruction and fragmentation, and loss of species integrity • The cost of the decline is reflected through the loss of important ecosystem functions, species extinctions, an eroded economic base—both commercial and recreational, and through disappearance of iconic and culturally symbolic species • The fish are an objective and honest indicator of the health of our state's rivers and streams • Our government's response to the crisis has been to treat a complex problem with simplistic and near-term solutions (e.g., emergency funds for commercial fishers), rather than providing long-term approaches to address and solve the underlying problem (reformed water management policies) • Our state government, most notably the California Department of Fish and Game, currently lacks the fiscal capacity and leadership to turn the tide before it's too late	• We need to protect and restore all 31 of California's remaining native salmonid species and the habitats vital to their survival; immediate action is required for those facing the greatest threat of extinction • We need a fundamental change in our state's water and fisheries management policy framework • We need to provide greater and more stable financial capacity for our state's fish, wildlife and water agencies • We need continued, long-term, science to monitor and track progress towards native fish species recovery • We need to mobilize angling constituencies and communities to lead change at the local, regional and state level—the *status quo* must go 	• Take immediate action on urgent salmon, steelhead and trout recovery needs highlighted by this report • Work with the Department of Fish and Game and other key state and federal constituents to increase capacity, improve efficiency and effectiveness for stream and fishery science, regulatory enforcement, planning, and implementation for fisheries and watershed recovery and restoration • Help the Department of Fish and Game to work more effectively with other state agencies, including the Department of Water Resources and the State Water Resources Control Board, that are key to fish protection and restoration • Redouble our efforts with local communities in our regions to protect their fish and their cool, clean waters • Mobilize grassroots support regionally and locally for species recovery, habitat protection and restoration, and water management by increasing outreach to anglers, watershed groups, and concerned citizens statewide • Update and release *SOS: California's Native Fish Crisis—Status of and solutions for restoring our vital salmon, steelhead and trout* populations every three years	• We can already point to a number of successes where we have made substantive progress in restoring fish and water • Our native salmon, steelhead and trout are resilient and, with adequate care and nurturing, can be restored and removed from threatened and/or endangered status • We now have the science necessary to make sensible decisions, focused and informed management choices, and to monitor and track progress • We are a smart and caring citizenry who see the whole being larger than the individual parts • We still have time—if we act quickly and decisively 

So What, Extinction?

Human activities are driving the accelerating rate of species extinction world wide. According to a poll conducted by the American Museum of Natural History and the Louis Harris survey research firm more than a decade ago[3] seven out of ten biologists believed the world was in the midst of the fastest mass extinction of living things in the 4.5 billion-year history of the planet. A majority (70 percent) of the biologists surveyed believed that, during the next 30 years, as many as one-fifth of all species alive today will become extinct, and a third of them think as many as half the species on Earth will die out in that time.

Ten years later scientists warned that endangered species may become extinct 100 times faster than previously thought, as they re-assessed the threat to global biodiversity. Writing in the journal *Nature,*[4] leading ecologists claimed that previous methods used to predict when species will die out were seriously flawed and dramatically underestimated the speed at which some plants and animals will be wiped out.[5]

Aside from the critical roles that species provide for maintaining the world's webs of life, they also provide humans with enormous benefits in the form of food, fiber, pharmaceuticals and other "free" services that are essential to our well being. For this reason, we all have a vested interest in preventing the extinction of any species, regardless how insignificant it may seem.

As Californians, and as a nation, we need to stop our state's native salmon, steelhead and trout from sliding ever closer to the brink of extinction. Not only are our fish important to the state's economy, but they are critical indicators of the health and well being of our state's environment. Their decline is symptomatic of systemically failing natural systems.

Although not all grazing, agricultural, recreational, and other activities are necessarily harmful to fish, the key stressors driving California's native salmon, steelhead and trout on their downward spiral and that need to be addressed include:

DAMS that block access to upstream habitat and/or have significant downstream effects

AGRICULTURE that diverts water, alters stream channels, and induces the run-off of silt, pesticides, salt, and other non-point source pollutants

GRAZING that modifies and adversely impacts riparian areas, water quality and streambeds

RESIDENTIAL DEVELOPMENT that impacts rivers and streams from levee construction, encroachment of the floodplain, diversions, and the run-off of silt and other non-point source pollutants

COMMERCIAL DEVELOPMENT that is often sited in riparian areas and harms fish from the construction of levees and diversions, and from non-point pollution run-off

INSTREAM MINING that alters streambed integrity, impacts spawning areas, and impairs water quality

OFF-STREAM MINING that can reduce water quality from off-stream open pits and from nearby abandoned mines

ROADS AND RAILROADS that are often located in stream corridors and frequently impair water quality, alter channels, and impede critical fish movement and migration

LOGGING that harms fish through tree removal and associated construction of logging roads resulting in sediment loading, loss of shade, and removal of woody debris that provides important cover and nutrients

RECREATION that impacts water quality and riparian habitats from off road vehicle use and from modified river flows for boating and rafting enthusiasts

POACHING that reduces populations through illegal removal of fish by anglers and commercial fishers and through inadequate fishing regulations

HATCHERIES that reduce the reproductive capacity and fitness of wild fish populations through hybridization and competition with hatchery fish for food and rearing habitat

INVASIVE SPECIES that can harm wild fish through predation, competition, parasites and disease

[3] http://www.amnh.org/museum/press/feature/biohall.html

[4] Melbourne, B.A. and A. Hastings. 2008. Extinction risk depends strongly on factors contributing to stochasticity. Nature 454:100–103.

[5] International Union for the Conservation of Nature. 2008. IUCN Red List reveals world's mammals in crisis. http://iucn.org

Introduction and Overview

California supports 31 distinct kinds of native salmon, steelhead and trout species,[6] 20 of which are found only in our state (Table 1). The anadromous forms—Chinook, coho, pink, and chum salmon, and coastal cutthroat and steelhead trout—are adapted to California's distinct coastal regions and include the southernmost populations of their species. These fish are prized for their economic importance and for their recreational, aesthetic and iconic attributes.

As seen in Table 1, most populations of California's native salmon, steelhead, and trout are in serious trouble. It is projected that 65 percent of our state's native salmonid species will be extinct within the next 100 years if present trends continue. Fully 65 percent of the species headed toward extinction are found only in California.

Most Californians are unaware of the magnitude of the problems facing our fisheries. Thousands of miles of California's rivers and lakes, home to our native fish, suffer from inadequate water flows, poor water quality, increased temperatures, barriers and diversions, and now—global climate change. We can no longer accept the *status quo,* but rather need a fresh new approach, strategy and blueprint to balance the water that our fish and that our families and communities so urgently need.

The absence of an objective analysis of California's native salmon, steelhead and trout populations prompted California Trout into action. More than two years ago, California Trout commissioned Dr. Peter B. Moyle of U.C. Davis to undertake a ground-breaking review and assessment of all 32 of California's native salmonids. The goal of this effort was to develop the gold standard methodology for assessing the status and trends of California's salmonid populations. Our responsibility is to harness what the fish are telling us in order to formulate scientifically-based approaches and recommendations on how to best manage, regulate, conserve, use and reuse our state's precious water resources.

The foundation of *SOS: California's Native Fish Crisis—Status of and solutions for restoring our vital salmon, steelhead and trout populations* is built upon the 32 full life history accounts that were prepared by Dr. Peter Moyle, Dr. Joshua Israel, and Ms. Sabra Purdy. They have been published as *Salmon, steelhead and trout in California: status of an emblematic fauna*. These accounts, which have been subject to extensive peer review and comment, can be found on the CD attached to the report's inside front cover. *Salmon, steelhead and trout in California: status of an emblematic fauna* can also be viewed and downloaded from California Trout's website (www.caltrout.org) to provide the original, comprehensive, peer-reviewed source documents that served as the basis for the 32 species accounts, as well as the report recommendations, which follow.

Table 1. Endangerment Summary

	SPECIES COMMON NAME	SPECIES SCIENTIFIC NAME	SPECIES STATUS (STATE AND FEDERAL LISTING)	STATUS
SALMON	Central California Coast Coho Salmon	*Oncorhynchus kisutch*	State and Federally endangered	1
	Chum Salmon	*Oncorhynchus keta*	State Species of Special Concern	1
	Pink Salmon	*Oncorhynchus gorbuscha*	State Species of Special Concern	1
	California Coast Chinook Salmon	*Oncorhynchus tshawytscha*	Federally threatened	2
	Central Valley Late Fall Chinook Salmon	*Oncorhynchus tshawytscha*	State and Federal Species of Special Concern	2
	Central Valley Spring Chinook Salmon	*Oncorhynchus tshawytscha*	State and Federally threatened	2
	Sacramento Winter Chinook Salmon	*Oncorhynchus tshawytscha*	State and Federally endangered	2
	Southern Oregon/Northern California Coast Coho Salmon	*Oncorhynchus kisutch*	State and Federally threatened	2
	Upper Klamath–Trinity Rivers Spring Chinook Salmon	*Oncorhynchus tshawytscha*	State Species of Special Concern, Federal Sensitive Species	2
	Upper Klamath–Trinity Rivers Fall Chinook Salmon	*Oncorhynchus tshawytscha*	Federal Sensitive Species	3
	Central Valley Fall Chinook Salmon	*Oncorhynchus tshawytscha*	Federal Species of Special Concern	4
	Southern Oregon/Northern California Coastal Chinook Salmon	*Oncorhynchus tshawytscha*	Federal Sensitive Species	4
STEELHEAD	Klamath Mountains Province Summer Steelhead	*Oncorhynchus mykiss*	State Species of Special Concern	2
	Northern California Coast Summer Steelhead	*Oncorhynchus mykiss*	Federally threatened	2
	South-Central California Coast Steelhead	*Oncorhynchus mykiss*	Federally threatened	2
	Southern Steelhead	*Oncorhynchus mykiss*	Federally endangered	2
	Central California Coast Steelhead	*Oncorhynchus mykiss*	Federally threatened	3
	Central Valley Steelhead	*Oncorhynchus mykiss*	Federally threatened	3
	Northern California Coast Winter Steelhead	*Oncorhynchus mykiss*	Federally threatened	3
	Klamath Mountains Province Winter Steelhead	*Oncorhynchus mykiss*	Federal Sensitive Species	4
TROUT	Bull Trout	*Salvelinus confluentus*	Extinct	0
	California Golden Trout	*Oncorhynchus mykiss aguabonita*	State Species of Special Concern	2
	Eagle Lake Rainbow Trout	*Oncorhynchus mykiss aquilarum*	State Species of Special Concern, Federal Sensitive Species	2
	Kern River Rainbow Trout	*Oncorhynchus mykiss gilberti*	State and Federal Species of Special Concern	2
	Lahontan Cutthroat Trout	*Oncorhynchus clarki hensawi*	State and Federally threatened	2
	Little Kern Golden Trout	*Oncorhynchus mykiss whitei*	State Species of Special Concern, Federally threatened	2
	McCloud River Redband Trout	*Oncorhynchus mykiss stonei*	State Species of Special Concern	2
	Paiute Cutthroat Trout	*Oncorhynchus clarki seleniris*	Federally threatened	2
	Coastal Cutthroat Trout	*Oncorhynchus clarki clarki*	State Species of Special Concern	3
	Goose Lake Redband Trout	*Oncorhynchus mykiss ssp.*	State Species of Special Concern	3
	Coastal Rainbow Trout	*Oncorhynchus mykiss irideus*		5
	Mountain Whitefish	*Prosopium williamsoni*		4

[6]Although this report contains 32 species accounts, because the bull trout is extirpated from California it is not included in the figures and percentages, which are based on 31 species, discussed below.

Major Findings

The Salmonidae is a family of fish species that require cold water of high quality for their existence. They are extraordinarily diverse in their life histories, ranging from large silvery species that cruise vast areas of ocean to small brightly-colored species that spend their lives in only a few tiny creeks. Because there is enormous human demand for the water these fish require, they are emblematic of the waters and water problems of the Pacific coast, valleys and mountains.

California contains the southernmost populations of salmon and steelhead, as well as endemic trout species, all of which are uniquely adapted to the state's climatic regime and complex terrain. These fish are in deep trouble. One species, the bull trout, is already extinct in the state and 65 percent (20) of the 31 remaining kinds will be extinct in California within the next century if present trends continue; 65 percent of the salmonids in trouble are found only in California. Of the 22 anadromous forms, 13 (59 percent) are in danger of extinction, while seven (78 percent) of the nine living inland forms of trout are in danger of extinction. All of the species still support, or historically supported, commercial and recreational fisheries, so they have economic as well as cultural value. They also are strong indicators of the health of California's streams, with large self-sustaining populations of native salmon and trout found mainly where watersheds are reasonably intact ecologically and in good condition.

BULL TROUT *Salvelinus confluentus*

Bull trout were last seen in California in the 1970s in the McCloud River. They disappeared because of the effects of Shasta and McCloud dams.

RAINBOW TROUT/STEELHEAD *Oncorhynchus mykiss*

Rainbow trout and steelhead have adapted in many extraordinary ways to California's diverse rivers, variable climate, and complex topography. There are 15 different kinds of rainbow trout in California, many of them formally recognized as subspecies. All display distinct, genetically-based attributes, especially in their life histories, that have allowed one form or another to live in virtually all of California's fresh waters. Most are in trouble.

- **Klamath Mountains Province winter steelhead** are declining.
- **Klamath Mountains Province summer steelhead**, that migrate to and remain in the upper parts of a few watersheds, are barely holding on at present.
- **Northern California Coast winter steelhead** are listed as a threatened species but can still be found in most of their watersheds.
- **Northern California Coast summer steelhead**, once abundant, are federally-threatened and barely holding on in remote headwaters of the Eel, Mattole, and Mad Rivers, and Redwood Creek.
- **Central Valley steelhead**, listed as federally-threatened, are in decline as a result of water projects and interactions with hatchery raised steelhead.
- **Central Coast steelhead** are listed as federally-threatened because of problems with the small coastal watersheds they inhabit.
- **South-Central California Coast steelhead** are federally-listed as threatened. Closely related to the Southern steelhead, South-Central Coast steelhead threats include generally smaller coastal watersheds, passage barriers and water diversions.
- **Southern steelhead**, federally-listed as endangered, suffer the difficult problem of trying to survive in heavily urbanized landscapes and from the region's ubiquitous passage barriers and water diversions.
- **Coastal rainbow trout** are the standard widespread rainbow trout of California, supporting fisheries all over the state, in part from hatchery planting programs. These trout have been widely introduced into waters in which they were not native, sometimes creating problems for native fish.
- **California golden trout**, the official state fish and native to a few streams in the southern Sierra Nevada, are in danger of disappearing as a pure form because of hybridization and stocking of non-native trout.
- **Little Kern golden trout**, with an even more restricted range than the California golden trout, are listed as a federally-threatened species.
- **Kern River rainbow trout**, native to the upper Kern River, continue to reside in a few small tributary streams.
- **McCloud River redband trout**, found in just a few small streams on Mt. Shasta, have stable but very small populations.
- **Goose Lake redband trout**, of extreme northeastern California, are a management success story as their habitat steadily improves, although the effects of climate change may create new challenges for these fish.
- **Eagle Lake rainbow trout**, the trophy trout of Eagle Lake, is on the verge of extinction as wild fish; today, the fishery is supported entirely by hatchery production.

CUTTHROAT TROUT *Oncorhynchus clarki*

Cutthroat trout has three distinct subspecies in California.

- **Lahontan cutthroat trout**, state- and federally-listed as a threatened species, were once the primary native trout species of the Eastern Sierra Nevada but are now confined to a few small wild populations, augmented by hatchery-supported populations.
- **Paiute cutthroat trout**, federally-listed as threatened, are native only to Silver King Creek in Alpine County; they survive only because they were transplanted to other streams outside their native distribution.
- **Coastal cutthroat trout**, a sea-run species, are still fairly common in north coast streams, south to the Eel River, but sea-run populations have declined.

CHINOOK SALMON *Oncorhynchus tshawytscha*

Chinook salmon, the big-river salmon of California, once supported major commercial and recreational fisheries, many of which are now closed. There are eight 'kinds' in the state, all having distinctive life history adaptations to local conditions, all showing high resilience in the face of human damage to their rivers, and all in decline with some verging on extinction.

- **Southern Oregon/Northern California Chinook salmon** are not particularly abundant in California but are in less severe decline than most other Chinook populations.
- **Klamath–Trinity fall Chinook salmon** are supported by hatcheries so are not in danger of extinction although naturally produced Chinook are in low abundance and their runs have declined as a result of basin-wide problems.
- **Klamath–Trinity spring Chinook salmon** are essentially confined to the upper Salmon River and South Fork of the Trinity River where they remain through the summer and are highly vulnerable to extirpation.
- **California Coast Chinook salmon** are federally-threatened and relatively scarce because of widespread impacts to their watersheds from decades of logging and other human induced factors.
- **Central Valley fall Chinook salmon** are probably 80-to-90 percent of hatchery origin; although the natural fishery has collapsed, the run will presumably continue to persist.
- **Central Valley late fall Chinook salmon** are a distinctive, if increasingly small, run of large salmon that receive little attention from managers compared to the other three, more widely recognized runs.
- **Sacramento winter Chinook salmon**, the most distinctive of California's Chinook salmon, are state- and federally-listed as endangered because Shasta Dam has completely divorced them from their historic habitats.
- **Central Valley spring Chinook salmon** were once at least as abundant as fall Chinook but, because of the construction of large dams, are now confined to a few small streams and are state- and federally-listed as a threatened species.

COHO SALMON *Oncorhynchus kisutch*

Coho salmon are rapidly being lost from the state after having been a mainstay of California's sport and commercial fisheries. These fish are characteristic of coastal streams with cold, permanent flows and intact forests. Coho salmon and California's coastal rainforests are virtually synonymous.

- **Southern Oregon/Northern California Coast coho salmon** are state- and federally-listed as a threatened species and still persist in much of their historic range, although most populations are probably not viable.
- **Central California coast coho salmon** track the coastal forests down to Santa Cruz but are on the verge of extinction, except possibly in Lagunitas Creek, Marin County. They are state- and federally-listed as an endangered species.

PINK SALMON *Oncorhynchus gorbuscha*
CHUM SALMON *Oncorhynchus gorbuscha, Oncorhynchus keta*

Pink and **chum salmon** have never been common in California's coastal streams, but they once contributed to salmon fisheries here. The few populations that have persisted probably will not last much longer.

MOUNTAIN WHITEFISH *Prosopium williamsoni*

Mountain whitefish still seem to be doing fairly well in their native rivers of the eastern Sierra, although little is known about the species' present status and trends.

Of the 13 species of anadromous salmonids facing extinction, the ones that are at the greatest immediate risk of extinction are pink salmon and chum salmon, southern steelhead, and coho salmon. Coho salmon numbered in the hundreds of thousands only 50-to-60 years ago and were significant parts of the state's coastal stream and ocean ecosystems. Other salmonids facing extinction are the two groups of summer steelhead and the two groups of spring Chinook salmon. Both types of fish are unusually vulnerable because their once widespread populations are now confined to a few small headwater streams into which they migrate to spend the summer before spawning. This makes these fish extremely prone to a wide array of factors, from poaching to climate change.

In contrast, there are nine anadromous salmonids that do not appear to be in danger of extinction, although most are in decline so the commercial and recreational fisheries they support may diminish or be lost altogether. Remarkably, populations of all species of coastal salmon and steelhead continue to exist throughout much of their native ranges, albeit in fragmented and markedly decreased numbers. They will continue to survive and persist only through focused and sustained efforts to protect their watersheds and stream flows along the entire California coast.

Seven of California's ten resident non-anadromous salmonids are in trouble, largely because they are endemic to a few streams in very small and isolated areas, such as the three species of golden trout in the Upper Kern River basin. In these isolated areas, they are exceptionally vulnerable to hybridization with introduced salmonids, primarily rainbow trout, as well as at risk to grazing, logging, and other human-induced factors.

The fact that California's salmonids still have scattered populations throughout their historic ranges, and that only one species has gone extinct, is a testament to their resilience in the face of ever increasing demands by humans for the resources they need to survive—abundant, cool, clean water. Their tenacity also provides Californians the opportunity to reverse course and chart a brighter future for our native salmon, steelhead and trout.

Saving California's native salmon, steelhead and trout will not be easy, but there is a pathway to their future and one that we all must follow. Doing so will not only protect our unique biological heritage, but will also guarantee the continued delivery of ecosystem services—such as abundant, cool, clean water—that salmonid streams provide and upon which our families, our communities, our economy, and our very security depend.

Report Implications[7]

California's magnificent native salmon, steelhead and trout are excellent barometers of the health of our waters, but they are in serious trouble. Unless we collectively and immediately embark on a series of sweeping, innovative and long-term solutions, the science resoundingly concludes that the majority of our native salmonids will be driven to extinction within the next 100 years, if not sooner.

Global climate change, unbalanced and unsustainable water policies, and habitat fragmentation and destruction—all the result of human activity—have put our fish at risk. We all share the responsibility to take charge of their destiny and apply human spirit and restorative determination to make a lasting place in the world for California's native salmon, steelhead and trout.

This report serves as a wake up call to all Californians who care about a future blessed with healthy fisheries, intact ecosystems and the public services they provide, vibrant and sustainable economies, and keeping our communities whole—all which are inextricably bound to sustained supplies of abundant cool, clean water.

As Dr. Peter Moyle has said, "the fish don't lie," meaning that their survival and well being are a mirror into our own survival and well being. The precipitous, widespread and unprecedented decline in California's native salmonids is delivering a clear and compelling a message: all is not well for our rivers, lakes and streams that suffer from a series of insults such as reduced flows, diversions, sedimentation, pollution, increased temperatures, migrational barriers and invasive species, to name a few.

This is why, in the coming years, California Trout will continue working in our communities, in our regional offices, and in Sacramento to stem the tide and reverse course for our fish by championing:

- **Water for Fish and People** to provide sufficient water quality and quantity to meet the needs of fish and people
- **Genetic Integrity of California Native Trout and Steelhead** to protect the long-term sustainability and genetic integrity of California's native trout and steelhead
- **Habitat Connectivity** to provide access to habitat components necessary for all life history strategies of our native salmon, steelhead and trout
- **Ecosystem Protection, Enhancement and Restoration** to protect and restore ecosystem functions necessary for recovered and sustainable native fisheries

Like fish, we need clean water … for drinking, for bathing, for cooking, for the coffee that starts our day, for feeding our families, and for virtually everything we do that sustains our lives morning, noon and night. If our fish—which require the same abundant, cool, clean water that we do—are unhealthy and failing, then what hope have we for a prosperous economy and sound quality of life?

Despite the enormity of the challenges before us, as well as the complex and seemingly insurmountable obstacles that must be overcome in order to turn the tide, there is hope, there is opportunity, and there is a bright pathway to the future—for our fish, for our rivers and streams, for our children, and for our families.

This report compels us into action. Listening to the science and "what the fish are telling us," California Trout is meeting with academic experts and water policy authorities, local community citizen groups and government officials, industry representatives and business officials, and conservation groups and commercial leaders, to develop a set of recommendations that, put into action, will reverse the current downward spiral of our fish, of our environment, and of our waters.

Possible recommendations—such as preparing for climate change and regulating California's groundwater resources—must inspire, and will require, sweeping, major long-term policy reforms. These "at scale" changes, which will take time and succeed only by marshaling unqualified support at the highest levels of government, are beyond the scope and capacity of a single non-profit organization like California Trout. They will require deep collaboration with a broad and diverse spectrum of interests, including agricultural irrigators, municipalities, water districts, energy producers, and residential developers, to name a few. Other recommendations—such as establishing fish refugia to strengthen the state's authority under the Wild and Heritage Trout program and water reuse and recycling programs—present enormous opportunities for local watershed groups and place-based conservationists who are already working on the ground in their communities to address these challenges.

A fundamental conclusion of the report is that our fish need a voice—ambassadors, advocates, and champions—to parlay their plight into forward-thinking policies that will provide sustained abundant, cool, clean water for people and for fish. Therefore, a first pair of recommendations

The California Golden Trout—A Conservation Success Story

More than a decade ago, California Trout recognized that the California golden trout—our state fish—was in danger of becoming extinct. Partnering with conservation organizations and agencies, California Trout has embarked on an ambitious program to keep the golden trout from becoming another federally-listed species.

The plight of this unique California fish began more than a century ago when livestock were introduced into the high elevation meadows of the southern Sierra Nevada. The intensive and unmanaged grazing in and along the sensitive streambeds destroyed the golden trout's habitat by reducing native vegetation, trampling banks, and degrading water quality. Meanwhile, the species' genetic purity was being eroded by hybridization with non-native trout and through direct competition and predation. The future of California's state fish was at risk.

In the early 1990s, California Trout was instrumental in completing a Conservation Strategy program for golden trout. Building on this program, in 2004, California Trout and Trout Unlimited, through the generous support of Orvis and the National Fish and Wildlife Foundation, established the Golden Trout Project which sought to protect and restore pure strains of California golden trout. As a bold new model based on collaboration, the project brought together conservation groups, state and federal agencies, and a cadre of volunteers with the singular purpose of re-establishing pure genetic strains of golden trout to their native waters.

With the establishment of a Conservation Strategy plan and the Golden Trout Project, California golden trout have benefited through the thousands of volunteer and agency hours that have gone into improving riparian and aquatic habitats, inventorying populations, collecting genetic samples, and supporting scientific research documenting the potential benefits to the fishery from retiring grazing allotments. California Trout has also helped develop education and outreach programs to inform the public about the plight of the golden trout and what they can do to help protect and recover this magnificent native trout species.

Although much remains to be done before the California golden trout is restored to historic population numbers, especially reducing threats from non-native trout, we are proud to say that the goldens are on the road to recovery!

PHOTO: ANDREW MAURER

PHOTO: ANDREW HARRIS

[7]This section was authored by California Trout.

focus on the need to revitalize and increase the capacity of the Department of Fish and Game—the state public trust agency legally vested to manage, protect and conserve the state's fish and wildlife resources and the habitats on which they depend. Also critical to the future of our fish is an engaged, supportive and strong presence of our federal natural resource agencies, in particular the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, the U.S. Forest Service, and the National Park Service. Ensuring that these key agencies make fish a priority will be essential to protecting the lands and habitats they manage and administer, and in meeting their obligations that the waters flowing through them are abundant, cool, and clean and support healthy fisheries.

But government reinvigoration and reform is only one part of the solution—the fish need much more if they are to thrive and flourish into the 21st century. This is why California Trout has framed a third set of recommendations that seek to leverage the skill, expertise, experience, and passion of the non-profit conservation community in playing a leadership role in protecting and restoring our state's imperiled fish. We recognize the nimbleness, entrepreneurial spirit, and ability of private-public partnerships and collaborations to "get things done" on the ground and that this must be an important part of our strategy and our solution.

Finally, California Trout understand that our efforts to reform and revitalize the Department of Fish and Game and, to a lesser extent, foster and develop greater private-public partnerships, are long-term investments that will take time before yielding results. As "Keeper of the Streams," we will remain vigilant in our advocacy work that is core to our mission, our legacy, our constituents, and the fish. Said differently, we will continue working across the state in our regional offices—the North Coast, Mt. Shasta, Eastern Sierra, Tahoe, and Southern California—and in Sacramento to aggressively pursue ongoing programs and projects for protecting native salmon, steelhead and trout.

Fostering long-term change at a scale and level commensurate with the needs so clearly documented in this report, while remaining true to our near-term work at the regional and watershed level will provide the necessary balance in doing what is "right by the fish." To this end, California Trout will redouble its efforts through its conservation science, advocacy, and policy programs, both in our regional offices and in Sacramento, to inspire the public and opinion leaders to chart a bright, hopeful and positive pathway forward for California's native salmon, steelhead and trout. There are limitless opportunities for everyone—regardless of political stripe, expertise or location—to play an important role in dramatically changing the course of California's water policies and in helping to chart a brighter tomorrow for our fish, our families, our environment, and our economy. Advocating for change, no matter how large or small it may be, is the only way to realize change.

Long-Term Recommendations

Water for Fish, Water For Wildlife, Water for People—Revitalizing the California Department of Fish and Game

The California Department of Fish and Game, a department of the Resources Agency, is responsible under the state constitution and by statutory law for managing and conserving California's diverse fish and wildlife and the habitats on which they depend. In turn, the California Fish and Game Commission, composed of up to five members appointed by the Governor and confirmed by the Senate, is responsible for formulating general policies for the conduct of the Department that the Director is responsible for administering.

The future of California's wildlife depends on an agency that is unwavering in mission, focused on purpose, relentless in pursuit of excellence, and committed completely to advocating for the state's natural resources. Fully utilizing the Department's existing authorities and enforcing laws already on the books will go a long way to protecting and restoring our fish. However, the Department must have adequate statutory authority necessary to meet its mission, as well as the political independence, and the financial capacity to meet its myriad legal and administrative public trust responsibilities for conserving California's fish and wildlife.

As noted time and again in this report, the lack of abundant, cool, clean water is the fundamental barrier to healthy fish, healthy wildlife, healthy communities, healthy economies, and a healthy quality of life. Restructuring the Department of Fish and Game's statutory authority, providing it additional financial resources, and inculcating a long-term vision for the fish are all critical to the successful revitalization of the Department that California Trout advocates. More effectively working with the California Department of Water Resources and the State Water Resources Control Board to promote sound water policies that benefit people and fish will also go a long way towards addressing the fish crises detailed in this report.

Girding the Department with an engaged, committed and mobilized constituent base will ensure that our fish become the change agents for how we value, use, reuse, recycle, and conserve our state's water resources—for people and for fish. It is our hope that this report will inspire and empower citizens across California in joining hands to address the systemic need which we all share—sustained supplies of abundant, cool, clean water.

THE FIRST PROBLEM

An Agency Awash in Unfunded Mandates

The California Department of Fish and Game's stated mission is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. As outlined by the 1990 Little Hoover Commission Report,[8] the key responsibilities within the Department include:

- Preserving, protecting and managing California's fish, game and native plants, without respect to their economic value.
- Conserving California's wildlife and wildlife habitat.
- Acquiring land, water and water rights to ensure game and fish propagation.
- Acquiring land, water and water rights to ensure ecological preserves.
- Identifying, inventorying, supporting and managing special programs for endangered/or rare species.
- Monitoring operation of all dams that affect waters containing fish.

In order to carry out these broad responsibilities successfully, the Department needs to have clear priorities, a focused plan, strong leadership, governmental and constituent support, and adequate funds. Compelling evidence suggests that the Department should seek improvement in each of these areas.

For decades, formal reviews of the Department's performance have highlighted its inability to fulfill its responsibilities and to adequately pursue its mission. Reports have cited the causes for these lapses due to insufficient funds and "unfunded mandates," improper management of financial resources, inappropriate influence of politics, mismanagement, and inefficient structuring. Again, as noted by the 1990 Little Hoover Commission report, there was "universal" frustration with the Department expressed by farmers, developers, anglers, hunters and conservationists, attitudes that continue today. The 1990 report cited the following specific challenges within the Department:

- Unfunded Mandates—the Department had been given broad environmental protection mandates without adequate funds commensurate with those duties.
- Fiscal Auditing Systems—the Department had antiquated information management systems incapable of tracking its income and expenses.

[8] Little Hoover Commission. 1990. Report on the California Fish and Game Commission and Department of Fish and Game. Little Hoover Commission, Commission on California State Government Organization and Economy.

- Improper Fund Allocation—the Department was incapable of responsibly allocating its resources to monitor, research, or enforce laws to protect California's natural resources.
- Political Influence—too frequently scientific opinion and research was brushed aside whenever it conflicted with outside political agendas and priorities.

Evaluations since the Little Hoover Commission study, such as a 1991 Legislative Analyst's Office Report,[9] a 1995 State Auditor's Report,[10] the Governor's California Performance Review,[11] and the Department's own 2005 Wildlife Management Action Plan,[12] found some or all of these issues to be a continuing problem. The Department of Fish and Game's inability to carry out its responsibilities has consequences that are detrimental to the protection and restoration of wild and native salmonids and our state's rivers and streams. These include:

- Insufficient and inconsistent scientific monitoring and assessment of species and habitats
- Unclear priorities for managing inland fisheries as a core Department mission
- Lack of consultation on environmental assessments, such as
  - Federal land management decisions,
  - Water diversions and minimum instream flow requirements,
  - Timber harvest plans,
  - Hydropower relicensing,
  - Dam decommissioning, and
  - Other infrastructure and development proposals.
- Unimplemented
  - Steelhead recovery plans,
  - Salmon recovery plans, and
  - Wild and native trout recovery plans.
- Lack of enforcement of state sport fishing regulations, streambed alteration projects, and water diversions
- Inadequate leadership in local and state long-term development planning
- Inadequate leadership on climate change, state water planning, and state budgeting; and
- Insufficient coordination between the Department of Fish and Game and other local, state, and federal government bodies.

THE FIRST SOLUTION

Perhaps the most pressing and universally-embraced need is to develop new and more stable funding sources for the Department of Fish and Game. Such funding must have broad public support, be explicitly restricted to the Department's fish and wildlife conservation programs, and immune to administrative raids (i.e., "borrowing").

THE FIRST RECOMMENDATION

Within the next year, create an independent panel for the purpose of identifying and recommending to the state's executive and legislative branches of government new funding sources for the California Department of Fish and Game's fish and wildlife conservation programs. The panel should be charged to evaluate existing programs being successfully implemented as well as new and innovative funding programs in other parts of the country. Possible funding strategies that the panel might review and consider include:

- Missouri's one-eighth of one percent sales tax dedicated to the Missouri Department of Conservation.
- The current ballot initiative effort underway in Minnesota to establish a three-eighths of one percent conservation sales tax and in other states, such as New Hampshire and Vermont.
- Increased user fees.
- Changing the Fish and Game Code to ensure that monies collected from angler licenses are spent on fish-related activities.
- Enactment of state excise taxes on outdoor and recreational equipment modeled on the hugely successful federal Pittman–Robertson and Dingell–Johnson programs.
- Surcharges on vehicular speeding fines dedicated to wildlife conservation, such as those in Florida.
- State lottery programs, such as that in Colorado, in which a portion of the revenue proceeds is dedicated to conservation programs.
- Surcharges on water deliveries and transfers.
- Surcharges on beverages, bottled water products, water bills and other water transactions.
- Surcharges on motorized aquatic recreational equipment, including personal watercraft.

Within the next two years, if not sooner, pursue the necessary state legislation, budgetary, and other executive branch changes needed to adopt and implement the independent panel's recommendations for providing new, additional, and stable funding for the Department of Fish and Game's fish and wildlife conservation programs.

THE SECOND PROBLEM

An Unfulfilled Agency

As noted above, the Department of Fish and Game lacks the funds to implement and enforce many of the laws and regulations already in place. It also lacks legal authority that is comprehensive, contemporary, and reflective of the complexities that are required to manage, monitor, protect and restore California's rivers and streams for fish and wildlife into the 21st century. Updating and, where necessary, revising this authority and creating a mission that is bold and audacious will spark the spirit so urgently needed to fundamentally change the Department and the *status quo* for our fish, our families and our future.

THE SECOND SOLUTION

Review and analyze the California Department of Fish and Game's existing fish restoration plans, such as the Recovery Strategy for California Coho Salmon, Steelhead Restoration and Management Plan for California, Strategic Trout Plan, and others, to determine how well the plans are being implemented and to prescribe the actions necessary to fully implement them. In addition, review the Department's current legal authority for protecting California's rivers, streams, and salmonid resources and identify statutory or regulatory deficiencies for protecting these resources that can be addressed through the necessary legislative and/or administrative reforms.

THE SECOND RECOMMENDATION

Within the next year, create an independent panel modeled after the 1990 Little Hoover Commission to conduct a comprehensive review of the Department of Fish and Game's current authority for protecting and restoring California's rivers, streams, and salmonid resources. In addition to identifying statutory and regulatory gaps, the panel should also examine the Department's unused and underutilized legal authority to protect and restore fish, policies and programs that are duplicative, contradictory and at cross-purpose, and areas that can be streamlined and made more efficient without compromising core environmental protections and safeguards. Based on its findings, the panel would recommend legislative, regulatory and administrative reforms to revitalize and reinvigorate the Department's salmonid conservation programs.

Within the next two years, if not sooner, initiate and pursue the legislative and executive branch actions required to adopt and implement the independent panel's recommendations. One possibility would be to enact new legislation, such as a California Stream Life Protection Act, to provide the Department of Fish and Game with the full complement

[9]California Legislative Analyst's Office Report. 1991. A Review of the Department of Fish and Game: Issues and Options for Improving its Performance. California Legislative Analyst's Office. http://www.lao.ca.gov/1991/090391_FishandGame.pdf

[10]http://bsa.ca.gov/pdfs/reports/2004-122R.pdf

[11]Department of Natural Resources. 2005. California Performance Review. A Government for the People for A Change. Chapter 8. January. http://cpr.ca.gov/report/

[12]U.C. Davis Wildlife Health Center for the California Department of Fish and Game. 2005 and 2007. California Wildlife, Conservation Challenges: California's Wildlife Action Plan. www.dfg.ca.gov/habitats/wdp/

of statutory and regulatory authority needed to protect and restore California's rivers and streams. Such a statute might authorize, direct, and fund the Department to:

- Monitor and assess all rivers and streams to determine base flows needed for sustained fish and wildlife populations and mandate the protection of key biological, chemical and physical characteristics of those rivers and streams.
- Ensure that Public Resources Code Sections 10000–10005 are fully and vigorously implemented and enforced by bolstering the Department's biological and legal divisions.
- Prepare a comprehensive and unified statewide fisheries conservation management plan that integrates protection and restoration strategies for all of California's 31 species of native salmon, steelhead and trout. Central to this plan would be the development of individual conservation strategies for each of the 31 species with the goal of achieving self-sustaining populations throughout their range for the indefinite future. These strategies must take into account climate change, increased water demand, existing and new water efficiency and conservation measures, and changed land use practices. An initial step in implementing the strategy might be to evaluate those species identified in this report at greatest risk of extinction for formal listing under state and/or federal law as either threatened or endangered and take other remedial action, such as developing recovery plans pursuant to Fish and Game Code section 2105.
- Develop strategies and programs to immediately provide additional protection to "salmonid strongholds," a concept proposed by the Wild Salmon Center, where salmonid diversity is high and habitats are intact and in reasonably good condition. For example, protocols might be established that require minimizing human activities within stronghold watersheds, predicated on the precautionary principal of managing the area's streams first and foremost for fish.
- Pursuant to AB 7, SB 384, SB 1262, and Hatchery Genetic Management Plans as required by ESA listings, develop a statewide hatchery policy that has as its primary goal the protection of wild populations of fish rather than enhancing fisheries and that requires all hatchery fish be marked and mark-selective fisheries instituted where appropriate.
- Develop a salmonid outreach and awareness program for the public and public schools that make native salmon, steelhead, and trout emblematic of California.
- Develop a statewide research and monitoring program for salmonids and other cold-water fishes that would be funded by state and federal agencies.
- Enforce and, where appropriate, strengthen existing laws and regulations, such as the state and federal endangered species acts, the Z'berg–Nejedly Forestry Practice Act, revised sections 710–712 of the Fish and Game Code, the Water Code and Public Resources Code, Clean Water Act and other statutes to increase protection for salmonids and their rivers.
- Prioritize conservation efforts for endemic trout that have limited distribution.
- As part of the "salmonid stronghold" concept, establish permanently protected fish refugia as a pro-active strategy for conserving genetic diversity in the face of global warming and to provide a focal point for government, private sector, and non-profit collaborative conservation efforts.
- More fully utilizing existing policies and programs, such as the Department of Fish and Game's Strategic Trout Management Plans, Wild and Heritage Trout Plans, Steelhead Restoration and Management Plan, and Recovery Strategy for California Coho Salmon, would be an important step in this direction.
- Target as a priority for protection special habitats that have high value to multiple native salmonid species—such as coastal lagoons and estuaries.
- Provide for robust, continuous scientific research and monitoring and for developing a simple legislative reporting tool to annually assess progress in protecting and recovering each of California's 31 species of native salmon, steelhead, and trout. Long-term, consistent monitoring will be critical to assessing the effectiveness of new and ongoing fisheries conservation policies and management decisions.

A Critical Piece of the Solution: Tapping The Private Sector And Inspiring Creative Collaborations To Protect And Restore Our Fish

While revitalizing and reforming the Department of Fish and Game—which is constitutionally entrusted with protecting our state's fish and wildlife resources—is critical to creating a bright and hopeful future for our rivers and streams, equally important is to leverage the skill, experience, expertise and passion within the conservation community to play a leadership role in protecting and restoring our state's imperiled fish. The nimbleness, entrepreneurial spirit and ability of the private sector to collaborate with non-government organizations to "get things done" on the ground in a timely and efficient manner make this an equally important area of focus. Simply said, our fish require much more than just government reform and capacity building if they are to flourish into the 21st century.

THE THIRD PROBLEM

California's Ecosystems are Unraveling

As this report documents, California's native salmon, steelhead and trout are spiraling downward, a clear bellwether that our state's ecosystems—notably those critical to fisheries production—are unraveling. The science is simple and straightforward: our fish are suffering because they lack abundant, cool, clean water.

To anyone who regularly reads the daily headlines, watches the evening news, traverses the state by plane, train, bus or automobile, rafts a favorite reach of river, hikes our public lands and open spaces, or fishes that "secret spot," the causes of our fisheries' demise are obvious and apparent. Our fish, our economy, and our communities suffer from poor water quality that is manifested by,

- Inadequate flows, when streams are robbed of their life-giving water, dry up, become too warm, or disappear altogether;
- Habitat degradation, when streambanks are trammeled, excessive sediment introduced, river corridors are channelized, and riparian cover removed;
- Habitat fragmentation, when artificial barriers are constructed, diversions installed, and impediments to free movement by fish are created; and
- Genetic degradation, when introduced and hatchery fish hybridize with our native salmon, steelhead and trout.

Equally apparent to even the most casual observer are the causes of California's poor water quality, including,

- Dams—that block access to upstream habitat and/or have significant downstream effects;
- Agriculture—that diverts water, alters stream channels, and induces the run-off of silt, pesticides, salt, and other non-point source pollutants;
- Grazing—that modifies and adversely impacts riparian areas and streambeds;
- Development—that impacts rivers and streams from levee construction, diversions, and the run-off of silt and other non-point source pollutants;
- Mining—that alters streambed integrity and impacts spawning areas;
- Roads and railroads—that are often located in stream corridors and frequently alter channels and impede critical fish movement and migration;

- Logging—that harms fish through tree removal and associated construction of logging roads resulting in sediment loading, loss of shade, and removal of woody debris that provides important cover and nutrients; and
- Recreation—that impacts riparian habitats from such things as off road vehicle use and modified river flows for boating and rafting enthusiasts.

THE THIRD SOLUTION

While remaining vigilant in our efforts to revitalize and reform state government, most notably the Department of Fish and Game, there are enormous untapped opportunities for greater collaboration between the public and private sector that will immediately benefit our native salmon, steelhead and trout. For example, California Trout is teaming with Pacific Gas and Electric to identify conservation strategies for restoring salmon and steelhead to the Sacramento basin; we are partnering with the Center for Watershed Sciences at U.C. Davis to implement cutting edge science on Mt. Shasta's cold spring water resources; we collaborate with like-minded organizations, such as The Nature Conservancy and Trout Unlimited, to promote common conservation goals and objectives; and we are engaging the Stanford Environmental Law Clinic to develop policy options and strategies for salmonid protection. Looking beyond government institutions and harnessing the creative power of the private and academic sector to produce real world tangible results will be critical to the successful protection and recovery of California's native salmon, steelhead and trout.

THE THIRD RECOMMENDATION

In the coming years, California Trout will work to protect and recover our state's native salmon, steelhead and trout through a diverse array of strategies and initiatives. Included in this approach is our commitment to,

- Create and empower unique public and private partnerships;
- Promote and improve on the ground restoration projects;
- Ensure adequate policy and regulatory oversight and reform;
- Conduct community outreach, education and involvement;
- Foster targeted, results-oriented science and research;
- Adequately fund monitoring programs;
- Create and institutionalize aquatic management methods, such as Aquatic Diversity Management Areas—watersheds that have as their top management priority the maintenance of aquatic biodiversity;
- Create economic incentives for aquatic species protection;
- Engage private landowners and foster a culture of acting to protect rivers and streams;
- Provide comprehensive legal oversight; and
- As appropriate, utilize land acquisition of key aquatic ecological hot spots.

Species Accounts

California's Native Salmon, Steelhead & Trout

What follows is the scientific heart of this report—32 accounts for each of California's native salmon, steelhead and trout species. Each species account has been distilled from the comprehensive, peer-reviewed full life history accounts prepared by Dr. Peter B. Moyle and his research team[13] at U.C. Davis and have been published as *Salmon, steelhead, and trout in California: status of an emblematic fauna.* Those readers interested in learning more about the science underlying the species accounts can view the full accounts on the CD attached to the report's inside front cover or by visiting California Trout's website (www.caltrout.org). Finally, readers might find the glossary provided at the end of the report a useful reference when reading this section.

Methods

This analysis sought to answer two primary questions. First, what is the population status of California's salmonids, both individually and collectively? Second, what are major factors responsible for their current status, especially for those species in decline?

The general approach taken to the analysis was to,

- *Select the taxa* for investigation.
- *Compile the existing literature* on native California salmonids.
- *Produce detailed accounts* of the biology and status of all 32 taxa.
- *Evaluate the status* of each taxon using a set of standard criteria.
- *Conduct an overall analysis* of the status of California's salmonids and of the factors affecting their status using the information summarized in the species accounts.

SELECTION OF TAXA In selecting the taxa, the research team primarily used species, subspecies, Evolutionary Significant Units (ESU), or Distinct Population Segments (DPS)—taxonomic assemblages already recognized and adopted by state and federal natural resource agencies.

[13]The U.C. Davis research team was Dr. Peter B. Moyle, Dr. Joshua A. Israel, and Ms. Sabra E. Purdy, assisted by Mr. Patrick K. Crain.

Explaining the Scores

In order to graphically simplify the many criteria used for ascertaining the state of a salmonid, a single score method is used as follows:

0 Extinct

1 Highly vulnerable to extinction in native range in the next 50 years

2 Vulnerable to extinction in native range in next 100 years

3 No immediate extinction risk but populations declining or small and isolated

4 No extinction risk; populations are large and appear to be stable

5 Populations expanding

However, the research team also recognized distinct life history variants of Chinook salmon and steelhead (i.e., summer steelhead). While these runs are not formally recognized by all management agencies, they nonetheless possess significant evolutionary and ecological differences. Although genetically similar to fall/winter runs in some of the watersheds they occupy, the spring/summer forms are so distinctive in their life history, including the immature reproductive state of migrating adults and holding through the summer in remote deep pools, that the team believed they deserved separate consideration for conservation of life history diversity within the species.

LITERATURE COMPILATION Much of the early literature used for the analysis had been compiled previously by Moyle et al. (1995)[14] and Moyle (2002).[15] Nonetheless, the research team conducted additional searches to (1) update information for each taxon, (2) analyze detailed summaries for taxa not treated adequately in previous reviews, and (3) find 'gray' literature not reported in previous accounts. The team also consulted with individuals and experts familiar with each taxon to gain a better appreciation of local conditions and its status.

PRODUCTION OF TAXON ACCOUNTS Two taxon accounts were prepared for each species. The full, peer-reviewed species accounts—or "main accounts"—are literature reviews with extensive documentation and have been published as *Salmon, steelhead, and trout in California: status of an emblematic fauna* and are posted on line at California Trout's website (www.caltrout.org). From these accounts, the research team produced condensed accounts—the versions presented in this report. Because the condensed accounts necessarily leave out many important details, readers should consult the main accounts as the basis for the information in the condensed accounts.

Each main account was drafted using a standard format (species description, taxonomic relationships, life history, abundance, factors affecting status, conservation, trends, and status). All drafts were reviewed and revised by the research team until they were reasonably satisfied with the accuracy of the drafts. These drafts were then sent out for review by one or more biologists familiar with the taxon and its status.

EVALUATION OF STATUS The status of each taxon was determined using six criteria (Table 2) that were scored on a scale of one-to-five where "one" was a low score and "five" a high score. The six criteria were then averaged to produce an overall score for each species. Taxa scoring a "one" or "two" were regarded as being in serious danger of extinction, while taxa scoring a "four" or "five" were regarded as reasonably secure for the immediate future. As noted above, additional information to support how each score was determined can be found in the main accounts.

Because the research team recognized that information for determining the status for some species was incomplete and uneven, it developed a "reliability index" (Table 3). Ranging from one-to-four, a reliability score of "one" indicated the status rating selected was unreliable because little peer-reviewed information was available, whereas a reliability score of "four" indicated the status rating selected was highly reliable, based on numerous accounts in the published and agency literature.

OVERALL ANALYSIS Finally, the team summarized the status rankings for all 32 taxa and for each of the six criteria used to determine overall status of California salmonids and to compare the status of anadromous and non-anadromous taxa.

[14]Moyle, P. B., R. M. Yoshiyama, J. E. Williams, and E. D. Wikramanayake. 1995. Fish species of special concern of California. California Department of Fish and Game, Sacramento, California. 2nd ed. 272 pp.

[15]Moyle. P. B. 2002. Inland Fishes of California. University of Press, Berkeley, California.

Table 2. Status by Taxon

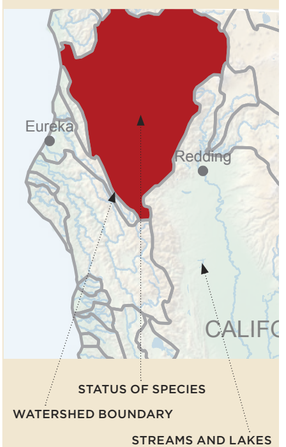
SCORE	1	2	3	4	5
AREA OCCUPIED					
INLAND	1 watershed/ stream system in CA only	2–3 watersheds/ stream systems w/o fluvial connections to each other in CA only	1–3 watersheds/ stream systems; populations present but depleted/rare outside CA	1–3 watersheds/ stream systems in CA but widely distributed outside CA	more than 3 watersheds in CA and widely distributed and abundant outside CA
ANADROMOUS	0–1 apparent self-sustaining populations in CA today	2–4 apparent self-sustaining populations in CA today	5–7 apparent self-sustaining populations in CA today	8–10 apparent self-sustaining populations in CA today	more than 10 apparent self-sustaining populations in CA today
BREEDING POPULATION SIZE	less than 50	50–100	100–1,000	1,000–10,000	10,000+
INTERVENTION NEEDS	captive brood-stock program or similar extreme measures required to prevent extinction	hatchery program using wild brood-stock or similar measures required for persistence	population persistence requires annual intervention	persistence requires periodic habitat improvements	self-sustaining population does not require intervention
ENVIRONMENTAL TOLERANCE	extremely narrow physiological tolerance during freshwater residence and/ or short lived, recruitment failure potential	narrow physiological tolerance during freshwater residence and/or short lived	moderate physiological tolerance during freshwater residence and/or short lived	broad physiological tolerance in fresh water and/or short lived	physiological tolerance rarely an issue during freshwater residence and/or long lived
GENETIC RISK	fragmentation, genetic drift, and isolation by distance owing to very low levels of migration, and/or hybridization with hatchery fish	limited gene flow among populations reduces risk although hybridization can continue to be a threat	moderately diverse genetically; hybridization risks low but present	genetically diverse but limited gene flow to other populations	genetically diverse with gene flow to other populations
CLIMATE CHANGE	vulnerable in all watersheds inhabited	vulnerable in most watersheds inhabited	vulnerable in portions of watersheds inhabited	low vulnerability due to location, cold water sources, and/or active management	not vulnerable to significant population loss due to climate change

Table 3. Reliability Index

RELIABILITY SCORE	STATUS SCORING RATIONALE
1	Status is based on educated guesses
2	Status is based on expert opinion using limited data
3	Status is based on reports found mainly in the gray literature
4	Status is based on reports from multiple sources including peer reviewed literature

Explaining the Maps

The following pages include maps that show the watersheds in which each species is found, the major rivers and lakes in each watershed, and the status of each species (color). Because the maps show entire watersheds, they do not necessarily reflect the limited distribution of species within the watershed, which is often reduced as a result of dams and other factors. The entire watershed is shown, even if the historic distribution was likely less expansive because precise historic limits are usually not known. The maps should thus be used as indicators of potential distribution rather than as exact indicators of distribution.



Central California Coast Coho Salmon

Oncorhynchus kisutch

PHOTO: MORGAN BOND

Central California coast coho salmon are one of two kinds of coho in California which look alike but are genetically different. Spawning adults are dark green on the head and back, maroon on the sides, and grey on the belly. Males are characterized by a bright red stripe, hooked jaw and slightly humped back. Spawners are typically 20 to 30 inches long and weigh six to 13 pounds. Most spawning adults are three years old but may include some two year olds. In the ocean, they are bright silver and are voracious predators on fish and shrimp. The young rear for one to two years in streams and require cold water and abundant protective cover which is often provided by fallen trees. For this reason, coho require dense coastal rain forests for their survival.

California Trout is There for the Fish!

In 2007, the California Court of Appeals affirmed endangered species status for the embattled California coho salmon in California Forestry Association et al. v. Fish and Game Commission. The original petition for listing the coho under the California Endangered Species Act, submitted by California Trout on behalf of the Salmon and Steelhead Recovery Coalition in July 2000, was reaffirmed with the landmark 2007 court ruling.

CATEGORY	SCORE	EXPLANATION
Range	2	Present only in California
Population size	2	All populations are small, isolated, and don't intermix. Most breeding populations are less than 50 fish in most years
Intervention needs	1	All populations require intervention to survive and most have intensive management programs in place or proposed
Tolerance	1	Coho are among the most sensitive salmonids to environmental conditions
Genetic risk	1	See Bucklin et al. (2007)
Climate change	1	At southern end of range, so exceptionally vulnerable to increased temperatures
Overall status	1	
Reliability	4	Well documented by scientific literature

chances for survival:
very poor

1

1 2 3 4 5

DISTRIBUTION: Central California coast coho were native to coastal streams from Punta Gorda south to the San Lorenzo River and tributaries to the San Francisco Bay. They were found in about 330 streams of which 200 are in Mendocino County alone. Few of these streams support viable populations today. The most southern populations of coho are in Scott and Waddell Creeks in Santa Cruz County, with the largest remaining population in Lagunitas Creek, Marin County.

ABUNDANCE: Since about 1980, there have been fewer than 3,000 wild Central California coast coho salmon spawning each year, but this number varies with age class and with year. In recent years, the number of spawning coho have been much lower with totals of 500–1,000 in 2006–2007.

FACTORS AFFECTING STATUS: Central California coast coho streams have been heavily altered since the 19th century when virtually all watersheds were logged with destructive methods. Some habitat recovery occurred in the 20th century; however many of the watersheds were not reforested but were converted to urban and agricultural use, especially vineyards. As a result, streams were dammed and diverted, water quality became unsuitable, shade and protective cover were eliminated, and heavy sedimentation destroyed spawning areas. Little natural habitat for coho salmon remains in the region.

STATUS 1: With the possible exception of the small population in the Lagunitas Creek watershed, Central California coast coho are on the verge of extinction. These coho are listed as endangered by both state and federal agencies. Given the extreme negative alteration of most Central California coast coho watersheds, special efforts will be required to prevent this species from extinction. The most important factor for this species' survival is to protect and enhance watersheds that have potential to support coho salmon. These watersheds include Scott, Waddell, and Lagunitas Creeks and the Garcia, Noyo, and Gualala Rivers. Other efforts needed to prevent extinction include (1) developing recovery hatcheries in conjunction with habitat improvement measures, (2) resolving water allocation issues to ensure adequate water is left to support coho salmon, (3) focusing on Lagunitas Creek in Marin County as a demonstration stream, and (4) providing additional protection to Santa Cruz County coho salmon as the southernmost population of the species.

CONSERVATION RECOMMENDATIONS: Conservation measures needed for the Central California coast coho salmon include rigorously protecting the few watersheds in which they still reside or have the potential to support coho in the future by reforming commercial logging practices and ensuring adequate water supplies. Recovery hatcheries should be developed and large-scale restoration projects, such as placement of large woody debris, need to be implemented immediately.

Lagunitas Creek. PHOTO: PAOLA BOULEY

Watersheds In Which Central California Coast Coho Salmon Were Historically Present

Chum Salmon

Oncorhynchus keta

chances for survival:
very poor

1

1 2 3 4 5

PHOTO: THOMAS DUNKLIN

Spawning chum salmon are dark olive on the back and dark maroon on the sides with irregular greenish vertical bars on the sides and no spots on the tail. California fish are typically less than 26 inches long. Genetic studies are lacking for California fish, but populations in Oregon and Washington are considered part of the broad Pacific Coast ESU.

Adults are usually observed in California streams in December and January, but can occur as early as August. In Mill Creek, a tributary to the Smith River, chums enter during mid-December, but only in years when stream flows are high. During years of low flow they may instead spawn in the main river. Adults return to natal streams where they spawn at two to seven years of age, but primarily at ages three to five. Fry spend only a short time in fresh water; however they may remain in estuaries for several months before moving into the ocean. In estuaries, chum salmon feed mostly on microscopic crustaceans, such as copepods, and while in the ocean eat both invertebrates and fish although jellyfish are an especially important food in their diet.

DISTRIBUTION: Chum salmon are commonly taken in the commercial salmon fishery off California, but records of occurrence in fresh water are sporadic. Historically, chum salmon had small spawning runs in the Sacramento, Klamath and Trinity Rivers, and spawners were observed in other coastal rivers as well. Today, they sustain small runs in the Klamath, Trinity, and Smith Rivers although evidence for their presence every year is limited. Chum salmon are still observed in other coastal streams, such as Redwood and Lagunitas Creeks in Marin County, Freshwater and Redwood Creeks in Humboldt County, and sporadically in the Eel River and Van Duzen Rivers. When regular surveys of spawning salmon were made on Lagunitas Creek for four years, chum salmon were observed to be present every year and included individuals on redds.

ABUNDANCE: Population numbers are consistently small at the present time although counts are rare; presumably there are a few hundred chum salmon spawning each year in California. Numbers were likely higher in the past but not large. These fish may have been largely overlooked because they spawn close to the coast and do not remain long in fresh water as juveniles.

FACTORS AFFECTING STATUS: The historic rarity of chum salmon in California makes it difficult to identify factors that may have affected their abundance. However, chum salmon historically spawned in the lower reaches of river systems which are the most likely to be degraded by human activities, such as logging, road building, mining, channelization, and draining of estuarine marshes. If California chum populations are largely comprised of fish "straying" from the more northern populations, then their abundance would also be related to factors such as ocean conditions and hatchery production, reflecting the status of populations in the northern part of their range.

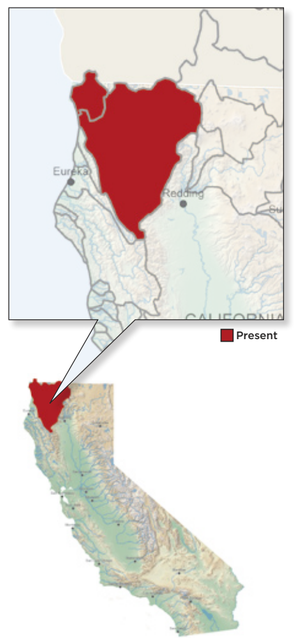
STATUS 1: There appears to be at least three very small populations of chum salmon within the Smith, Klamath, and Trinity Rivers in California, all of which are threatened with extinction. Given the lack of data, the certainty of this species' status is low; however the alternative is to recognize that chum are extinct in California with populations depending entirely on fish from elsewhere. In this case, spawning in California streams would take place when chum salmon populations are high in the ocean. At present, there is no conclusive evidence to support either hypothesis, and so the conservative approach is to assume that chum salmon populations exist in California and to take actions to enhance and protect them as the southernmost population of a species that is on the verge of extinction.

CONSERVATION RECOMMENDATIONS: Because chum salmon are rare in California, surveys in the South Fork Trinity, Klamath, and Smith Rivers should be continued to monitor the status of the few fish spawning, genetic studies should be conducted to determine the relationship of California and Oregon chum populations, and suitable habitat, flow, and water quality should be maintained to protect these imperiled fish.

CATEGORY	SCORE	EXPLANATION
Range	2	Data is scarce, but it is likely that if chum salmon still maintain California populations, they exist in the Smith, Trinity and Klamath Rivers
Population size	1	There is little evidence that any population is more than six to 20 spawners in most years
Intervention needs	2	No effort is being made to protect chum salmon runs and it is likely that without intervention the species will soon be extirpated in California
Tolerance	2	Southern populations of chum salmon seem to have fairly narrow spawning habitat requirements, and their young seem to require estuarine habitats for rearing
Genetic risk	1	If California populations are still self-sustaining, they are extremely small and vulnerable to inbreeding and other genetic problems which is not an issue if the populations are maintained by 'strays' from the more northern populations
Climate change	1	Given the limited size of existing California populations, small changes in flows, temperatures or ocean conditions could eliminate the populations
Overall status	1	
Reliability	1	Information is very limited

Lower Klamath River. PHOTO: TOM WESELOH

Chum Salmon Historic Distribution



Pink Salmon

Oncorhynchus gorbuscha

chances for survival:
very poor

1

1 2 3 4 5

PHOTO: THE WILD SALMON CENTER

Pink salmon are the smallest of the Pacific salmon, with adults usually 18 to 25 inches in length. Spawning males have a pronounced hump (and are often called humpback salmon) with a snout that is greatly enlarged and hooked. The body color is dark purplish, especially on the head and back. Spawning females resemble trout in general body shape and are paler in color. Nothing is known about the genetic background of California pink salmon, but populations in Washington have spawning runs in odd years and are regarded as a distinct ESU. Presumably, California fish are most closely related to members of this ESU. Pink salmon have a two year life cycle. Most pink salmon spawn in the lower-most reaches of streams. Spawning in California has only been recorded in September and October and occurs in gravelly riffles. The young emerge from the gravel and immediately emigrate out to sea where they feed on fish, squid, shrimp, and small crustaceans.

CATEGORY	SCORE	EXPLANATION
Range	1	Pink salmon are only confirmed in the Garcia and Russian Rivers and Redwood Creek
Population size	2	Their numbers are very uncertain
Intervention needs	3	Pink salmon in California are largely unstudied, but some intervention is needed if this species is to survive
Tolerance	1	Pink salmon have a short life cycle dependent on one river
Genetic risk	1	If the California Pink Salmon are a local population, then risk is high
Climate change	1	The Garcia watershed has been highly impacted by logging; and spawning areas are unprotected
Overall status	1	
Reliability	2	Very limited documentation is available

DISTRIBUTION: Spawning pink salmon ascend coastal streams of northern Asia, from Korea and Japan, and along the coast of North America south to California. In California, there are records from many coastal streams but spawning in recent years has only been recorded in the Garcia, Russian, and Sacramento Rivers, as well as Redwood Creek.

ABUNDANCE: Pink salmon are extremely abundant in Alaska and Canada and support major commercial fisheries there. California is the southern edge of the species' range so they have never been common here. However, given that pink salmon spawn in the lower reaches of streams in autumn when few observers are likely to be present and, given that their young emigrate to sea immediately after emerging from the gravel, spawning pink salmon in coastal streams could be easily overlooked. It seems highly likely that pink salmon were once common enough in California to support small runs in several rivers, but they are now close to extinction.

FACTORS AFFECTING STATUS: The lack of historical data on the abundance and distribution of pink salmon in California makes assessment of factors affecting their status difficult. In fact, they may occur in California only as a fringe population from sources further north. If so, then pink salmon abundance in the state would reflect the abundance of populations in Washington and British Columbia. However, if pink salmon did once have self-sustaining populations in California, then their tendency to spawn only short distances upriver from the ocean would make them extremely vulnerable to the general degradation of estuaries and the lower reaches of coastal rivers in California from logging, gravel mining and other human activities.

STATUS 1: Pink salmon are considered extirpated from California, except for occasional strays. However, recent reports of a spawning run in the Garcia River suggest that a small population may have been overlooked. It is highly likely that pink salmon will disappear completely from California streams in the future, although it is possible that these populations periodically go extinct and then re-establish when pink salmon are abundant elsewhere.

CONSERVATION RECOMMENDATIONS: The first step in conservation of pink salmon is to determine if there are any reproducing populations in California. The lower reaches of the Ten Mile, Garcia and Russian Rivers should be thoroughly surveyed at the appropriate time of year. If viable spawning populations are found to exist, then habitat, flow, and water quality should be protected.

Mouth of the Russian River. PHOTO: SONOMA COUNTY WATER AGENCY

Pink Salmon Distribution

California Coast Chinook Salmon

Oncorhynchus tshawytscha

chances for survival: *poor* **2**

PHOTO: DOUG KILLAM

California coast Chinook salmon comprise a genetically distinct set of salmon populations that spawn in the larger coastal watersheds from Humboldt County south to the Russian River. As with other Chinook salmon, spawning adults are olive brown to dark maroon in coloration, with a hooked jaw in the males. Juveniles have six to 12 parr marks, all equal to or wider than the spaces between them. Adults range between 21 and 48 inches in length and weigh between 28 and 50 pounds, with the state record of 88 pounds. All remaining spawning runs are in the fall although there is still considerable variability in their timing due to variability in the start of the rainy season.

California coast Chinook return to spawn in fresh water between September and early November following the early winter storms, but low flow barriers may prevent upstream access until December or January. Fry emerge from the gravel in late winter or spring and can emigrate to the ocean within one week to a few months of emergence.

CATEGORY	SCORE	EXPLANATION
Range	3	Species occupies multiple watersheds
Population size	3	All populations are under 1,000 spawners in most years but some mixing among populations between rivers
Intervention needs	2	Severe declines indicate strong intervention is needed, especially in Russian and Eel rivers and for restoration to rivers where now missing
Tolerance	2	Resilient life history but warm water puts embryos at risk
Genetic risk	3	Major watersheds may have distinct populations, all threatened by small size and similar genetic issues
Climate change	2	Likely to accelerate declines, especially where flows are reduced and altered channels increase temperatures
Overall status	2	
Reliability	3	National Marine Fisheries Service analyzed much of the existing information in reports

California Trout is There for the Fish!

California Trout fought from 1970 to 2004 to secure increased flows on the Eel River from the Potter Valley Project to benefit northern California coast steelhead and salmon. Due to these efforts, Eel River flows were augmented and modified to more closely mimic the natural hydrograph. The changes benefited adult and juvenile salmonid migration as well as improved rearing habitat. A component of the agreement reached includes a program to suppress and eradicate non-native pike minnow that heavily prey on juvenile salmon and steelhead.

DISTRIBUTION: This ESU inhabits coastal watersheds from Redwood Creek (Humboldt County) in the north to the Russian River in the south. Streams include the Eel River and all its tributaries, Redwood Creek, the Mad, Bear, Mattole, Little, Big, Ten Mile and Noyo Rivers. The Navarro, Garcia and Gualala rivers no longer have California coast Chinook salmon. The Russian River appears to have a self-sustaining population.

ABUNDANCE: California coast Chinook salmon are much less abundant than they were historically. In high return years, historic runs numbered 600,000 fish and decreased to a range of 30,000 to 50,000 fish in poor years. Present numbers total about 5,000 to 20,000 fish annually, with most rivers supporting just a few hundred fish.

FACTORS AFFECTING STATUS: Factors affecting California coast Chinook include (1) habitat degradation, (2) alteration of water flows, (3) urbanization, (4) gravel mining, and (5) alien species. These fish have disappeared from or are imperiled in most of their watersheds because of degradation of spawning, incubation, and rearing habitats due to sedimentation. In 1955 and 1964, record rainfalls on hillsides denuded by logging, grazing, and road building caused large-scale erosion as huge floods ripped through the basins. Sedimentation from logging, agriculture, urbanization and other activities continues to be a problem, not only in the rivers but in the estuaries. Several estuaries have been converted from expansive wetlands that juvenile salmon use for rearing to narrow diked channels without the benefits of a plentiful food source typically found in estuary habitat. Dams have limited access to salmon habitat on several rivers. Scott Dam on the Eel River is not only a barrier to the salmon, but is also used to move water to the Russian River, via Cape Horn Dam downstream. The transfer has contributed to California coast Chinook salmon declines in the Eel River. In all rivers, small scale water diversions reduce flows and habitat. An additional problem in both the Russian and Eel Rivers is the abundance of non-native predators on juvenile salmon, especially pikeminnows in the Eel River.

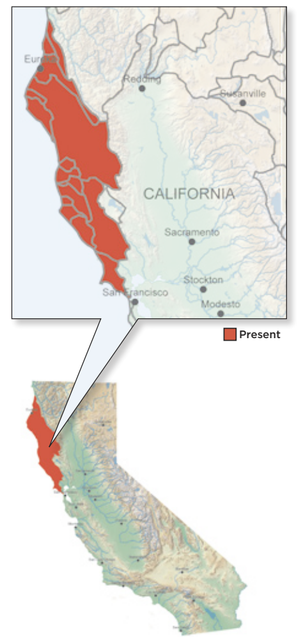
STATUS 2: California coast Chinook salmon are vulnerable to extinction in the next 100 years or less. The species was listed as threatened under the federal Endangered Species Act in 1999, but this was rescinded in 2002 as the result of a lawsuit. A status review was completed in 2005 and the California coast Chinook was again listed as threatened.

CONSERVATION RECOMMENDATIONS: To reverse the downward trends of California coast Chinook salmon, water quantity and quality issues need to be resolved in most of its watersheds in order to protect and restore their spawning and rearing habitat. Protection and restoration of estuarine habitat is also key to recovery. Currently, these salmon have no official status at the state level, although they should be listed as threatened for consistency with the federal law.

Eel River. PHOTO: JOE FERREIRA

1 **2** **3** **4** **5**

California Coast Chinook Salmon
Historic Distribution



Central Valley Late Fall Chinook Salmon

Oncorhynchus tshawytscha

chances for survival: *poor* **2**

PHOTO: DOUG KILLAM

One of four distinct runs of Chinook salmon in the Central Valley, late fall Chinook tend to be larger than fish from the other runs at 30 to 40 inches in length. They are most similar genetically to fall Chinook and are often combined with them into one ESU despite their distinctive life history. As with other Chinook, these fish become olive-brown to dark maroon with numerous black spots while in fresh water. Their basic life history is not well known because they migrate and spawn at times when the rivers are high, cold, and turbid. In the past, adults were a mixture of ages from two to five years old. At the present time, most are three year olds.

Adults migrate upstream in December and January as mature fish. Spawning occurs in late December and January. Fry emerge from the gravel from April through early June. The juveniles live in the river for seven to 13 months before moving out to sea. Like other Chinook, they are voracious predators on shrimp and fish while living in the ocean.

CATEGORY	SCORE	EXPLANATION
Range	1	Only one population is present in the Sacramento River
Population size	4	If a typical population is 10,000 spawners, the effective population size is around 2,000 fish
Intervention needs	3	Requires periodic actions as for winter run Chinook salmon
Tolerance	3	Moderate physiological tolerance and multiple age classes
Genetic risk	2	Risk of hybridization with other salmon runs and hatchery fish is high although the consequences are poorly known
Climate change	1	There is just a single population that requires cold water from Shasta Reservoir and therefore they are vulnerable to extended drought
Overall status	2	
Reliability	3	Least studied of all Sacramento River Chinook runs

DISTRIBUTION: Late fall Chinook are found mostly in the Sacramento River between the Red Bluff Diversion Dam and Keswick Dam. However, some fish spawn downstream of Red Bluff. Small numbers also spawn in Battle Creek, Cottonwood Creek, Clear Creek, Mill Creek, as well as the Yuba and Feather Rivers. Battle Creek spawners presumably originated from the Coleman National Fish Hatchery. Historically, they spawned mostly in river reaches now blocked by Shasta Dam which included the Upper Sacramento, McCloud, and Pit Rivers and in the San Joaquin River.

ABUNDANCE: Historic abundance of late fall Chinook is not known. During 1967 to 1976, the run averaged about 22,000 fish annually. Between 1982 and 1991, the run averaged 9,700 fish annually. During 1992 to 2007, total numbers averaged 21,000 fish, with a wide range in annual numbers including a 1998 peak total of over 80,000 fish. The population today may be partly sustained by hatchery production.

FACTORS AFFECTING STATUS: The causes of long-term decline and present fluctuating numbers are similar to those of other Central Valley salmon. Principle factors are (1) dams, (2) loss of habitat, (3) commercial fisheries, (4) out-migrant mortality, and (5) hatcheries. In the 1940s, Shasta Dam blocked access to areas where water temperatures were cool enough for spawning, egg incubation and over-summering of juveniles. Subsequent deterioration of downstream habitats and unselective ocean fisheries contribute to present variable numbers.

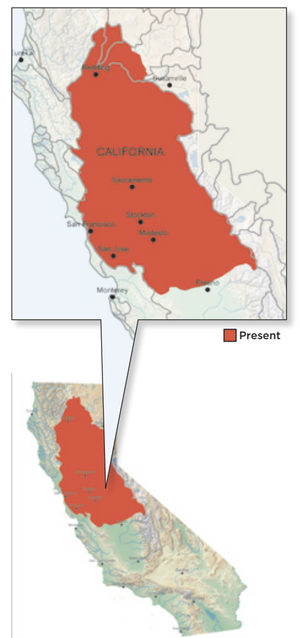
STATUS 2: This run is vulnerable to extinction within the next 100 years or less due to its relatively small population size. Central Valley late fall Chinook salmon are listed as a species of special concern by both the state and federal agencies. The limited area for spawning and rearing make this species exceptionally vulnerable to changes in water quality and flows in the Sacramento River. Late fall Chinook survival depends entirely on operation of water projects and hatchery operations. Presumably, they have benefited from actions taken to protect winter Chinook with which they co-occur at times. The wild population would benefit from having all hatchery fish marked so that commercial and recreational fisheries could selectively capture hatchery-origin fish of all runs.

CONSERVATION RECOMMENDATIONS: Late fall Chinook will benefit from actions taken to protect winter Chinook. Nevertheless, it should be recognized as a distinct ESU (or DPS) and listed as a threatened species. Special consideration needs to be made for restoring late fall Chinook to the San Joaquin River, as part of the restoration efforts taking place there.

Sacramento River. PHOTO: DOUG KILLAM

1 **2** **3** **4** **5**

Central Valley Late Fall Chinook Salmon Likely Historic Distribution



Central Valley Spring Chinook Salmon

Oncorhynchus tshawytscha

chances for survival: *poor*

2

1 **2** 3 4 5

PHOTO: ALLEN HARTHORN

These fish are one of four genetically distinct runs of Chinook salmon in the Central Valley. Like other Chinook, they are large and often reach 30 to 34 inches in length. At sea they are silver, a color they retain initially in fresh water, but eventually become olive-brown to dark maroon with numerous black spots. The spotted tail and black gums distinguish Chinook from other salmon. They enter fresh water in the spring while immature and hold through the summer in deep cold pools at higher elevations. These Chinook then spawn in the early fall and the young either leave for the ocean in the spring or rear for an entire year in the spawning stream before emigrating to the sea.

DISTRIBUTION: Central Valley spring Chinook salmon historically ranged throughout the Sacramento and San Joaquin watersheds. In the south, they once ascended the Kings, upper San Joaquin, Merced, Tuolumne, and Stanislaus Rivers. In the north, they once ranged into the Fall, Pit, McCloud, and upper Sacramento Rivers.

CATEGORY	SCORE	EXPLANATION
Range	2	Mainly found in just three adjacent creeks: Butte, Mill and Deer
Population size	4	Populations in the three streams in recent years have had population sizes of 600 to 6,000, lower in other years
Intervention needs	3	Requires continuous protection and monitoring to maintain populations
Tolerance	2	Narrow physiological tolerances for both adults and juveniles in the summer given high temperatures and low water levels of the streams they inhabit
Genetic risk	2	Butte, Deer, and Mill Creek populations appear to be distinct. There is always the risk of inbreeding when populations decline during poor years. The Feather River population has hybridized with fall Chinook
Climate change	1	Extremely vulnerable given the small population sizes and limited range as well as already high summer temperatures of the streams
Overall status	2	
Reliability	4	Well studied by fisheries agencies and scientists

California Trout is There for the Fish!

California Trout led the legal proceedings that established Section 5937 of the Fish and Game Code as a binding doctrine for regulated streams. The historic court order to restore spring run Chinook salmon to the San Joaquin River was based on Section 5937 and its expanded interpretation that originated with California Trout's efforts.

Current distribution is limited mainly to Mill, Deer, and Butte Creeks in the northern Central Valley. The Feather River Hatchery releases about two million spring Chinook smolts per year. However, these fish are hybridized with the hatchery fall-run Chinook with which they are most similar genetically.

ABUNDANCE: Central Valley spring Chinook have been extirpated from the vast majority of their historical range. In the 19th century, combined run sizes were probably in the range of one million fish per year plus or minus 500,000. Excluding the Feather River salmon, total escapement of returning spawners plus the catch in fisheries has averaged about 16,000 fish since 1992. In some years, escapement has been less than 1,000 fish. Butte Creek has the largest adult escapement, averaging around 22,630 individuals, while Mill Creek has an average of 3,360 individuals and Deer Creek on average has 6,320 individuals. In recent years, numbers have been lower, reflecting an overall general decline in Central Valley salmon.

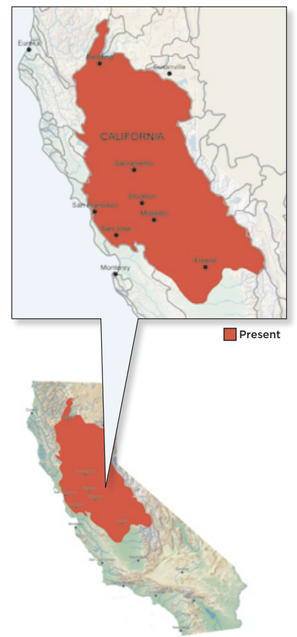
FACTORS AFFECTING STATUS: The single biggest factor affecting Central Valley spring Chinook salmon populations are dams which block access to more than 95% of their historic spawning and rearing areas. Additional factors influencing existing populations include, (1) water diversions, (2) urbanization and rural development, (3) logging, (4) grazing, (5) agriculture, (6) mining, (7) estuary alteration, (8) commercial fisheries, and (9) breeding with hatchery Chinook. The fact that the three existing populations are all in the shadow of Mt. Lassen suggests vulnerability to fire and volcanic eruptions.

STATUS 2: There is a high likelihood of Central Valley spring Chinook going extinct in the next 50 to 100 years. Recent management efforts and protection have somewhat reduced their vulnerability to extinction, but the probability of the three principal populations plummeting in the future is high. Central Valley spring Chinook salmon are currently listed by both state and federal agencies as threatened. Conservation actions that need to be taken include providing additional protection to the three major refuge streams, restoration of the San Joaquin River and Battle Creek, improving habitat for juveniles in the Sacramento–San Joaquin Delta, and marking all hatchery salmon of all runs to reduce the catch of wild spring Chinook in a fishery aimed at hatchery fall Chinook. Salmon hatcheries need to be managed better to reduce spawning between hatchery and wild Chinook salmon in order to maintain pure strains of spring Chinook.

CONSERVATION RECOMMENDATIONS: Implementation of the settlement agreement for the San Joaquin River will provide nearly 150 miles of restored habitat to reestablish a self-sustaining population of spring Chinook salmon in the Central Valley. Additional habitat expansion for spring run Chinook is also necessary in the Northern Central Valley.

Butte Creek. PHOTO: THOMAS DUNKLIN

Central Valley Spring Chinook Salmon
Likely Historic Distribution



Sacramento Winter Chinook Salmon

chances for survival: poor **2**

Oncorhynchus tshawytscha

PHOTO: DOUG KILLAM

Sacramento winter Chinook salmon are the most distinctive of the four runs of Chinook salmon in the Central Valley. Adults tend to be smaller than other Chinook and are often less than 22 inches long. They enter fresh water while still immature and silver, but before spawning they become olive-brown to dark maroon with numerous black spots. The spotted tail and black gums distinguish Chinook from other salmon species. Sacramento winter Chinook salmon migration occurs from January to May when they move upriver to below Keswick Dam. The salmon hold there for several months until spawning in April through early August. The timing of winter Chinook spawning results in embryo incubation during the hottest part of the year. This timing is unique among Chinook salmon and indicates the unusual geographical and hydrological conditions in which they evolved. Cold water springs maintained water temperatures favorable for egg incubation and juvenile survival even during the hot summer climate. With the construction of Shasta Dam this habitat was lost and the salmon must now be maintained by cold water releases from the dam. Juveniles rear for approximately five to 10 months before moving downstream to the ocean.

CATEGORY	SCORE	EXPLANATION
Range	1	A single population in an area below dams; extinct from their historical range
Population size	4	The recent assessments indicate an average of 10,000 returning spawners and therefore an effective population size of 2,000
Intervention needs	1	The population depends entirely on releases from Shasta Dam and secondarily on rearing in Livingston Stone Fish Hatchery
Tolerance	1	Winter Chinook spawn at the most thermally challenging times of the year and are particularly at risk to drought or climate change
Genetic risk	2	Considerable genetic drift has probably occurred with the consolidation of the winter Chinook populations into a single population with limited habitat
Climate change	1	Extremely vulnerable because of reliance on cold water releases from Shasta Reservoir
Overall status	2	
Reliability	4	Well studied by fisheries agencies and scientists

California Trout is There for the Fish!

California Trout advocated for the initiation of the Statewide Fish Passage Forum. As a charter member, we have assisted in development of protocols, guidelines and design criteria for standardized assessment, prioritization and implementation of fish passage projects thus expediting dozens of migration barrier removals throughout the state. In 2005 California Trout sponsored Senate Bill 857 mandating that all new highway projects meet fish passage criteria for anadromous adult and juvenile fish.

DISTRIBUTION: Historically, winter Chinook salmon had four populations in the Upper Sacramento, McCloud, and Pit Rivers, and in Battle Creek. They now exist as a single population that spawns in the Sacramento River below Keswick Dam. Juvenile emigration and rearing takes place in the Sacramento River, in various tributary streams, and in the Sacramento Delta.

ABUNDANCE: Historical abundance of winter Chinook salmon was likely about 200,000 spawners per year. Recent populations have averaged about 10,000 fish with high variability. Since winter Chinook salmon were added to the federal and state endangered species list, the population has steadily risen. Livingston Stone Hatchery on the Sacramento River produces approximately 200,000 winter run smolts per year that are marked and tagged before release. The percentage of hatchery fish spawning at the base of Keswick Dam in recent years has also been increasing.

FACTORS AFFECTING STATUS: The biggest single cause of winter Chinook salmon decline was the blocking of access to spawning areas by Shasta Dam in the 1940s. The subsequent steep population decline in the late 1980s to early 1990s was caused by a combination of (1) excessively warm water temperatures from releases at Shasta Dam, (2) barriers to passage of juveniles and adults, (3) entrainment or becoming trapped in diversions, and (4) commercial fisheries, combined with unfavorable natural conditions (drought, poor ocean conditions).

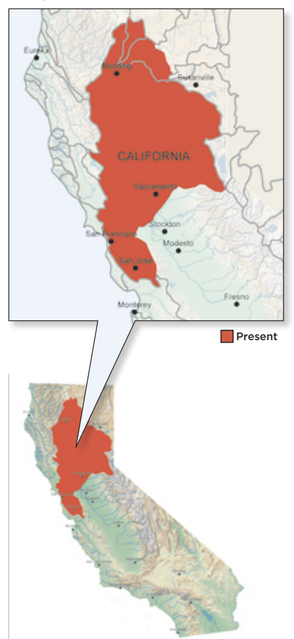
STATUS 2: Sacramento winter Chinook salmon have a high likelihood of extinction within the next 50 years as reflected in their listing as an endangered species by both state and federal governments. They are among the most "at risk" salmonids because of their unique life history. There have been a great number of conservation measures instituted, including opening the gates at the Red Bluff Diversion Dam to allow free passage of adults and juveniles, construction of a temperature control device at Shasta Dam, hatchery rearing, habitat improvements, screening of diversions, and removal of dams on Battle Creek. However, their dependence on cold water releases from dams makes them especially vulnerable to climate change and drought.

CONSERVATION RECOMMENDATIONS: As a listed species, Sacramento winter Chinook benefits from the raising of the gates at Red Bluff Diversion Dam to allow free passage of adults and juveniles, but additional improvement for spawning and rearing habitat is also needed. A major restoration project on Battle Creek should add 42 miles of spawning habitat as well as higher water flows and cooler temperatures.

Sacramento River. PHOTO: PETER MOYLE

1 **2** **3** **4** **5**

Sacramento Winter Chinook Salmon
Likely Historic Distribution



Southern Oregon/Northern California Coast Coho Salmon *Oncorhynchus kisutch*

chances for survival: *poor* **2**

1 **2** 3 4 5

SALMON

PHOTO: TOM WESELOH

Southern Oregon/Northern California coast coho salmon is one of two kinds of coho in California which look alike, but are genetically different. For this reason they are placed in different ESUs for management. Spawning adults are dark green on the head and back, maroon on the sides, and grey on the belly. Males are characterized by a bright red stripe, hooked jaw, and slightly humped back. Spawners are typically 20 to 30 inches long and weigh six to 13 pounds. Most spawning adults are three years old with some two year olds. In the ocean, they are bright silvery in color and are voracious predators on fish and shrimp. The young rear for one to two years in streams and require cold water year around with abundant protective cover, often provided by fallen trees. These coho require dense rainforests and cold water for their survival.

DISTRIBUTION: Southern Oregon/Northern California coast coho salmon are found from Cape Blanco in Oregon south to the Mattole River, just north of Punta Gorda. In California, they occupy small coastal basins where high quality habitat is located in lower tributaries and in the headwaters. Major California river systems with Southern Oregon/Northern California coast coho include the Smith, Klamath, Trinity, Mad, Eel, and Mattole Rivers, plus Redwood Creek. In the Klamath and Trinity Rivers, their upstream limits are determined by Iron Gate and Lewiston dams, respectively. In the Klamath River they were once especially abundant in the Scott and Shasta Rivers because of the presence of cold water and diverse habitats created by beavers.

CATEGORY	SCORE	EXPLANATION
Range	2	These coho populations are mainly in California with some in Oregon
Population size	3	Most populations are isolated, live independently and are less than 100 fish
Intervention needs	3	All populations require intervention to survive
Tolerance	1	Coho are among the most sensitive of salmon to environmental conditions.
Genetic risk	1	See Bucklin et al. (2007)
Climate change	1	Coho are vulnerable in all watersheds
Overall status	2	
Reliability	4	Populations have been well studied

ABUNDANCE: Probably 200,000 to one million wild coho once spawned in California streams; however these numbers had been reduced to about 100,000 by the 1960s. By 1990, this number had fallen to about 31,000 fish per year, about 80% of which were Southern Oregon/Northern California coast coho. Approximately 50% to 60% of these fish were of hatchery origin. Total wild Southern Oregon/Northern California coast coho spawners in California each year is currently between 3,000 and 30,000 fish, probably more often closer to the lower estimate. These fish comprise about 250 isolated populations that show evidence of genetic and demographic problems likely to lead to extinction.

FACTORS AFFECTING STATUS: Major factors affecting coho salmon include, (1) dams, (2) water diversions, (3) logging, (4) grazing and agriculture, (5) mining, (6) estuary alteration, (7) pollution, (8) alien species, and (9) hatcheries. In particular, coho streams suffer from the effects of intense logging dating back to the 19th and 20th centuries. Because of their long residence time in fresh water, coho salmon populations are strongly affected by negative changes in water flows and by water and habitat quality.

STATUS 2: These coho salmon are vulnerable to extinction within the next 50 to 100 years. Most or all populations in small coastal streams will likely disappear in the next 25 to 50 years. Southern Oregon/Northern California coastal coho are listed as threatened by both state and federal agencies. Conservation of the species requires protecting spawning streams, restoring damaged habitat, and improving water quality. There are hundreds of actions needed, many of which are often watershed-specific. In particular, there is a need for improved management of the Trinity and Iron Gate hatcheries to reduce the influence of hatchery fish on wild coho populations.

CONSERVATION RECOMMENDATIONS: Key to stopping the decline of coho salmon is to protect their spawning and rearing streams, to restore damaged habitat, and to improve water quality. This can be difficult because it may mean reforming commercial timber harvesting practices, farming, and road construction activities in dozens of coastal drainages and implementing habitat restoration plans along hundreds of miles of streams. In many streams it means that major reconstruction projects must be funded, completed, and monitored. Keeping sport and commercial fisheries for coho closed or greatly restricted is also a necessity. Given the large scale of problems facing coho salmon, innovative approaches to stream restoration must be tried, working with landowners, timber companies, and gravel miners. Where population augmentation is deemed necessary, small-scale, on-stream hatchery operations using local wild stock could be used as temporary measures but must be used with extreme caution, with firm closure dates.

Lower Klamath River. PHOTO: TOM WESELOH

Possible Historic Distribution Of Southern Oregon/Northern California Coast Coho Salmon

California Trout is There for the Fish!

As a member of the Salmon and Steelhead Recovery Coalition, California Trout served as a team member that developed the 2004 Recovery Strategy for California Coho Salmon Plan. Goals of the Plan are to remove coho salmon from the California endangered species list and to restore tribal, commercial and recreational coho salmon fisheries.

Upper Klamath–Trinity Rivers Spring Chinook Salmon *Oncorhynchus tshawytscha*

chances for survival: *poor* **2**

1 **2** 3 4 5

SALMON

PHOTO: AARON MARTIN

California Trout is There for the Fish!

Since 2000, California Trout has worked collaboratively with agencies, tribes, water users, commercial fishermen, and conservation groups to remove four dams on the Klamath River. These dams block access to hundreds of miles of spawning and rearing habitat for salmon and steelhead. California Trout is committed to moving this important effort, one of the most ambitious river restoration projects ever undertaken, forward in the coming years. If successful, we will help foster the recovery of the once world class Klamath River salmon and steelhead runs.

The Upper Klamath–Trinity Rivers Chinook salmon ESU includes all Chinook salmon in the Klamath River Basin upstream of the confluence of the Klamath and Trinity rivers and includes both fall and spring run fish. These spring Chinook are similar to fall Chinook salmon except that they enter fresh water while sexually immature and are silvery fish during spring without breeding colors or elongated male kype. Genetic analyses indicate that spring Chinook from a sub-basin within the region are more closely related to fall Chinook in the same stream than to spring Chinook elsewhere in the ESU. Despite this, we treat Upper Klamath–Trinity Rivers spring Chinook as unique because they represent a life history strategy that is highly distinctive and requires separate management strategies. Historically, these fish were on their own evolutionary path before being negatively affected by human activities in the basin. They enter the Klamath River in March through July and then hold in upstream deep cold pools for two to four months before spawning in September and October. Peaks of juvenile emigration have been observed during spring/early summer and fall.

CATEGORY	SCORE	EXPLANATION
Range	2	Multiple populations exist including hatchery populations, but only the Salmon River and South Fork Trinity populations are viable
Population size	2	Although there is a hatchery stock, effectively there are few natural spawners to support the population
Intervention needs	2	Hatchery programs in Trinity area are probably keeping Trinity stock viable and the Salmon River wild population is vulnerable to extinction from both local and out-of-basin events; more intervention is necessary to preserve the Klamath stock by re-establishing populations
Tolerance	2	Temperature and other factors in the summer holding areas may exceed physiological tolerances
Genetic risk	2	Hybridization may be occurring in some watersheds with fall-run fish and populations low enough so genetic problems can develop
Climate change	1	The Salmon River has temperatures in summer (70–73°F) that approach lethal temperatures; 1–2°F increase in temperature could greatly reduce the amount of suitable habitat
Overall status	2	
Reliability	3	Watershed monitoring efforts by the U.S. Forest Service, CDFG, tribes and local organizations give reasonable information about status

DISTRIBUTION: Upper Klamath–Trinity Rivers spring Chinook were once found throughout the Klamath and Trinity basins and within the larger tributaries, including the Salmon, Scott, Shasta, South Fork and North Fork Trinity Rivers. Their distribution is now restricted to below dams that block access to the upper Klamath and Trinity Rivers. These Chinook once spawned in tributaries up to upper Klamath Lake. In the Trinity River they are present in small numbers in Hayfork and Canyon creeks as well as in the North Fork Trinity, South Fork Trinity and New Rivers.

ABUNDANCE: While spring Chinook salmon are still scattered through the Klamath and Trinity basins, the only viable wild population appears to be in the Salmon River. Trinity River numbers are presumably largely influenced by the Trinity River hatchery. Even if Trinity River tributary spawners are considered to be wild fish, the total number of spring Chinook in the combined rivers rarely exceeds 1,000 fish and may drop to less than 300 in many years.

FACTORS AFFECTING STATUS: Upper Klamath–Trinity Rivers spring Chinook are largely lost from their historic range because their life history makes them extremely vulnerable to the combined effects of dams and other factors. Access to a significant portion of their habitat has been blocked by Lewiston, Iron Gate, and Dwinell Dams. Dams have also led to their extirpation in the Klamath and Shasta Rivers due to alteration in water quality and temperature, channel simplification, and disconnection from floodplains. They have also been affected by logging, mining, rural development, fisheries, hatcheries, and disease.

STATUS 2: The only viable wild population today is in the Salmon River. This population has wide annual fluctuations, is small in size, and is highly localized in distribution. For this reason, the Upper Klamath–Trinity Rivers spring Chinook are vulnerable to extinction in the next 50 to 100 years. Other populations are either small and intermittent or heavily influenced by hatchery fish and so are likely to be lost in the near future. Spring Chinook are a state species of special concern and are listed by the U.S. Forest Service as a sensitive species.

CONSERVATION RECOMMENDATIONS: To prevent extinction of this species, cool water refuges are required as well as reconnecting historic habitats in the Klamath and Trinity Rivers and their tributaries. Among other things, this would require reforming commercial timber harvesting practices and motorized instream gold mining activities known to be harmful to these fish and obstacles to their recovery. These efforts would increase habitat availability for spring run Chinook and remove barriers which negatively impact water quality and quantity.

Salmon River. PHOTO: PETER MOYLE

Historic Upper Klamath–Trinity Rivers Spring Chinook Salmon Distribution, Including Migratory Pathways

Upper Klamath–Trinity Rivers Fall Chinook Salmon *Oncorhynchus tshawytscha*

chances for survival: *average* **3**

PHOTO: NATHANIEL PENNINGTON

The Upper Klamath–Trinity Rivers Chinook salmon ESU includes all populations of Chinook salmon in the Klamath River Basin upstream from the confluence of the Klamath and Trinity Rivers. The ESU includes both fall and spring run fish, treated separately here. Spawning adults are smaller, on average about 28 inches long, more rounded, and heavier in proportion to their length compared to Sacramento River fish. Adults are olive brown to dark maroon without streaking or blotches on the side. They enter the Klamath estuary from early July through September where they often hold for a few weeks. Upstream migration takes place in mid-July to late October. Migration and spawning both occur as temperatures decrease. Juveniles spend less than a year in fresh water.

CATEGORY	SCORE	EXPLANATION
Range	3	They are widely distributed in Klamath and Trinity basins
Population size	5	These Chinook salmon are abundant with several large populations
Intervention needs	3	Presumably they would survive without much human intervention, albeit in small numbers, however, major intervention is required to maintain fisheries
Tolerance	3	They possess moderate physiological tolerance and multiple age classes
Genetic risk	4	There is one genetically diverse population
Climate change	2	Climate change can reduce abundance but their 'ocean' life history strategy makes them least vulnerable of all runs, although warm temperatures in Klamath River threaten this part of population
Overall status	3	
Reliability	4	These fish are the most studied of Klamath River Chinook runs

California Trout is There for the Fish!

California Trout and partner Friends of the Trinity River advocated for and supported the 2000 Record of Decision that resulted in a near doubling of flows on the Trinity River, establishment of the Trinity River Restoration Program and mandated watershed restoration. California Trout was appointed by the Secretary of Interior to the Trinity Adaptive Management Working Group to oversee the Program and recommend restoration actions for the Trinity River.

DISTRIBUTION: These Chinook salmon are found in the mainstem and all major tributaries of the Klamath and Trinity Rivers. They are also reared in the hatcheries at Iron Gate and Trinity Dams. They historically spawned in reaches above Iron Gate Dam. In the mainstem Klamath River, most spawning occurs between Iron Gate Dam and Indian Creek. Historically, the majority of Trinity River fall Chinook spawning was between the North Fork Trinity River and Ramshorn Creek. Currently, spawning is confined in the North Fork Trinity to between Lewiston Dam and Cedar Flat.

ABUNDANCE: Historic numbers of fall Chinook spawners were probably 300,000 to 400,000 fish per year. In recent years (1978 to 2006), the numbers have averaged an estimated 112,000 fish, although 50% to 60% of these fish are of hatchery origin.

FACTORS AFFECTING STATUS: Principal causes of decline have been (1) dams, (2) logging and other land use, (3) hatcheries, and (4) disease. Upper Klamath–Trinity River fall Chinook are primarily mainstem spawners, so dams have had a negative impact by both changing downstream habitat and denying access to historic spawning areas. The dams have reduced spawning gravels and adversely impacted water movement. Inadequate release of water from Iron Gate Dam was a factor in the September 2002 salmon kill in the lower river. The direct cause of the fish kill was a disease outbreak related to poor water quality. Flows on the Trinity River were greatly reduced by Lewiston Dam, but a restoration effort is now underway. Most spawning and rearing habitat is surrounded by public lands which have been heavily logged, roaded, and mined. As a result, the rivers are impaired from sediment and high temperatures. The large hatcheries maintain fisheries, but competition between hatchery and wild fish may suppress wild populations.

STATUS 3: Upper Klamath–Trinity River fall Chinook populations seem stable at reduced or slightly declining numbers, but are increasingly reliant on hatcheries to maintain population size. They are a U.S. Forest Service sensitive species and managed for sport, tribal, and ocean fisheries.

CONSERVATION RECOMMENDATIONS: Conservation of these fish requires the restoration of the Klamath River in order to provide adequate water temperatures critical to maintaining and increasing healthy populations. The Shasta and Scott Rivers need continued restoration efforts and improved water allocations to protect the salmon. Instream motorized gold mining practices that disrupt spawning and rearing of juvenile fish also need to be curtailed.

Trinity River. PHOTO: JEFF BRIGHT

1 **2** **3** **4** **5**

Upper Klamath–Trinity Rivers Fall Chinook Salmon Distribution, Including Migratory Pathways

Central Valley Fall Chinook Salmon

Oncorhynchus tshawytscha

chances for survival: *better* **4**

PHOTO: ANDREW MAURER.

Fall Chinook are one of four genetically distinct runs of Chinook salmon in the Central Valley. Like other Chinook, they are large and often reach 30 to 34 inches in length. At sea they are silver, but in fresh water they become olive-brown to dark maroon with numerous black spots, a spotted tail and black gums. Fall Chinook migrate upstream in September through December as mature fish and usually spawn within one to two months. Juveniles emerge in December through March, move downstream into the main rivers within a few weeks and rear in fresh water for one to seven months. These fish have adapted to take advantage of productive lowland rivers that historically were often too warm in summer to support salmon. Fall Chinook salmon are ideal for use in hatcheries because they can be artificially spawned as they arrive and the fry only have to be reared for a relatively short time before being released. Fish from throughout the Central Valley are genetically extremely similar due to the constant mixing of hatchery and wild fish and the high rate of straying of spawners away from the rivers where they were born.

CATEGORY	SCORE	EXPLANATION
Range	2	Multiple populations in the Central Valley although only one population genetically
Population size	5	This is the most abundant salmon stock in California
Intervention needs	4	Presumably this ESU would persist even without much human intervention, albeit in small numbers; major intervention is required to maintain fisheries
Tolerance	3	Moderate physiological tolerance and multiple age classes
Genetic risk	5	One genetically diverse population
Climate change	3	Climate change can reduce abundance and survival but their ocean life history strategy makes them the least vulnerable of all runs to extirpation, but not to severe population decline
Overall status	4	
Reliability	4	Well studied although high uncertainty about ocean stage life history

DISTRIBUTION: Fall Chinook once spawned in all major rivers of the Central Valley and migrated as far south as the Kings River to the Upper Sacramento, McCloud, and Pit Rivers to the north. Today, they spawn upstream as far as the first impassable dam on major rivers although on the San Joaquin River they can only travel as high up as the Merced River because of lack of flows in the mainstem.

ABUNDANCE: It is likely that fall Chinook were the most abundant of the four Central Valley runs with about a million spawners per year, plus or minus 200,000 fish. In |the 1960s to 1990s, average production was about 374,000 fish per year, although the number of spawners usually varied somewhere between 200,000 and 300,000 fish, and occasionally decreased to about 100,000. In 1992 to 2005, production averaged about 450,000 fish per year, although this number dropped to less than 200,000 fish in 2006 and to about 90,000 spawners in 2007, despite the virtual closure of commercial fisheries. These numbers include fish of both wild and hatchery origin with hatchery fish comprising up to 90% of the total, depending on the river and year.

FACTORS AFFECTING STATUS: In the 19th century, fall Chinook numbers were depleted by heavy fishing, while hydraulic mining debris buried major spawning and rearing areas. In recent years, principal factors affecting their status have been, (1) dams, (2) water diversions, (3) habitat alteration, (4) commercial fisheries, (5) hatcheries, (6) pollution and disease, (7) alien species, (8) climate change, and (9) poor ocean conditions. The rapid decline of the population in 2003 to 2008 with the subsequent closure of the commercial fishery indicates that these factors can act synergistically.

STATUS 4: Fall Chinook are not at risk of extinction, but their reliance on hatchery production and the recent severe decline of the population indicates that more efforts are required to maintain self-sustaining wild populations. The run is listed as a species of special concern by the National Marine Fisheries Service. Populations of Central Valley fall Chinook could be so reduced in the future as to require permanent closures of commercial fisheries.

CONSERVATION RECOMMENDATIONS: To increase the populations of the Central Valley fall Chinook salmon, the large scale water diversions out of the Sacramento–San Joaquin Delta, loss of juvenile floodplain habitat, commercial fisheries regulation, hatchery fish impacts on wild stocks, and the problems of agricultural and urban pollution need to be addressed.

Merced River. PHOTO: MIKE BIRMINGHAM

1 **2** **3** **4** **5**

Central Valley Fall Chinook Salmon
Likely Historic Distribution

Southern Oregon/Northern California Coastal Chinook Salmon *Oncorhynchus tshawytscha*

chances for survival: *better* **4**

PHOTO: CURTIS KNIGHT

Chinook salmon have numerous small black spots on the back, dorsal fin, and both lobes of the tail in both sexes which distinguishes them from other salmon. Spawning adults are the largest Pacific salmon. Smith River Chinook routinely exceed 40 inches in length and have been recorded up to 86 pounds, although Klamath River Chinook are smaller, more rounded, and heavier in proportion to their length compared to Sacramento River Chinook. Spawning adults are the largest Pacific salmon. Smith River Chinook routinely exceed 40 inches in length and have been recorded up to 86 pounds, although Klamath River Chinook are smaller, more rounded, and heavier in proportion to their length compared to Sacramento River Chinook. They are principally late fall run salmon and are adapted to coastal watersheds in the Klamath Mountains Province. These fish enter the rivers in September through December and spawning activity occurs between October and February. Fry emerge from February through mid-April and usually emigrate to the sea soon thereafter when the stream flows are still high, however some young will rear in fresh water for four to six months. These Chinook rear in the California Current off the California and Oregon coasts and follow predictable ocean migration routes.

CATEGORY	SCORE	EXPLANATION
Range	4	Blue Creek and Smith River are stable populations with additional populations in Oregon
Population size	4	About 200 fish spawn in the Lower Klamath tributaries and at least 1,000 in the Smith River
Intervention needs	5	California populations are largely self-sustaining
Tolerance	3	Multiple juvenile life histories and spawner age diversity demonstrate physiological tolerances
Genetic risk	4	There are limited hatchery operations in California, but there is some concern for hybridization with hatchery 'strays' from other ESUs
Climate change	4	The fall run is least vulnerable to climate change in the north coastal environment of California since they spawn later, and their streams are likely to stay cool since they are close to the coast
Overall status	4	
Reliability	3	This species is the least studied of Klamath River Chinook runs

DISTRIBUTION: The ESU includes all Chinook salmon from Cape Blanco, Oregon (south of the Elk River) to the Klamath River. Tributaries of the Klamath River up to the Trinity River confluence are included. In California, these fish are found primarily in relatively small watersheds that are heavily influenced by maritime climate.

ABUNDANCE: The majority of Southern Oregon Northern/California coastal Chinook originate from the Rogue River in Oregon, with Lower Klamath tributaries and the Smith River contributing relatively small numbers of fish to the ESU. About 4,000 fish on average use tributaries of the lower Klamath and Trinity Rivers.

FACTORS AFFECTING STATUS: Population levels of these Chinook seem to have been fairly stable in recent years except for fluctuations in response to ocean conditions. However, they are presumably less abundant than they have been in the past because of habitat alteration and the commercial fishery, although the effects are poorly documented. Upslope land practices and road building likely have affected habitat quality in many of the rivers through increased sedimentation and the reduction in large woody debris, landslides from road construction and clear-cut logging can cause chronic sedimentation and reduce the ability of spawning areas to support fish. In the Smith River estuary, land reclamation through the construction of dikes and levees has reduced the amount of juvenile rearing habitat by up to 40%. Commercial fisheries have probably reduced escapement in the past but are currently restricted.

STATUS 4: Southern Oregon/Northern California coastal Chinook do not face extinction, although their distribution is limited in California to only a few fairly wild watersheds. In 1999, this ESU was determined not to warrant federal listing under the Endangered Species Act, although it is considered a sensitive species by the U.S. Forest Service. Currently, this species is primarily managed for its fishery value.

CONSERVATION RECOMMENDATIONS: All hatchery Chinook salmon should be marked so that a mark-selective fishery can be instituted and the contribution of hatchery fish to wild spawning better evaluated. Large-scale restoration of the Smith River estuary is needed to improve juvenile growth and survival before they head out to sea. Sediment reduction in all spawning rivers should become a major goal of restoration activities.

Smith River. PHOTO: TOM WESELOH

1 **2** **3** **4** **5**

Watersheds In Which Southern Oregon/Northern California Coastal Chinook Are Found; They Are Largely Confined To The Lower Reaches Of Larger Streams

California Trout is There for the Fish!

California Trout has continually sought and secured state and federal restoration funding for the California Coastal Salmon and Steelhead Restoration Program resulting in over $100 million in restoration projects coastwide in the last decade. California Trout reviews all restoration proposals within this program and provides recommendations for expenditures.

Klamath Mountains Province Summer Steelhead *Oncorhynchus mykiss*

chances for survival: *poor*

2

1 **2** 3 4 5

PHOTO: MATT STOECKER

Klamath Mountains Province summer steelhead are distinct from winter steelhead because of their springtime entry into the Klamath River, their lack of sexual maturity at entry, and the upstream location of spawning. Klamath Mountains Province summer steelhead enter the rivers during April through June and migrate upstream in early summer to mature in deep pools. Summer steelhead spawn in upstream regions that include the smaller headwater streams which are largely unavailable to winter steelhead.

Peak spawning occurs from December to March and thus summer steelhead are separated in time and spawning areas from winter steelhead. Half-pounders, sub-adults that have spent only two to four months in the Klamath estuary, are included in annual surveys of summer steelhead in the Salmon, New, and South Fork Trinity Rivers.

DISTRIBUTION: The Klamath Mountains Province summer steelhead range includes the Klamath and Trinity Rivers and other streams north to the Elk River near Port Orford, Oregon. Their range includes the Smith River in California and the Rogue River in Oregon. In California, these summer steelhead currently inhabit the larger tributaries to the middle Klamath River (Bluff, Red Cap, Camp, Dillon, Clear, Elk, Indian, and Thompson Creeks), the Salmon River, and the Trinity River. In the Salmon River, they are found in the North Fork, South Fork, and Wooley Creek. In the Trinity River, populations are present in Canyon Creek, Hayfork Creek, North Fork Trinity, East Fork Trinity, South Fork Trinity, and New Rivers. In addition, the Smith River also supports a few summer steelhead.

ABUNDANCE: Little is known about past abundance since records of Klamath Mountains summer steelhead population numbers exist only for recent decades. Given the available habitat, it is likely that they are at only a small fraction of their original numbers and have declined precipitously in the past 30 to 40 years.

FACTORS AFFECTING STATUS: The major factors causing population declines include, (1) dams and water diversions, (2) logging, (3) mining, (4) poaching, and (5) human disturbance. This species is exceptionally vulnerable to human activities because adult fish are conspicuous in their summer pools. In addition, because all life stages are present at all times in the rivers, these fish can suffer acutely from habitat degradation.

STATUS 2: Klamath Mountains Province summer steelhead have a high likelihood of becoming extinct within the next 50 to 100 years. They are a U.S. Forest Service sensitive species and are a species of special concern of the California Department of Fish and Game. They are not federally listed as endangered because they are part of the more abundant Klamath Mountains Province steelhead DPS. There is a general lack of basin-wide management actions to protect them, increasing the likelihood of local extirpations. Present management focuses on monitoring to assess if the populations are recovering to the point where some harvest will be possible. The Steelhead Restoration and Management Plan for California recognizes the importance of protecting healthy sub-basins, allowing natural processes to take precedence over human activities that cause degraded habitat conditions and maintaining a natural flow regime. Intense management that focuses on reducing human impacts and improving habitats is needed in the few watersheds where these summer steelhead are most abundant. In particular, maintaining cooler water temperatures in the summer is of critical importance.

CONSERVATION RECOMMENDATIONS: In conjunction with improved water flows in the Klamath and Trinity Rivers, management plans should address better enforcement of fishing and land use regulations, minimizing sedimentation, providing healthy water quality, and improving habitat for current populations. Restoration of extirpated populations is also needed as well as additional research on summer steelhead genetics, spawning areas, juvenile habitat requirements, the effect of poaching, gold dredging and recreation on the adult fish, and Trinity River restoration and flow increases.

Trinity River. PHOTO: JEFF BRIGHT

Likely Historic Distribution Of Klamath Mountain Province Summer Steelhead, Including Migratory Pathways

California Trout is There for the Fish!

In 1972, California Trout and others led the passage of the California Wild and Scenic Rivers Act. The result of this landmark legislation was to mothball plans for almost 20 dams slated for construction on the Klamath, Trinity, Smith and Eel Rivers. Because of California Trout's leadership in establishing the Wild and Scenic Rivers Act, threatened Klamath Mountains Province summer steelhead are benefitting.

CATEGORY	SCORE	EXPLANATION
Range	2	Summer steelhead in the Klamath Mountain Province have several populations that probably vary independently of one another
Population size	2	A majority of subpopulations are very small and isolated
Intervention needs	3	No intervention is being undertaken to assist in long term survival, but it is badly needed
Tolerance	2	Adults require cold water refuges
Genetic risk	2	Hybridization risk with hatchery fish is high, which could result in loss of distinctive life history traits
Climate change	1	Highly vulnerable and temperatures and flows already marginal in many areas
Overall status	2	
Reliability	3	Well documented in literature

Northern California Coast Summer Steelhead *Oncorhynchus mykiss*

chances for survival: *poor*

2

1 2 3 4 5

PHOTO: MATT STOECKER

Northern California coast summer steelhead are managed with winter steelhead as a single DPS. Summer steelhead, however, differ from winter steelhead in time of migration, state of sexual maturity at migration, and location of spawning. Little is known about the genetic relationships among summer steelhead populations, but they are likely more similar to winter steelhead in the same basin than to other regional summer steelhead. Northern California coast summer steelhead migrate upstream from mid-April through June into headwaters to over-summer in deep, cool pools.

During this time, they mature and spawn in late fall and winter. This life history has reinforced reproductive isolation between summer and winter steelhead. As for all steelhead, there is a great deal of variation in behavior, such as age at ocean entry, age upon return, and number of repeat spawners.

DISTRIBUTION: Populations remain in the upper reaches of Redwood Creek and in the Mad, Van Duzen, Middle Fork Eel, and Mattole Rivers. Other populations exist, or formerly existed, in the North Fork Eel, Upper Mainstem Eel, and South Fork Eel Rivers.

ABUNDANCE: Little historical abundance information exists for Northern California coast summer steelhead. It appears that a majority of these summer steelhead populations have declined precipitously since the initial recognition of their presence 30 to 40 years ago. Extirpation of most remaining populations is a serious threat with a majority of populations declining to extremely low populations since the 1980s. The number of summer steelhead in the Middle Fork Eel River has ranged from 198 to 1,601 adults during annual summer surveys.

FACTORS AFFECTING STATUS: The primary factors affecting the status of Northern California coast summer steelhead include, (1) logging and other land use activities, (2) water diversions, (3) human disturbance, (4) hatcheries, and (5) poaching. In the Middle Fork Eel River, steelhead numbers were lowest following the 1964 flood. This flood likely caused the loss of deep, complex pools necessary for over-summering habitat. The cumulative effect of this flood, compounded by continued sedimentation from logging and road building in the latter part of the 20th century, has been a major factor in the low numbers of steelhead. At the present time, numbers are so low that each population is extremely vulnerable to poaching and any local disturbances that may cause declines in water quality.

STATUS 2: The entire Northern California coast steelhead DPS is listed as federally threatened, but the likelihood of extinction of the summer steelhead portion is particularly high. Only the Middle Fork Eel population seems likely to remain viable beyond the next 25 years. However, adequate water flows and reduced hatchery releases in the Mad River may protect summer steelhead in this watershed. Meeting the objectives of a joint National Marine Fisheries Service and State of California Memorandum of Agreement are critical to the recovery of both Northern California coast summer (and winter) steelhead. It has been almost a decade since the Memorandum was issued and many of its objectives have yet to be enacted. Very little management effort is directed specifically at summer steelhead and, as a result, their populations have continued to decline. Recent changes in sport fishing regulations and hatchery operations have reduced some of the threats. The problem with poaching continues to plague summer steelhead due to the absence of adequate law enforcement. Although fishing is prohibited in many areas and fines for violations are high, protection of summer steelhead populations requires special enforcement efforts.

CONSERVATION RECOMMENDATIONS: Several critical conservation actions are needed to protect this imperiled species including increased protection of summering areas from poachers, improved watershed management for adequate summer flows and temperatures, and better management of downstream waters to favor out-migrating smolts. Additional projects benefitting the species include habitat improvements, restoration of populations which have become extirpated, and protection of adults and juveniles from predation.

CATEGORY	SCORE	EXPLANATION
Range	2	The Middle Fork Eel, Van Duzen, Mattole, and Mad Rivers and Redwood Creek all have summer steelhead runs
Population size	2	Among all populations, there are likely about 1,000 spawners, but only the Middle Fork Eel River has enough fish to persist for more than 25 to 50 years
Intervention needs	3	No intervention currently being undertaken but it is needed to maintain populations
Tolerance	2	Northern California coast summer steelhead require cold water refugia
Genetic risk	2	The genetic difference between winter and summer steelhead is unknown
Climate change	1	Climate change is likely to impact all populations
Overall status	2	
Reliability	3	Populations have been well studied

California Trout is There for the Fish!

California Trout has organized river dives to assess summer steelhead populations and provide recommendations for their long term protection by altering hatchery practices, developing protective angling regulations, and advocating for increased habitat protection and restoration.

Mad River. PHOTO: TOM WESELOH

Likely Historic Distribution Of Northern California Coast Summer Steelhead, Including Migratory Pathways

South-Central California Coast Steelhead

Oncorhynchus mykiss

chances for survival: *poor* **2**

PHOTO: MARK CAPELLI

South-central California coast steelhead are adapted to deal with highly variable rainfall and temperature conditions, but are otherwise similar to other steelhead.

These fish spend one to three years in fresh water before migrating to the ocean for two to four years, returning to natal rivers to spawn. Adults can reproduce more than once, but the rate of repeat spawning is unknown. Three life history patterns have been noted: stream anadromous, freshwater resident, and lagoon-anadromous. Anadromous steelhead may produce young which complete their life cycle entirely in freshwater, while rainbow trout which have completed their life cycle entirely in freshwater may produce progeny which emigrate to the ocean and return as anadromous steelhead. Having both resident and anadromous fish may help to ensure survival and each type is essential for recolonization (either from marine or freshwater) after local loss. Juvenile life history patterns are influenced by the need to emigrate in dry years, when streams are low or dry. Some populations may grow more during the winter and spring when temperatures are optimal while showing little growth in summer and fall when conditions are stressful. Steelhead have managed to persist in the face of rapidly expanded human populations and increased demand for water, particularly in the northern, inland, and southern portions of their range.

DISTRIBUTION: South-central coast steelhead are found from the Pajaro River south to (but excluding) the Santa Maria River. They are currently found in almost all coastal watersheds in which they were historically present. Adult steelhead are likely found in the ocean as far south as northwestern Mexico and are more solitary than other salmonids. In the Big Sur Coast and northern portion of the San Luis Obispo Terrace regions, 37 streams contain steelhead and bear more ecological resemblance to steelhead streams in northern California than to other streams in the region.

ABUNDANCE: Limited data from the larger watersheds suggest that, in the past 50 years, total steelhead numbers have declined by 90% or more. Historically, annual runs totaled more than 27,000 adults but, by 1965, total numbers had declined to around 17,000 adults. Today, it is likely that the total number of spawners throughout their range in a wet year is considerably less than 5,000 fish, and perhaps as few as 2,000 fish.

FACTOR AFFECTING STATUS: The principal threats to south-central California coast steelhead are, (1) alteration of natural stream flow patterns, (2) physical impediments to fish passage, (3) alteration of floodplains and channels, (4) sedimentation, (5) urban and rural waste discharges, (6) spread and propagation of alien species, and (7) loss of estuarine habitat. In general, steelhead populations in the northern, inland and extreme southern portion of their range have experienced the most extensive habitat degradation. The inadequacy of federal and state regulatory mechanisms has allowed aquatic habitats to be damaged repeatedly, protected ineffectively, and managed inconsistently. Although a majority of local extirpations have been associated with barriers, climate change is highly likely to have an adverse impact. Estuarine degradation and loss, particularly in the northern and southern portions of the range, has significantly reduced rearing potential.

STATUS 2: South-central California coast steelhead were listed as federally threatened in 1997, but they continue to persist in most of their historic watersheds. Nonetheless, a majority of the population is likely to be extinct within 50 years without serious intervention. South-central California coast steelhead are threatened by increasing human land and water development, as well as climate change, wildfire, and drought. Solving these problems requires both short- and long-term social and managerial changes. Best management practices for water use and agriculture need to be implemented by private landowners and industrial water users to conserve and restore instream, floodplain and riparian habitats, as well as critical lagoon habitats.

CONSERVATION RECOMMENDATIONS: Essential tasks for protecting these steelhead include sufficient provisions for habitat protection and restoration in the Los Padres National Forest Plan, coordination of governmental agencies to balance water resources with recovery of the steelhead, and completion of a Coast-Wide Anadromous Fish Monitoring Plan by the National Marine Fisheries Service and the California Department of Fish and Game. Beneficial actions which can be taken quickly include further research on their life history, continued fish barrier removal in smaller coastal streams, and providing flows in the Salinas and Pajaro river systems to support floodplain habitats.

CATEGORY	SCORE	EXPLANATION
Range	3	Multiple watersheds are occupied, though extended occupancy makes these watersheds unique compared to most coastal basins
Population size	2	Most populations probably contain less than 100 spawners
Intervention needs	2	Habitat restoration and barrier modification projects are critical for recovery; most populations will require reconnection of resident and anadromous populations in the near future to boost them to sustainable levels
Tolerance	3	Moderate physiological tolerance, rate of repeat spawning is unknown
Genetic risk	3	Limited gene flow among populations and limited hatchery hybridization
Climate change	1	Effects will be exacerbated by human population growth
Overall status	2	
Reliability	3	Relies heavily on gray literature, but some published reports available

California Trout is There for the Fish!

California Trout was instrumental in the formation of the Southern California Steelhead Coalition, whose mission is to restore Southern California rivers and streams. Some major accomplishments of the coalition have included obtaining almost $4 million for Southern California steelhead restoration projects and raising public awareness of the importance and needs of Southern California steelhead.

Arroyo de la Cruz. PHOTO: MARK CAPELLI

1 2 3 4 5

Historic Distribution Of South-Central California Coast Steelhead

Southern Steelhead

Oncorhynchus mykiss

chances for survival: *poor* **2**

PHOTO: MARK CAPELLI

Southern steelhead are the southernmost native anadromous rainbow trout in North America. They spend one to two years in fresh water before migrating to the ocean for two to four years, returning to natal rivers to spawn.

Differences between the southern steelhead DPS and those to the north relate mainly to life history, reflecting the variable environment in which these fish evolved. Southern steelhead are dependent on short-duration winter rains to provide passage through estuaries and rivers to upstream spawning and rearing habitats. This results in a restricted and rapid spawning period, so fish are generally mature when they ascend the rivers. Recent summer observations of spawned out adult steelhead holding in the closed estuary of the Ventura River illustrates the tenuous connection between the marine and freshwater habitats. Three life history patterns have been noted: stream anadromous, fresh water resident, and lagoon-anadromous. Anadromous steelhead may produce young which complete their life cycle entirely in fresh water, while resident rainbow trout may produce young which emigrate to the ocean and return as anadromous steelhead. Having both resident and anadromous fish may help to ensure survival and each type is essential for recolonization (either from marine or freshwater) after local extirpation. Because of frequent droughts in southern California, streams may be inaccessible from the ocean during some years, forcing adult steelhead to spend additional years in the ocean. The increased growing time in the ocean, plus rich food sources in southern coastal waters, may account for the large size of 20 pounds occasionally attained.

CATEGORY	SCORE	EXPLANATION
Range	2	Found only in isolated populations
Population size	2	Limited availability of suitable spawning and rearing habitat annually likely leads to limited spawning; each population appears to be small and independent
Intervention needs	3	Intensive efforts such as barrier modification, habitat restoration, and restoration of instream flows are essential to maintenance of populations. This is likely to become a '2' in the near future
Tolerance	2	Moderate physiological tolerance to existing conditions, although limits are being reached; the frequency of reproduction is unknown
Genetic risk	2	Limited gene flow among populations; hatchery hybridization is limited based on the genetic evidence and populations are small
Climate change	1	Climate change likely to impact them throughout their range, exacerbating other factors
Overall status	2	
Reliability	3	Relies heavily on gray literature, but some published reports available

California Trout is There for the Fish!

California Trout took the lead in efforts to provide fish passage over the Robles Diversion on the Ventura River. Since 2004, the completed ladder has been successfully passing southern steelhead. As a continuation of these activities, California Trout is a leader in the efforts underway to remove Matilija Dam, which will provide access to substantial reaches of critical steelhead habitat in the Ventura River watershed.

DISTRIBUTION: The southern steelhead DPS includes all naturally spawned anadromous rainbow trout populations below barriers in streams from the Santa Maria River, San Luis Obispo County, south to the U.S.–Mexico Border. Populations from over half of the 46 watersheds historically supporting steelhead runs have been lost. Four of the largest known historic steelhead runs (Santa Maria, Santa Ynez, Ventura, and Santa Clara Rivers) are in the northern portion of the range. Recently, steelhead have been documented in San Juan, San Luis Rey, and San Mateo creeks in Orange and San Diego counties. These southernmost populations are separated from other populations by 80 miles.

ABUNDANCE: Overall, southern steelhead numbers have declined in the past 50 to 75 years from runs of about 30,000 adults to less than 500 returning fish. There have been no comprehensive surveys in recent years to provide a reliable estimate of population size, but reductions in habitat access and quality have reduced numbers by 90% or more.

FACTORS AFFECTING STATUS: The primary factors impacting southern steelhead populations include, (1) alteration of stream flow patterns, (2) physical impediments to fish passage, (3) alteration of floodplains and stream channels, (4) sedimentation, (5) waste discharges, (6) exotic species, (7) loss of estuarine habitat, and (8) stocking of hatchery reared salmonids. Southern steelhead have survived despite the extensive modification of much of their habitat.

STATUS 2: Southern steelhead were listed as an endangered species by the National Marine Fisheries Service in 1997, a status reaffirmed in 2006. Southern steelhead are in danger of extinction within the next 25 to 50 years due to the growing human population in southern California and climate change. The steelhead's decline is continuing, following lost populations in watersheds where barriers blocked migrations. While there is considerable interest in restoring southern steelhead, the lower reaches of their streams are increasingly less hospitable, although significant portions of their watersheds are protected in the four U.S. National Forests in the region: Los Padres, Angeles, San Bernardino, and Cleveland. Recovery of these populations will take a major commitment to reconnect the upper and lower portions of the watersheds and to restore natural flow regimes and protect and restore estuarine habitats.

CONSERVATION RECOMMENDATIONS: Conservation of southern steelhead will require the immediate protection and expansion of their habitat and the reestablishment of runs that were historically highly productive, including the Santa Maria, Santa Ynez, Ventura and Santa Clara Rivers. Changes in water management to ensure adequate flows and passage to spawning and rearing areas are critically needed.

Agua Blanca Creek. PHOTO: MARK CAPELLI

1 **2** **3** **4** **5**

Historic Distribution Of Southern Steelhead—Now Absent From Many Streams

Central California Coast Steelhead

Oncorhynchus mykiss

chances for survival: *average* **3**

1 2 3 4 5

PHOTO: MORGAN BOND

Central California coast steelhead are a distinct group of anadromous trout inhabiting rivers of the central coast. Many of these rivers have dams blocking migration for spawning. Central California coast steelhead are unusually dependent on estuaries at the mouths of their streams for growth and survival. Although they demonstrate a tremendous amount of juvenile and adult life history variation, all adult spawning runs occur during the winter.

DISTRIBUTION: The Central California coast steelhead DPS includes all populations below natural and manmade barriers in streams from the Russian River in the north to Aptos Creek in the south. Steelhead in drainages of San Francisco, San Pablo, and Suisun Bays are also part of this DPS. Currently, Central California coast steelhead remain in 82% of their historically occupied watersheds, which is impressive given the extensive urbanization of the southern portion of this region. The Russian River supports steelhead in tributaries and the mainstem for much of its length. Within the San Francisco Bay coastal and interior regions, independent populations are found in the Guadalupe and Napa Rivers, as well as in San Leandro, San Lorenzo, Coyote, and Alameda Creeks. Separate populations are also found south of the Golden Gate in the Santa Cruz mountains region including the San Lorenzo River and San Gregorio and Pescadero Creeks.

CATEGORY	SCORE	EXPLANATION
Range	3	Multiple watersheds occupied in California but probably less than ten Functionally Independent Populations (FIPs) still exist
Population size	3	The Russian River likely contains more than 1,000 steelhead annually with smaller contributions from other FIPs, but numbers are declining
Intervention needs	3	Habitat restoration and barrier removal are critical to increasing habitat availability
Tolerance	4	Able to live in freshwater and brackish water environments
Genetic risk	4	Widespread but populations increasingly fragmented and isolated
Climate change	1	Extremely vulnerable in all watersheds because of stress from other factors (urbanization, etc.)
Overall status	3	
Reliability	3	Populations have been well studied

ABUNDANCE: Data on central California coast steelhead abundance are very limited, but it is likely that these steelhead spawning runs have declined by 80 to 90% in the past 50 years and that the decline is continuing. During the early 1960s, the California Department of Fish and Game estimated 94,000 spawners, with the majority occurring in the Russian River (50,000) and San Lorenzo River (19,000) and coastal tributaries supported about 24,000 fish annually. Current population estimates average about 14,100 adult steelhead per year for all streams.

FACTORS AFFECTING STATUS: Central California coast steelhead are limited by a wide variety of factors including, (1) dams and other barriers, (2) degradation of stream habitat, (3) degradation of estuarine habitat, and (4) hatcheries. In most streams, their upstream limit is determined by dams, whereas in smaller streams population viability is usually determined by the amount of water diverted for vineyards and other purposes. Many streams now flow through heavily urbanized areas. Climate change will exacerbate these problems by increasing temperatures beyond lethal limits in unprotected streams and increasing the demand for already scarce water supplies.

STATUS 3: Central California coast steelhead were listed as a federally threatened species in 1997, a finding that was reaffirmed in 2006. They do not appear to be in immediate danger of extinction because some populations, such as those in the Russian River, seem to be still fairly large, but this could change as additional information becomes available. Every indication is that the number of fish in all populations is trending downward. Unless conservation actions are taken, it is likely extirpation of these steelhead from most small watersheds will occur over the next 25 to 50 years. The solutions are simultaneously local and widespread. Small-scale actions would include improved watershed management, such as addition of large wood, adequate riparian buffers, and limiting sediment and other pollutants flowing into a stream. Larger-scale actions include improved water releases from dams and better regulation of thousands of small water diverters from tributaries.

CONSERVATION RECOMMENDATIONS: All streams containing these steelhead should have flow, temperature, and sediment standards established and enforced by state and regional water boards. The persistence of this DPS depends on the persistence of habitat in hundreds of small streams.

Navarro River. PHOTO: JOE FERREIRA

Central California Coast Steelhead Distribution

Central Valley Steelhead

Oncorhynchus mykiss

chances for survival: *average* **3**

PHOTO: ANDREW MAURER

Adult Central Valley steelhead are sea-run rainbow trout that rarely exceed 24 inches in length. They are silvery, often showing an iridescent pink to red lateral line and have a slightly forked tail fin with radiating spots. Many small, black spots also cover the back, adipose, and dorsal fins.

Juveniles display five to 13 oval parr marks centrally located along the lateral line, with interspaces wider than the parr marks. It is difficult, if not impossible, to reliably distinguish steelhead from resident rainbow trout in the Sacramento River because of the highly variable appearance of both forms. Steelhead are part of a rainbow trout complex that exists in the Central Valley, although the steelhead are recognized as a distinct unit for management. They exhibit flexible reproductive strategies which allow for survival despite variable conditions within California's Central Valley.

At present, the winter run is the only form which migrates upstream to spawn from late September to mid-February. Central Valley steelhead historically spent one to three years in their natal streams before smolting and emigrating to the ocean in December through May. It is not known if their historic life-history diversity is still present or if some steelhead young do not go to sea at all and become resident. It is possible that some steelhead have adapted to the improved conditions in the Sacramento River for rearing (cold water in summer and abundant food in the form of hatchery salmon fry) and simply migrate between River and tributaries, rather than risking emigration through the Sacramento–San Joaquin Delta and adverse conditions in the ocean.

CATEGORY	SCORE	EXPLANATION
Range	4	Multiple populations are present in the Central Valley, but individual viability is not known
Population size	2	Does not include resident fish in Sacramento River and tributaries
Intervention needs	2	Intensive effort required to maintain steelhead life history with appropriate genotype
Tolerance	3	Broad physiological tolerances, but conditions often unfavorable in large rivers and the San Francisco Estuary
Genetic risk	2	Hybridization risk is high with hatchery steelhead of Eel River origin and other non-native strains of trout
Climate change	2	Climate change will likely reduce populations but not eliminate many of them, however, their inability to access historic cold water tributaries makes them more vulnerable
Overall status	3	
Reliability	2	Unequivocal data are not readily available

DISTRIBUTION: Historically, steelhead were found in accessible streams throughout the Central Valley. Today they are largely confined to rivers below dams in the Sacramento River Basin, but have been found in the lower Tuolumne River in the San Joaquin River Basin.

ABUNDANCE: There is no good method to accurately estimate past and present abundance of Central Valley steelhead. Crude estimates made in the early 1990s that included both hatchery and wild fish indicated there were about 10,000 adult fish. Incomplete counts of fish returning to the upper Sacramento River show a decline from an average of 6,574 fish in the period 1967 through 1991, to an average of 1,282 from 1992 to present.

FACTORS AFFECTING STATUS: Many stressors have contributed to their decline, including, (1) major dams, (2) water diversions, (3) barriers, (4) levees and bank protection, (5) dredging and sediment disposal, (6) mining, (7) contaminants, (8) alien species, (9) fisheries, and (10) hatcheries. The single most important cause of Central Valley steelhead population decline has been the loss of access to 80 to 95% of their historic habitat above impassable dams.

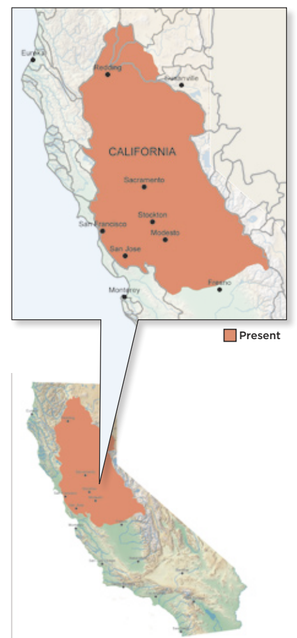
STATUS 3: Central Valley steelhead do not appear to be in immediate danger of extinction, although this assessment could change with better information on the relationship between anadromous and resident populations and on the status of resident populations below the major dams. The high degree of uncertainty suggests that scoring a "2" might be more conservative. The Central Valley steelhead was first listed as a threatened species under the Endangered Species Act in 1998 and was re-evaluated and confirmed as such in 2005. The Central Valley steelhead is managed by the California Department of Fish and Game with no legal harvest on wild fish and only hatchery (fin-clipped) fish may be harvested in some areas.

CONSERVATION RECOMMENDATIONS: Because of the lack of information on Central Valley steelhead life history, abundance, and interactions with resident and hatchery rainbow trout, a monitoring program that will reliably estimate numbers of these steelhead entering the Sacramento and San Joaquin Rivers should be developed. In addition, there should be a research program which includes a comprehensive analysis of rainbow trout genetics in watersheds known to contain Central Valley steelhead, as well as a comprehensive habitat improvement program that includes barrier removal, adequate flows, and spawning habitat enhancements.

Lower Tuolumne River. PHOTO: CARL MESICK

1 2 **3** 4 5

Central Valley Steelhead
Likely Historic Distribution



Northern California Coast Winter Steelhead *Oncorhynchus mykiss*

chances for survival: *average* **3**

PHOTO: TOM WESELOH

Northern California coast winter steelhead return from the ocean as silvery trout with numerous black spots on their tail, adipose fin and dorsal fin. The spots on the tail are typically in radiating lines. Their back is an iridescent blue to nearly brown or olive. They are considered to be a DPS, together with summer steelhead. Northern California coast winter steelhead enter estuaries and rivers between September and March before spawning between December and early April. Repeat spawning varies considerably among runs and populations, from 18% to 64% of spawners, and females make up the majority. Because these fish spawn over a lengthy period of time, fry emergence also takes place over a long period of time. Juveniles rear in the streams for one to three years before leaving for the ocean. In the Navarro River some steelhead enter the ocean after spending at least one year in the estuary. Juvenile steelhead in streams favor areas with cool, clear, fast-flowing riffles, ample riparian cover, undercut banks, and abundant invertebrate food. They grow rapidly in the ocean, feeding on fish, squid, and crustaceans.

DISTRIBUTION: Northern California coast steelhead are present in California coastal river basins from Redwood Creek in Humboldt County to just south of the Gualala River in Mendocino County. This distribution includes the Eel River, the third largest watershed in California with its four forks (North, Middle, South, and Van Duzen) and their tributaries. There are an estimated 32 self-sustaining populations. An additional 33 small populations are likely dependent on immigration steelhead from other watershed populations.

ABUNDANCE: Little historical abundance information exists for Northern California coast winter steelhead, but current abundance is low relative to historical estimates. The Eel River once supported a run of at least 82,000 steelhead. Optimistically, annual spawning returns in the entire DPS today range from 25,000 to 50,000 fish, down from an historical estimate of about 200,000 fish.

FACTORS AFFECTING STATUS: Due to their varied habitats and large ranges, a number of factors affect Northern California coast winter steelhead including, (1) dams, (2) logging, (3) agriculture, and (4) alien species. The biggest cumulative effect to the streams of winter steelhead has come from logging, beginning with the huge impacts of unrestricted logging in the 19th and early 20th centuries. Today, a significant proportion of steelhead habitat is industrial timberlands, both private and public, which have already undergone one or more cycles of tree removal. The cumulative effects of these operations in combination with historic logging is difficult to assess, although direct impacts include increased sedimentation and stream temperatures, reduced canopy cover, destruction of instream habitat, and altered flows. The channels of the Eel River and its tributaries have become shallower and less defined due to the massive flood of 1964. These changes have reduced the ability of adults to reproduce, juveniles to forage, and migrants to safely swim to the ocean. In addition aquatic invertebrates, which are an important food source for the fish, have been reduced. Increasingly, agriculture, including vineyards, is replacing forests as the dominant factor having a negative impact on coastal rivers.

STATUS 3: Northern California coast winter steelhead have a low to moderate risk of extinction in the next 50 to 100 years. The entire DPS, which includes summer steelhead, was listed as threatened under the Endangered Species Act on June 7, 2000, and reaffirmed in 2006. The listing resulted from the failure of California to follow guidelines in a 1998 National Marine Fisheries Service and State of California Memorandum of Agreement, and, in particular, improvements to the California Forest Practices Act. The objectives of this Memorandum remain critical to the recovery of Northern California coast winter steelhead, yet almost a decade later, most have not been implemented.

CONSERVATION RECOMMENDATIONS: The California Memorandum of Agreement should be enacted and enforced, along with fish-friendly improvements to the California Forest Practices Act. This would be the start of initiating hundreds of improvements needed on steelhead streams, from increased flows, to reduced sedimentation, to physical habitat restoration.

CATEGORY	SCORE	EXPLANATION
Range	3	They exist in multiple watersheds in California
Population size	3	About 1,000 wild spawning steelhead are present annually in the Mad and Eel Rivers, and other populations (Redwood Creek, Mattole, and Garcia Rivers) may contain as many though information is lacking
Intervention needs	3	Habitat restoration and barrier removal is critical to juvenile and spawning habitat for Northern California coastal steelhead to prevent continued decline
Tolerance	4	Steelhead can spawn more than once and have broad tolerance in fresh water
Genetic risk	4	They are genetically diverse with gene flow among populations although hatchery influence is a concern
Climate change	3	The coast range has cooler temperatures and more consistent flow than in most basins, but effects can be high in altered watersheds
Overall status	3	
Reliability	3	Actual numbers of fish are poorly known

California Trout is There for the Fish!

In a precedent-setting 2006 decision, the California Court of Appeals ended a decades-long court case that began in 1993 when the North Fork Gualala Water Company in 1993 sued the California State Water Resources Control Board challenging its authority to regulate subterranean stream flows. Such underflow is critical to sustain healthy fisheries as a primary source of surface stream flow during the late summer/ early fall periods.

South Fork Eel River. PHOTO: THOMAS DUNKLIN

1 **2** **3** **4** **5**

Northern California Coast Winter Steelhead Distribution

Klamath Mountains Province Winter Steelhead *Oncorhynchus mykiss*

chances for survival: *better* **4**

PHOTO: JEFF BRIGHT

Klamath Mountains Province winter steelhead are distinguished from other California steelhead through genetics and life history traits. Together with the summer steelhead located in this region, they form the Klamath Mountains Province steelhead ESU. These fish differ from summer steelhead by their entry into fresh water in winter as sexually mature fish that spawn soon after arrival. They migrate upstream from September through March with the fry typically emerging beginning in April.

Juveniles begin downstream emigration in May, before peaking in June and July, with the migrants being about equally divided among young-of-year, one, and two year olds. The presence of "half-pounders," sub-adult individuals that have spent two to four months in the estuary or inshore marine areas before returning to the river in winter, is a distinguishing life history trait. Adults remain in the ocean for one to three years before returning to spawn.

DISTRIBUTION: The Klamath Mountains Province winter steelhead range includes coastal streams throughout the Klamath and Trinity basins, and streams north of the Klamath River to the Elk River near Port Orford, Oregon. Their range includes the Smith River in California and the Rogue River in Oregon. In the Klamath River they ascend as high as Iron Gate Dam, although historically they ascended into tributaries to Upper Klamath Lake. In the Trinity River their upstream access is blocked by Lewiston Dam. Their migration and spawning period coincides with the period of greatest flows, so winter steelhead often ascend into smaller tributaries not accessible during low-flow periods.

CATEGORY	SCORE	EXPLANATION
Range	5	Widely distributed
Population size	5	Wild populations in Klamath seem to be large
Intervention needs	4	Wild populations may require protection from hatchery fish
Tolerance	4	Steelhead are physiologically tolerant and have a flexible life history
Genetic risk	4	Some risk from hatchery fish in the Klamath River
Climate change	4	More opportunities to respond than most salmonids
Overall status	4	
Reliability	4	Well documented population

California Trout is There for the Fish!

In 2007, California Trout co-sponsored legislation with the Karuk Tribe to stop motorized suction dredge mining practices harmful to coho salmon populations on segments of the Klamath, Scott, and Salmon Rivers, but the measure was vetoed. California Trout championed similar reforms as part of the 2008 state budget in partnership with our allies and continues to seek creative solutions to reforming these practices.

ABUNDANCE: Winter run steelhead numbers in the Klamath and Trinity Rivers declined from 283,000 spawners in 1965 to between 87,000 and 181,000 between 1982 to 1983. Based on creel and gill net harvest data, the winter run steelhead population was estimated at 10,000 to 30,000 spawners per year in the Klamath River. The Trinity River steelhead run seems to be in the same range, however it is more variable. Returns to the Iron Gate hatchery have been distinctly depressed in recent years. Trinity River hatchery returns have been on the increase since 2000 with some of the highest hatchery returns recorded in the last several years. On the Smith River, spawning escapement was estimated to be approximately 30,000 adult steelhead during the 1960s, but there are no subsequent drainage-wide estimates.

FACTORS AFFECTING STATUS: Populations of Klamath Mountains Province winter steelhead are large enough to support sport fisheries, but appear to be in a long-term decline and are increasingly supported by hatcheries. Their long-term decline is the result of (1) dams blocking access to upstream areas, (2) diversions that diminish flows in tributaries, (3) degradation of critical watersheds from logging, agriculture, and other factors, and (4) a possible reduction of fitness due to hatchery practices.

STATUS 4: There is no immediate extinction risk for Klamath Mountains Province winter steelhead. The entire ESU was rejected by the National Marine Fisheries Service for listing under the Endangered Species Act in March 1998. A court ruling in 2000 overturned this decision, finding that the agency had relied too heavily on the expected benefits of future conservation efforts. However, in 2001 the species' listing was again determined to be "not warranted." Klamath Mountains Province winter steelhead today are largely managed to support major sport fisheries. A number of key goals for reversing trends include the reduction of dependence on hatchery stocks, improved flows below dams or dam removal, and watershed restoration. The latter requires reducing the impacts of road building, logging, and instream mining, as well restoring riparian and instream habitat where possible.

CONSERVATION RECOMMENDATIONS: Key elements for Klamath Mountain Province winter steelhead conservation include increasing naturally produced stocks, improving flows below Iron Gate and Lewiston Dams, and restoring favorable instream conditions to benefit multiple species. Protection from the adverse effects of logging practices allowed by the State of California is also important. Finally, in the long run, dams on the Klamath and Shasta Rivers should be removed to greatly increase the amount of habitat available for these steelhead, as well as for improving downstream flows.

Trinity River. PHOTO: JEFF BRIGHT

1 **2** **3** **4** **5**

Klamath Mountain Province Winter Steelhead Distribution

Bull Trout

Salvelinus confluentus

PHOTO: U.S. FISH AND WILDLIFE SERVICE

Bull trout are olive green in color with tiny yellowish spots on the back, and small red and black spots on the sides. The head is broad and flat, and the eyes are close to the top of the head. The mouth is large with conspicuous sharp teeth and the upper jaw extends beyond the eye. Bull trout were once thought to be Dolly Varden char, but the two are now regarded as separate species. Museum specimens of California bull trout are distinct in body form from other populations, but not sufficiently enough to designate them a subspecies. Bull trout were not studied in California before they became extinct and therefore the information here is drawn from other regions. In the McCloud River, adults lived in pools in the lower reaches of the river and migrated upstream to spawn. Juveniles fed on aquatic insects, but gradually switched to a diet of fish as they grew larger. Adults fed on fish, including juvenile trout and salmon, sculpins and their own young, as well as frogs and mice. Bull trout from the McCloud River were reported to exceed 15 pounds in weight and the California angling record fish is about 11 pounds.

DISTRIBUTION: In California, bull trout were known to occupy only about 60 miles of the McCloud River, from its mouth to the Lower Falls. They are currently widely distributed throughout the western United States and Canada.

ABUNDANCE: Bull trout are now extinct in California. The last known bull trout caught in California was captured by U.C. Davis graduate student Jamie Sturgess in 1975 by hook and line. It was tagged and released. Bull trout were in decline throughout most of the 20th century, although in the 1930s they still supported a small fishery on the McCloud River. After the construction of Shasta Dam in the 1940s bull trout were scarce. They became increasingly rare in the 1960s and were extinct by the late 1970s.

FACTORS AFFECTING STATUS: The biggest single factor affecting the bull trout population in California was the construction of Shasta Dam which blocked access of salmon to the McCloud, eliminating a primary source of food for the trout. The decline of salmon runs prior to dam construction started the bull trout decline. In addition, the construction of McCloud Reservoir blocked spawning migrations from the lower to upper river and contributed to higher water temperatures in the reaches of the lower river. An additional factor impacting the bull trout was introduction of brown and brook trout, both successful competitors with bull trout, into the watershed.

STATUS 0 (EXTINCT): Bull trout are extinct in California and are listed as federally threatened under the Endangered Species Act throughout the remainder of their range in the U.S.A.

CONSERVATION RECOMMENDATIONS: The California Department of Fish and Game has a plan for restoring bull trout by establishing resident populations in some tributaries upstream of the McCloud Reservoir and in the lower river. However, because Shasta Dam blocks access to spawning salmon, the abundance of prey is much lower than it was historically, so the river is unlikely able to support a self-sustaining population of bull trout.

McCloud River. PHOTO: PETER MOYLE

extinct **0**

1 **2** **3** **4** **5**

Bull Trout Historical Distribution

California Golden Trout

Oncorhynchus mykiss aguabonita

chances for survival:
poor

2

1 2 3 4 5

PHOTO: JOE FERREIRA

California golden trout, the official state fish, is one of three species of brilliantly colored trout native to the upper Kern River Basin; the others are the Little Kern golden trout and Kern River rainbow trout. California golden trout evolved in streams of the southern Sierra Nevada Mountains, at elevations above 7,500 feet. The Kern Plateau is broad and flat, with wide meadows and meandering streams. The streams are small, shallow, and have only limited vegetation along the edges. The exposed nature of these streams is the result of intensive grazing of livestock in the fragile landscape, which began in the 1860s. The stream bottoms are mostly volcanic sand and gravel with some cobble. The water is clear and cold, although summer temperatures can fluctuate from about 37 to 68°F.

California Trout is There for the Fish!

Protecting California golden trout has been a major conservation focus for California Trout for over a decade. Working first to develop a watershed group in 1995 and then collaborating with the Inyo National Forest, California Trout was instrumental in retiring grazing allotments that provided the means to scientifically assess whether grazing was detrimental to California golden trout and their habitats.

CATEGORY	SCORE	EXPLANATION
Range	1	Native to one watershed, but they now contain hybrid trout. "Pure" California golden trout are confined to a few small tributaries
Population size	2	Tributary populations show signs of genetic limitations, but probably still contain 100 to 1,000 non-hybrid adults, although the population size could be smaller
Intervention needs	3	Non-hybridized fish require maintenance of barriers and continued vigilant management
Tolerance	2	Require conditions present in relatively undisturbed small alpine streams
Genetic risk	1	Hybridization with rainbow trout is constant high risk
Climate change	3	Risk declines with better watershed management
Overall status	2	
Reliability	4	Well documented in scientific literature

DISTRIBUTION: California golden trout are endemic to South Fork Kern River and to Golden Trout Creek. They have been introduced into many other lakes and creeks in and outside of California, including the Cottonwood Lakes not far from the headwaters of Golden Trout Creek and into the headwaters of South Fork Kern River, such as Mulkey Creek. The Cottonwood Lakes have been a source of golden trout eggs for stocking other waters and are still used for stocking lakes in Fresno and Tulare Counties. As a result of widespread stocking in California, golden trout are now found in more than 200 high mountain lakes and streams outside of their native range. Many of these populations have hybridized with coastal rainbow trout. Golden trout are also widely distributed in lakes and streams of the Rocky Mountains, but most populations there are also hybridized with both rainbow and cutthroat trout.

ABUNDANCE: When the first major California Department of Fish and Game habitat management plan was issued in 1965, there were about 2,400 to 15,600 golden trout in Golden Trout Creek (19 miles) and 4,000 to 26,000 in the South Fork Kern River (31 miles). It is estimated that unhybridized fish exist today only in about three miles of Volcano Creek with only 400 to 2,600 "pure" golden trout left today, a decrease of at least 95% from historic numbers.

FACTORS AFFECTING STATUS: The principal threats to California golden trout are (1) hybridization with rainbow trout, (2) competition and predation from non-native brown trout, and (3) degradation of streams from livestock grazing, which continues even in the Golden Trout Wilderness Area.

STATUS 2: California golden trout have a high likelihood of extinction in 50 to 100 years, if not sooner. A recovery plan for California golden trout has been developed that could reduce the threat of extinction, but it has not been fully implemented. Major efforts have been made to create refugia for golden trout in the upper reaches of the South Fork Kern River by constructing barriers and then applying the poison rotenone to kill all unwanted fish above barriers. Despite these and other efforts, most populations of California golden trout are hybridized and are under continual threat from brown trout invasions. Management actions are needed to address threats to California golden trout which include hybridization with rainbow trout, competition, and degradation of their streams from livestock grazing, which continues even in the Golden Trout Wilderness Area.

CONSERVATION RECOMMENDATIONS: Management measures should include, (1) repair or replacement of barriers, (2) eradication of all rainbow and brown trout populations that threaten California golden trout, (3) elimination of grazing, and (4) management of recreation to reduce impacts on the trout. The most urgently needed management measure is the repair or replacement of deteriorating fish barriers that exclude brown trout and rainbow trout from the South Fork Kern River.

Mulkey Creek. PHOTO: RICHARD JAMES

California Golden Trout Were Historically Present In South Fork Kern Basin, Part Of The Upper Kern River Basin Shown Here

Eagle Lake Rainbow Trout

Oncorhynchus mykiss aquilarum

chances for survival: *poor*

2

PHOTO: KAREN VANDERSALL

Eagle Lake rainbow trout are the only rainbow trout native to the eastern Sierra Mountains and are endemic to Eagle Lake in northeastern California. Eagle Lake is a large terminal lake that becomes extremely alkaline during periods of drought. The trout are predators of other native fish and invertebrates.

Historically, their life history was to migrate into tributaries, principally Pine Creek, during the spring and spawn in the headwaters. The young reared in the creek for one to two years before migrating back to the lake. Eagle Lake rainbow trout do not mature until they are at least two years old. Adults quickly grow to a size of 17 to 18 inches in three years and can live for up to 11 years. These trout were once so abundant that there was a commercial fishery for them in the late 19th century. At the same time, extensive logging and heavy livestock grazing caused Pine Creek to change from a permanent to an intermittent stream in its lower reaches. In the early 1950s, the California Department of Fish and Game rescued the few remaining Eagle Lake rainbow trout at the mouth of Pine Creek and began a hatchery program to maintain the species and the sport fishery. Today, the trophy fishery is supported entirely by hatchery production.

DISTRIBUTION: Eagle Lake rainbow trout are native solely to Eagle Lake and its tributary streams, which include Pine, Papoose, and Merrill Creeks. A domestic strain of the trout is maintained at the Mt. Shasta Hatchery for planting in reservoirs and as a source for brood stock for other hatcheries.

CATEGORY	SCORE	EXPLANATION
Range	1	Lives in only one watershed
Population size	4	Includes hatchery fish; if only wild fish included the score would be "1"
Intervention needs	2	Survival depends on trapping wild fish for hatchery spawning and rearing
Tolerance	4	One of the most tolerant, long-lived kinds of trout
Genetic risk	3	Hatchery rearing presumably has changed genetics and accidental hybridization in hatcheries possible
Climate change	1	Reduced stream flows or increased alkalinity of lake could endanger the fish further
Overall status	2	
Reliability	3	Well documented in the scientific literature

California Trout is There for the Fish!

Almost two decades ago, California Trout partnered with local agency representatives and cattlemen's groups to enhance riparian ecosystems in order to restore healthy and stable populations of Eagle Lake rainbow trout to Eagle Lake.

ABUNDANCE: In 1950, six trout were captured from Pine Creek and about 2,000 fertilized eggs taken to the Crystal Springs Hatchery. The 600 trout that grew to adults were then used for brood stock. Regular trapping operations began in 1959 when 16 trout were captured and spawned. In the next five years, the numbers of Eagle Lake trout captured varied from 45 to 391. At the present time, about 150,000 to 200,000 trout are planted in the lake each year. These are first generation fish derived from adults captured at the mouth of Pine Creek in order to support a major sport fishery.

FACTORS AFFECTING STATUS: Eagle Lake rainbow trout continue to thrive in Eagle Lake, although the degradation of spawning streams has lead to dependence on hatchery production. Due to extensive restoration, Pine Creek has been recovering its ability to hold water and fish, but few fish are allowed to spawn naturally. A second management challenge is controlling a large population of non-native brook trout in Pine Creek that limit natural production of Eagle Lake rainbow trout due to competition and predation.

STATUS 2: Eagle Lake rainbow trout are no longer a naturally self-sustaining species and their ability to exist as a wild population diminishes each year they remain completely dependent on hatcheries for production. The trout are currently listed as a species of special concern and a Heritage Trout Species by the Department of Fish and Game, and as a sensitive species by the U.S. Forest Service. Although major efforts have been made in recent years to address passage problems in Pine Creek, meadows along the lower creek are still heavily grazed by cattle and the creek below Highway 44 is generally dry by May or June. During some wet years, trout can make it up to spawning areas and spawn successfully. In August 2007, Bogard Spring Creek, a tributary to Pine Creek, was electrofished to remove brook trout. Nearly 5,000 brook trout were removed from the nearly two mile long creek. During the removal, 170 yearlings and two older rainbow trout were also captured and returned to the creek. The presence of these fish indicated that a wild spawning population of Eagle Lake rainbow trout can be reestablished, although restoration may require trapping and trucking fish in both directions for some years. Their restoration will also require eradication of brook trout from the Pine Creek watershed.

CONSERVATION RECOMMENDATIONS: Because these trout have gone through more than 55 years of selection for life under hatchery conditions, actions which support natural migration, spawning and rearing are needed. Eliminating passage problems to spawning areas, reducing cattle grazing, eradicating non-native brook trout, and reducing water diversions will help to make Pine Creek able to support spawning and rearing of Eagle Lake rainbow trout. Annual trapping and trucking operations should begin immediately to jump start the migration process.

Eagle Lake. PHOTO: PETER MOYLE

1 **2** **3** **4** **5**

Eagle Lake Rainbow Trout Distribution

Kern River Rainbow Trout

Oncorhynchus mykiss gilberti

chances for survival: *poor*

2

PHOTO: CALIFORNIA DEPT. OF FISH AND GAME HERITAGE TROUT PROGRAM (ROGER BLOOM)

The Kern River rainbow trout is one of three trout endemic to the Kern Basin; the others are the Little Kern and California golden trout. The Kern River rainbow inhabits the lower portions of the Kern River and grows to larger sizes than its golden trout relatives. It is more brightly colored than a typical rainbow trout and its spots are more irregular in shape than the two golden trout species.

The Kern River rainbow trout has a complex evolutionary history and has been the subject of much debate over its origins since it was first described in 1894 as a subspecies of rainbow trout. It was later thought to be a population of golden trout, but subsequent genetics work indicates a distinct evolutionary heritage intermediate between coastal rainbow trout and Little Kern golden trout. Hybridization with both hatchery rainbow trout and planted populations of the two golden trout threaten the genetic integrity of Kern River rainbow trout.

DISTRIBUTION: The Kern River rainbow trout were once widely distributed in the Kern River and its tributaries. Today, remnant populations live in the Kern River above Durrwood Creek, in Upper Ninemile, Rattlesnake and Osa Creeks, and possibly in upper Peppermint Creek. Additionally, there are introduced populations of Kern River rainbows in the Kaweah-Kern River and Chagoopa Creek, which appear to have maintained their genetic integrity.

ABUNDANCE: In the Kern River in Sequoia National Park during 1992, there were about 600 to 1,400 trout per mile of all sizes. If it is assumed the trout currently persist in 12 miles of small streams, then the total estimated number of fish would be between 7,000 and 17,000, with a spawning population likely less than 1,000 individuals. These estimates suggest that absolute numbers of Kern River rainbow trout in the wild are low and the species vulnerable to reduction by natural and human-caused events.

FACTORS AFFECTING STATUS: The construction of Isabella Dam eliminated much of the Kern River rainbow's historic habitat. This barrier resulted in massive introductions of hatchery trout into the river and heavy fishing pressure which led to the elimination of most of the native population. The primary threats to remaining populations of Kern River rainbow trout involve interactions with non-native trout and include, (1) hybridization with hatchery rainbow trout which are still planted in the upper Kern Basin, (2) hybridization with golden trout planted or moving into their waters, and (3) competition from brown, brook, and hatchery rainbow trout. Further introductions by anglers of hatchery rainbow, brown or brook trout into the remaining small isolated streams are possible. In addition, continued grazing in riparian areas and heavy recreational use of the basin, including angling, can degrade the trout's fragile habitat. Random natural events, such as floods, drought, and fire, can also exacerbate these problems.

STATUS 2: The Kern River rainbow trout has a high probability of extinction in the next 50 to 100 years if present trends continue. It is listed as a species of special concern by both the U.S. Fish and Wildlife Service and the California Department of Fish and Game. A multi-agency management plan for the upper Kern River basin lists as its goals to "restore, protect, and enhance the native Kern River rainbow trout populations so that threatened or endangered listing does not become necessary." The Edison Trust Fund, established as mitigation for a hydropower generating station, provides at least $200,000 each year to implement the management plan and improve fish populations in the upper Kern Basin. Funding has been provided for developing a conservation hatchery for Kern River rainbow trout, for increasing patrols of wardens in areas where the trout are fished, and for funding genetics studies.

CONSERVATION RECOMMENDATIONS: Issues that need to be addressed for conserving Kern River rainbow trout include stopping the planting of non-native trout, curbing grazing in riparian areas, and decreasing heavy recreational activities in the Kern River basin that adversely impact the fish's habitat.

CATEGORY	SCORE	EXPLANATION
Range	1	Found only in four to six small tributaries and short reaches of the Kern River
Population size	3	Much uncertainty exists about size of unhybridized populations
Intervention needs	2	Barriers must be maintained, planting of hatchery fish managed, grazing managed, and other continuous activities
Tolerance	3	Presumably fairly tolerant as are most rainbow trout but not tested
Genetic risk	1	Hybridization with rainbow and other golden trout is a constant high risk
Climate change	3	Risk declines with better land management
Overall status	2	
Reliability	3	This is the least studied of the three Kern River trouts

Upper Kern River above Johnsondale Bridge. PHOTO: ANDREW HARRIS

1 **2** **3** **4** **5**

Kern River Rainbow Trout Were Native To The Upper Kern River Watershed, Mainly In The Main River And Some Small Tributaries

California Trout is There for the Fish!

California Trout has worked with the California Department of Fish and Game to reintroduce Kern River rainbow trout into its historic waters by providing expert input on scoping documents and actively participating in public meetings. Most recently California Trout worked with the Department to complete genetic research that was used to develop a Kern River Rainbow Trout Management Plan and for future production of Kern River rainbow trout in the Kernville Hatchery.

Lahontan Cutthroat Trout

Oncorhynchus clarki hensawi

chances for survival: *poor*

2

1 **2** 3 4 5

PHOTO: GERARD CARMONA

The Lahontan cutthroat trout is a distinctive subspecies of cutthroat trout native to the western Great Basin. These fish are recognized by their generally yellowish coloration, heavy black spotting, and red slash marks under the jaw. Lahontan cutthroats historically occurred in a wide variety of stream and lake habitats, ranging from terminal alkaline lakes, such as Pyramid and Walker Lakes, to the clear alpine waters of Lake Tahoe and Independence Lake. They were found in large, low gradient rivers, such as the Humboldt River in Nevada, moderate gradient streams, such as the Carson and Walker Rivers, and small, headwater tributary streams, such as Donner and Prosser Creeks. Lahontan cutthroat trout are most plentiful in well vegetated cold water streams with abundant cover and in large lakes. They feed primarily on terrestrial and aquatic invertebrates, but large individuals often feed on juvenile fish. Spawning takes place in streams from April to July depending on stream flows, water temperatures, and elevation.

DISTRIBUTION: Lahontan cutthroat trout are native to the Great Basin watersheds in eastern California, southern Oregon, and northern Nevada. In California, they were found only in the Carson, Walker, Truckee, and Susan River drainages on the east side of the Sierra Nevada Mountains. In 1844, their distribution included 11 lake populations occupying approximately 334,000 acres of lakes and other populations living in more than 3,600 miles of streams. Today, there are approximately 17 lakes and streams that still contain Lahontan cutthroats within their historical range and an additional nine creeks outside of their historic native range.

ABUNDANCE: Lahontan cutthroat populations in California most likely contain less than 200 adult fish each. Definitive population estimates for Lahontans are lacking, but it is estimated that they now occupy less than 11% of their original stream habitat and less than 1% (0.4%) of their original lake habitat. Wild self-sustaining populations in the headwater streams of California likely total only a few hundred fish age one and older. There is only one self-sustaining wild lake population of Lahontan cutthroat trout in California, located in Independence Lake.

FACTORS AFFECTING STATUS: The threats to Lahontan cutthroat trout include, (1) non-native fish introductions which create problems of competition, predation and hybridization, (2) overfishing during the 19th and early 20th centuries, (3) water diversions, (4) impacts to habitat from overgrazing, logging, and development, and (5) loss of genetic diversity. Re-introductions of Lahontan cutthroats can only be made to streams and lakes from which non-native trout have been eliminated, indicating that interactions with alien trout are the single biggest factor in their decline.

STATUS 2: Lahontan cutthroat trout have a high likelihood of extinction in California within 50 to 100 years. They are listed as threatened under both federal and state Endangered Species Acts. As of 1999, ten populations of Lahontan cutthroats had been reestablished in their native range in California; however all but one suffer from geographic isolation and small population sizes. Hatchery propagation of Lahontan cutthroats has been ongoing since 1939 and continues today with releases of approximately 50,000 fish a year. Habitat alteration, abundant alien trout, and the loss of inter-connected populations has left managers trying to recover a species with very little habitat available for re-introductions. Survival of the fish will require innovative management, habitat restoration, and the elimination of competing species of trout from their streams.

CONSERVATION RECOMMENDATIONS: Conservation challenges for the Lahontan cutthroat trout include determining suitable remaining habitats for re-introduction, habitat restoration, and elimination of competing species of trout from reintroduction watersheds. Continued management efforts are necessary to maintain the genetic diversity of Lahontan cutthroat trout, since wild populations are no longer inter-connected due to dams, diversions and urbanization.

California Trout is There for the Fish!

In 1999, California Trout worked with the California Department of Fish and Game to establish the Heritage Trout Program to protect the state's native trout and steelhead. Heenan Lake and the Upper Truckee River are included in the Heritage Trout Program, both of which are home to the Lahontan cutthroat trout.

CATEGORY	SCORE	EXPLANATION
Range	3	Occupies multiple watersheds in California, but they are not connected
Population size	3	Wild populations have less than 1,000 fish each
Intervention needs	2	Hatchery programs using wild brood stock are required for survival
Tolerance	5	They are fairly long-lived, breed multiple times and demonstrate broad physiological tolerances.
Genetic risk	1	Hybridization risk and loss of genetic variation is well documented
Climate change	1	Lahontan cutthroats are vulnerable to climate change in all watersheds inhabited
Overall status	2	
Reliability	4	Reports concerning this risk level are found in published scientific literature

Independence Lake. PHOTO: PETER MOYLE

Historic Range Of Lahontan Cutthroat Trout

Little Kern Golden Trout

Oncorhynchus mykiss whitei

chances for survival: *poor*

2

PHOTO: ANDREW HARRIS

The Little Kern golden trout is endemic to the Kern Plateau and closely related to the California golden trout. The two are very similar in appearance and have been isolated for thousands of years by barriers between the Little Kern River and the rest of the Kern River basin.

Little Kern golden trout are well adapted for living in small, meandering meadow streams and the steeper slope areas surrounding them. They are not as well studied as California golden trout, but their life histories and habitat requirements are quite similar.

DISTRIBUTION: This subspecies is endemic to roughly 100 miles of the Little Kern River and tributaries. By 1973, their range had decreased to just five headwater streams in the basin (Wet Meadows Creek, Deadman Creek, Soda Spring Creek, Willow and Sheep Creeks, and Fish Creek) plus an introduced population in Coyote Creek, a tributary to the nearby Kern River. The Upper Coyote Creek population was eventually found to be genetically influenced by California golden trout. Excluding Coyote Creek, the 1973 distribution of Little Kern golden trout was approximately ten miles of creek. Recent genetic studies have identified unhybridized populations in Upper Soda Spring Creek, Trout Meadow Creek, Clicks Creek, Burnt Corral Creek, Tamarack Creek, Deadman Creek, Wet Meadows Creek, Fish Creek and Coyote Creek. All of these streams, except Coyote Creek, are within the subspecies' native range.

ABUNDANCE: When Little Kern golden trout were at their minimum range, their population was estimated at 4,500 fish. Based on a current habitat of approximately 32 miles, estimated population numbers hover around 15,000 fish. During low flow years, these numbers are probably considerably less. The number of Little Kern golden trout spawning within each stream is likely small and so may limit persistence of populations.

CATEGORY	SCORE	EXPLANATION
Range	1	Occupies about 31% of its historic habitat, but the most secure populations are above barriers in a few small headwater streams amounting to less than 10% of historic habitat
Population size	3	Existing populations are fairly dense
Intervention needs	3	Barriers must be maintained and non-native trout removed from streams using piscicides
Tolerance	2	Little Kern golden trout require cool, clean water
Genetic risk	2	Hybridization with rainbow trout is a constant high risk
Climate change	3	Risk declines with better grazing and other management practices
Overall status	2	
Reliability	4	Populations have been well studied

California Trout is There for the Fish!

California Trout has a long history working to conserve the Little Kern golden trout. California Trout was directly involved collecting Little Kern golden trout genetic samples throughout the Little Kern Basin, developing the Little Kern Golden Trout Management Plan to enhance their populations throughout the basin, and working with the Sequoia National Forest to establish policies that ensure the health and viability of Little Kern golden trout for generations to come.

FACTORS AFFECTING STATUS: Factors affecting Little Kern golden trout in the past included, (1) hybridization with rainbow trout, (2) competition with alien trout, and (3) grazing, logging, and road-building activities. Today, the biggest problems are invasions of non-native trout (including hatchery rainbow trout), grazing in riparian areas, and heavy recreational use of the basin, including angling. Since the trout was listed as a threatened species, several miles of stream and seven headwater lakes have been treated with fish poisons to eradicate hybrid Little Kern golden trout/rainbow trout and brook trout, a fierce competitor. However, a major continuing problem is that fish available for restoration programs are either interbred with rainbow trout or come from small isolated populations with limited genetic diversity which, in turn, could lead to inbreeding and decreased viability.

STATUS 2: Despite major efforts to protect the Little Kern golden trout, they still have a high probability of disappearing as a genetically distinct species within the next 50 to 100 years. This possibility has long been recognized and serious management efforts to protect the fish began in 1975. The species was listed as threatened by the U.S. Fish and Wildlife Service in 1978 and is considered a species of special concern by the California Department of Fish and Game. Critical habitat for the fish has been designated in the Little Kern River, including the main channel and all streams tributary to the Little Kern River, but little has changed for the fish despite this designation. One of the main goals of a multi-agency management plan for the upper Kern River basin is restoration of native trout so they can be delisted. Beginning in 1975, efforts by the Department of Fish and Game and other agencies were made to restore Little Kern golden trout to their historic range by applying fish poisons to streams and lakes in the drainage, constructing barriers to immigration of non-native trout, and rearing Little Kern golden trout at the Kern River Planting Base near Kernville. This effort resulted in the apparent restoration of fish to approximately 32 miles of stream, in addition to the introduction of fish into three headwater lakes by 1998. Subsequent genetic studies, however, have shown that many of the re-established populations have hybridized with rainbow trout.

CONSERVATION RECOMMENDATIONS: All planting of rainbow trout in the upper Kern watershed should be halted to prevent movement of fish into Little Kern golden trout waters. Where possible, non-native trout should be removed and barriers constructed or maintained. Grazing should be eliminated and other human uses restricted.

South Fork Kern River. PHOTO: RICHARD JAMES

1 **2** **3** **4** **5**

Little Kern Golden Trout Are Native To A Small Section Of The Upper Kern River Basin

McCloud River Redband Trout

Oncorhynchus mykiss stonei

chances for survival: *poor*

2

PHOTO: RACHEL SIMMONS

The McCloud River redband trout is one of two types of redband trout found in Northern California. These are small rainbow trout with a brick-red band along the sides.

The uncertain taxonomic status of California populations reflects the diversity of forms and the long isolation of many populations. McCloud redbands now exist only in a few small streams. Within this group, the population at Sheepheaven Creek is so distinctive that some have suggested it be classified as a separate subspecies. The life history of the McCloud River redband trout is similar to that of other rainbow trout in small streams. Redband trout caught from Sheepheaven Creek were in spawning condition in June. The largest fish caught during a 1973 survey was about eight inches in length and the population at that time was estimated at 250 fish more than three inches long.

DISTRIBUTION: McCloud River redband trout were once present in the mainstem McCloud River above Middle Falls. They were also perhaps present in the lower river and its tributaries, residing especially in areas inaccessible to anadromous steelhead. Trout from Sheepheaven Creek were transplanted to Swamp and Trout Creeks. Currently, unhybridized populations are present only in Sheepheaven, Trout, Swamp, and Edson Creeks, with populations also possible in Tate, Moosehead, Raccoon, Blue Haron, Bull, and Dry Creeks. The trout's total permanent habitat is estimated to be about 15 to 16 stream miles, less in dry years.

ABUNDANCE: Surveys conducted on redband trout creeks from 1975 to 1992 indicate that populations are variable and fluctuate widely with the water year type. Total populations are estimated to be around 2,500 fish, although this number could be much higher in wet years and much lower in dry years, making climate change a potential problem for the conservation of McCloud River redbands.

CATEGORY	SCORE	EXPLANATION
Range	2	These trout occupy just one small watershed but the isolation of at least four populations provides some security, assuming the Sheepheaven Creek population is not a taxon distinct from the rest of the McCloud redbands
Population size	3	Minimum total population today is probably more than 1,000 adults, although individual populations have 100 to 500 fish in drought years
Intervention needs	3	McCloud redbands require continual monitoring and habitat protection and improvement
Tolerance	3	Physiological tolerances have not been studied, but it is likely they are fairly tolerant of high temperatures and low dissolved oxygen
Genetic risk	2	They have high hybridization risk with rainbow trout
Climate change	1	McCloud redbands are vulnerable in all streams because of small population size
Overall status	2	
Reliability	3	Existing current information is mainly for the Sheepheaven Creek population

California Trout is There for the Fish!

California Trout has been extremely active in protecting the McCloud River redband trout through funding provided by the National Fish and Wildlife Foundation and Orvis for the McCloud Redband Core Group—a collaborative of natural resource agencies, private landowners, community members and nonprofit organizations—to pay for the costs of genetic studies and creating educational outreach programs about this distinctive native fish.

FACTORS AFFECTING STATUS: The factors, past and present, that threaten the McCloud River redband trout include, (1) competition with alien trout, (2) hybridization, (3) logging, (4) grazing, and (5) angling pressure. McCloud River redbands have only small populations in tiny streams that are highly vulnerable to local impacts from grazing, logging and take by anglers. The McCloud River has received substantial plants of stocked hatchery rainbow trout to support recreational fisheries. Generally, where alien trout are present, redband trout are absent. The exact cause of the disappearance of redband trout has not been documented in the McCloud and smaller streams, but presumably it is a combination of predation on young by non-native brown trout, competition for space by all fish species, disease introductions from other fish, and hybridization with rainbow trout.

STATUS 2: Because of the heightened level of interest and management for McCloud River redband trout, there seems to be no immediate risk of extinction. However, since redband trout populations are small and exist in small isolated habitats, their status could change in as few as five to ten years. Therefore, conserving these fish requires eradication of non-native trout from its historic habitats, followed by reintroduction. Conservation of McCloud River redband trout is active and ongoing, thanks to the leadership of California Trout, Shasta-Trinity National Forest, and the California Department of Fish and Game. The forging of a new Redband Trout Conservation Agreement in 2007 is the latest step towards protecting these fish and their habitats.

In the past, most management attention focused on the Sheepheaven Creek population, but current fishery management focuses on all populations. Because the conservation agreement is an effort to provide a systematic framework for all restoration and management activities in the watershed, it is crucial that the agreement be finalized as the working plan to improve conditions for McCloud River redband trout.

CONSERVATION RECOMMENDATIONS: A Redband Trout Conservation Agreement was reached in 2007 which recommends several actions to protect the McCloud River redband trout, including establishing a McCloud redband refuge, maintaining and enhancing existing habitats, and protecting the genetic integrity of existing populations by eliminating all planting of hatchery fish in streams of the upper McCloud Basin. Additional recommendations are to develop and enforce angling regulations for the protection of redbands, a complete genetic evaluation of all redband populations, and establishing a regular population monitoring program. The Agreement needs to be fully implemented.

Sheepheaven Creek. PHOTO: PETER MOYLE

1 **2** **3** **4** **5**

McCloud River Redband Trout, Historically Found Throughout The McCloud Watershed Shown Here, Are Now Confined To A Few Small Isolated Streams

Paiute Cutthroat Trout

Oncorhynchus clarki seleniris

chances for survival: *poor*

2

1 **2** 3 4 5

PHOTO: CALIFORNIA DEPT. OF FISH AND GAME HERITAGE TROUT PROGRAM (ROGER BLOOM)

Paiute cutthroat trout are the rarest of native California trout. They are a subspecies of cutthroat endemic to Silver King Creek below Llewellyn Falls in Alpine County. Paiutes are pale yellow to bronze in color and almost completely lack the spotting characteristic of their close relative, Lahontan cutthroat trout.

Few Paiute cutthroats survive beyond three to four years in the wild, which gives them just two years of potential spawning activity. Peak spawning activity is June and July. Mature fish grow to be about six to ten inches long. The juvenile fish rear in backwaters, shoals and small tributaries until they reach approximately two inches in length. Larger fish occupy the more desirable pool habitats, whereas smaller fish are relegated to riffle and runs. Pauite cutthroat trout require pools for successful over-wintering.

DISTRIBUTION: Historically, Paiute cutthroats existed in only about nine miles of stream from Llewellyn Falls downstream to Silver King Canyon, and included three small tributary creeks, Tamarack Creek, Tamarack Lake Creek, and the lower reaches of Coyote Valley Creek. They are extinct in these streams at the present time. In the early 20th century, Basque sheepherders moved the trout to above Llewellyn Falls and into other creeks in the basin, such as Corral Valley and Coyote Creeks. Numerous out-of-basin transfers were made throughout the 20th century, but many failed probably due to the presence of other trout. Some populations are still present in Cottonwood Creek in the White Mountains, Cabin Creek, and Stairway Creek.

CATEGORY	SCORE	EXPLANATION
Range	2	Paiute Cutthroat occupy several watersheds, but they are isolated
Population size	3	The largest population may be around 1,000 but most are smaller
Intervention needs	3	Management is required to maintain genetic diversity and protect its limited habitats
Tolerance	2	Actual physiological tolerances of Paiute cutthroats are not known, but they are adapted for small cold-water headwater streams which suggests limited tolerance
Genetic risk	1	Past hybridization has reduced the current population size and genetic diversity
Climate change	3	They are vulnerable because their streams are very small and some may become dry during droughts
Overall status	2	
Reliability	4	Paiute cutthroat trout are well documented in the peer-reviewed literature and in agency studies

California Trout is There for the Fish!

With the generous support from foundations and our donors, California Trout will be opening a new Tahoe Region Office in early 2009. Protection, restoration, and recovery of the Paiute cutthroat trout will be a major focus and emphasis of our conservation work in the Tahoe Basin.

ABUNDANCE: Paiute cutthroat trout currently occupy a minimum of about 21 miles of stream habitat in five widely separated drainages. Population surveys in the Silver King Basin indicate a population of 400 to 700 adults. The out-of-basin populations probably total a few hundred individuals. There are approximately nine streams and lakes that currently hold pure Paiute cutthroat trout. The results of a 2001 California Department of Fish and Game population survey in the Silver King drainage above Llewellyn Falls estimated about 424 fish, a number that, over the years, indicates the population is either stable or growing. Paiute cutthroat trout were originally planted in Sharktooth Lake, but are now found only in its outlet creek. All other lake introductions have failed.

FACTORS AFFECTING STATUS: The biggest threats to the survival of Paiute cutthroat trout include, (1) alien trout which compete and hybridize with, and prey on, Paiute cutthroats, (2) loss of genetic diversity, and (3) habitat loss. All populations are small and isolated, and therefore vulnerable, to illegal introductions of alien trout as well as to local natural and man-made disasters. The many unauthorized introductions of non-native trout are the single biggest threat to Paiute cutthroat trout. However, had it not been for the 1946 stocking of Paiutes into Cottonwood Creek and unauthorized introduced populations within Silver King basin in Fly Valley and Four Mile Creeks, the species might have been completely lost. Efforts by the California Department of Fish and Game, U.S. Fish and Wildlife Service, and the U.S. Forest Service to eradicate alien trout in lower Silver King Creek with piscicides have been blocked by litigation. Hopefully, these agencies can soon move forward with the treatment so that Paiute cutthroat trout can be reintroduced into their native range.

STATUS 2: Paiute cutthroat trout were listed as federally endangered in 1967 but were subsequently downlisted to threatened in 1973 to facilitate management of the species. They have a high likelihood of extinction within the next 50 years without continued intense monitoring and management. The 2004 Paiute Cutthroat Trout Recovery Plan lists reintroduction to their native range and eradication of non-native salmonids in their streams as one of the criteria for delisting the species. They are not listed by the California Department of Fish and Game on the premise that federal protection alone is adequate for the Paiute cutthroats.

CONSERVATION RECOMMENDATIONS: Key protective elements for the Paiute cutthroat trout are to restore them to their historic range and to remove non-native trout from their habitat. Restoring Paiute cutthroats to their historic habitat will more than double the number of fish in the Silver King basin and provide greater connectivity of habitat to preserve their genetic diversity.

Silver King Creek. PHOTO: PETER MOYLE

Silver King Creek, Home Of The Paiute Cutthroat Trout, Is Part Of The Carson River Watershed

Coastal Cutthroat Trout

Oncorhynchus clarki clarki

chances for survival: *average* **3**

PHOTO: THOMAS DUNKLIN

Coastal cutthroat trout are anadromous trout found in the coastal drainages of northern California, the southern end of their range. These fish are distinguished by their copious black spotting and the namesake red slash along the jaw. In salt water, cutthroat trout are silvery in coloration. Coastal cutthroat trout have a highly variable life history ranging from fully anadromous to resident. They are the most freshwater-dependent of the anadromous salmonids, migrating to the ocean for only a few months in the summer. They are competitively subordinate to nearly all other salmonids. Juveniles can emigrate to the sea at ages one to three years, but often spend time in estuaries as well. Environmental factors that affect their growth rate, such as food availability, water quality, and temperature, also markedly influence their migratory behavior and residency time. The maximum length of these fish in California is about 16 to 22 inches and they rarely exceed seven years in age.

DISTRIBUTION: Coastal cutthroat trout occur in coastal basins in several Humboldt Bay tributaries, Little River and Redwood Creek, as well as a number of coastal lagoons and ponds, such as Lake Earl, Big, and Stone Lagoons. However, most of these trout in California are found in the Smith, Mad, and Lower Klamath Rivers with the Smith River having the largest and most diverse population. There are currently no known populations of coastal cutthroat trout south of the Eel River. Their inland distribution is largely coincident with coastal rainforests.

ABUNDANCE: Population numbers in California streams are difficult to determine, but there are most likely less than 5,000 anadromous spawners each year. The lack of surveys for coastal cutthroat in California makes estimating abundance difficult, but they are apparently present in at least low numbers in about 700 miles of streams and in four lagoons.

FACTORS AFFECTING STATUS: Major factors that have reduced coastal cutthroat trout populations include, (1) watershed degradation from logging activities, (2) estuarine alteration, (3) barriers to migration, and (4) hybridization. Most watersheds in which the trout occur are still recovering from the legacy of unrestricted logging in the 19th and early 20th centuries. Hatcheries play a minor role in the status of this species. Coastal cutthroat trout depend more on smaller tributaries than do steelhead, and these are the very watersheds most likely to be affected by logging and other disturbances. There are a number of small landlocked populations that may contribute migratory individuals to downstream populations.

STATUS 3: Coastal cutthroat trout are in no immediate danger of extinction, but the high degree of uncertainty due to lack of data calls for precaution in management. This species merits special attention because California is the southern end of its range, and it therefore may be strongly affected by climate change. Management of coastal watersheds to maintain diverse habitat and high water quality year round is critical to the fish. A 1999 National Marine Fisheries Service status review of coastal cutthroat trout in Washington, Oregon, and California concluded that "there is insufficient evidence to demonstrate that coastal cutthroat trout are at significant risk of extinction," and that, "there is insufficient evidence to demonstrate that coastal cutthroat trout are not at significant risk of extinction." The conservative course of action for this species is to protect watersheds where they are abundant, with a special focus on the Smith River.

CONSERVATION RECOMMENDATIONS: The single-most important need for coastal cutthroat trout is the protection and restoration of lagoons, estuaries and small tributaries, as well as removal of migrational barriers. Also important is the continued management of the Smith River as a free-flowing, wild river that is a refuge for all salmonids.

CATEGORY	SCORE	EXPLANATION
Range	5	Found in most watersheds from the Eel River north to the Smith River
Population size	3	This is a '5' if we assumed all populations are genetically interconnected but most appear to be small and isolated
Intervention needs	3	Persistence requires improved management of heavily logged watersheds
Tolerance	3	Moderately tolerant of conditions in California streams
Genetic risk	4	Little information on genetics available
Climate change	2	Because most populations are in small streams, there is considerable range-wide vulnerability to climate change
Overall status	3	
Reliability	2	Most published data are ten or more years old with exception of the Smith River Alliance dive counts

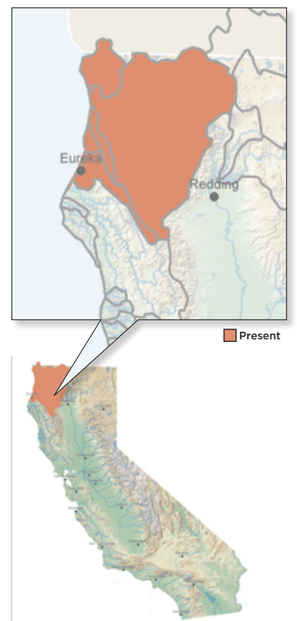
California Trout is There for the Fish!

In 1990, the Smith River Alliance and California Trout convinced Congress to establish the Smith River National Recreation Area, thereby protecting 3,100 miles of pristine rivers for generations to come. As the largest single undammed Wild and Scenic River system in the U.S., the Smith River National Recreation Area plays a major role in preserving the quality and quantity of fish habitat, including that of coastal cutthroat trout.

Smith River. PHOTO: TOM WESELOH

1 **2** **3** **4** **5**

Most Populations Of Coastal Cutthroat Trout Are In The Lower Reaches Of Watershed Streams



Goose Lake Redband Trout

Oncorhynchus mykiss ssp.

chances for survival: *average*

3

1 2 3 4 5

PHOTO: CALIFORNIA DEPT. OF FISH AND GAME HERITAGE TROUT PROGRAM (ROGER BLOOM)

Redband trout are inland descendents of rainbow trout found in the watersheds of the northern Great Basin. Goose Lake redband trout are closely related to the five other redband groups, but have been isolated for thousands of years.

Goose Lake is a shallow, alkaline body of water that only overflows to the Pit River in wet years. During severe droughts, the lake dries up completely. There are two forms of Goose Lake redband trout—the lake form and the stream form. The lake form grows to about 20 to 24 inches long, feeding on the superabundant fairy shrimp and tui chubs in the lake. It spawns in tributary streams and returns to the lake after spawning. The smaller stream form which, as adults, reach six to eight inches, persists in scattered populations in tributaries. The periodic desiccation of Goose Lake presumably eliminates the lake population, which becomes re-established by dispersing stream fish. Goose Lake redband trout appear to have a higher temperature tolerance than most trout, having evolved in small, drought prone drainages, but make use of small cool water refuges and cold springs to survive the hottest periods. However, living at the upper edge of their tolerance makes them highly vulnerable to drought and climate change.

DISTRIBUTION: Goose Lake straddles the California/Oregon border in the northeast corner of the state. In California, the main spawning streams are Willow and Lassen Creeks, as well as Cold Stream, a tributary of Lassen Creek. They are also present in a number of smaller streams such as Pine, Cottonwood, Davis, and Corral Creeks. In Oregon, they inhabit the extensive Thomas/Bauers Creek system as well as 12 smaller streams. Joseph, Parker, and East Creeks, tributaries of the upper Pit River in California, contain redband trout genetically similar to Goose Lake redband trout.

CATEGORY	SCORE	EXPLANATION
Range	4	Present in six creeks in California and 13 in Oregon
Population size	4	Lake spawners are less than 1,000 but headwater populations presumably contain more fish, especially in Oregon
Intervention needs	3	Long-term decline reversed by human actions, which must be continued if the fish are going to persist in numbers
Tolerance	4	Indirect evidence suggests they are more tolerant than most salmonids of adverse water quality
Genetic risk	3	Genetic risks currently low although hybridization with introduced rainbow trout may have occurred in the past
Climate change	2	Because they occur in small streams that are now largely isolated from one another, these trout are very susceptible to major declines as the result of prolonged drought
Overall status	3	
Reliability	2	Based on mostly unpublished reports

ABUNDANCE: In the 19th century, Goose Lake redbands were so abundant in the lake that they were harvested commercially and sold to logging camps. Current populations in Lassen and Willow Creeks fluctuate with dry and wet years, but these creeks combined have the potential to support 1,000 spawning fish under optimal flow conditions. The Oregon Department of Fish and Wildlife estimates 102,000 Goose Lake redband trout live in 13 Oregon streams under normal conditions. Surveys of California streams in 1988 and 1999 show 600 to 1,600 trout per kilometer in Lassen Creek, which suggests that densities and population numbers in California and Oregon streams are roughly comparable.

FACTORS AFFECTING STATUS: The primary threats to Goose Lake redband trout include, (1) habitat modification, (2) water diversions, (3) overfishing, (4) non-native fish competitors, and (5) drought and climate change. In recent years, considerable effort has been made to restore habitats, but the drying and warming of the headwater streams is likely to be a problem for the fish in the future.

STATUS 3: Goose Lake redband trout face no immediate extinction risk because of public-private partnerships to protect the fish and their habitats. During the 1987 to 1994 drought, Endangered Species Act listing was proposed for the Goose Lake fishes. In response, the Goose Lake Fishes Working Group was formed in 1991 comprised of representatives from California and Oregon. The Group, which included private landowners, state and federal agencies, non-government organizations, and universities, sought to protect and reestablish native fishes in the Goose Lake basin. The stated goal was "to conserve all native fishes in Goose Lake by reducing threats, stabilizing population numbers, and maintaining the ecosystem." Since publication of the conservation strategy in 1996, a number of projects have been completed or long-term projects begun. These include culvert improvements, diversion or passage projects, fencing of streams, habitat improvement projects, fish surveys, and road improvements to reduce sedimentation. Because of the potential effects of climate change on an arid basin, populations must be monitored closely to assure they are sustaining, given the limited habitat available. Continued protection of streams and improvements to habitat are critical to ensure survival.

CONSERVATION RECOMMENDATIONS: Management actions needed for the Goose Lake redband trout include removal of barriers to fish passage, protection of spawning and rearing habitat, elimination of livestock grazing from riparian areas, and eradicating non-native fish from redband streams.

Lassen Creek. PHOTO: PETER MOYLE

Goose Lake Redband Trout Distribution

Coastal Rainbow Trout

Oncorhynchus mykiss irideus

chances for survival: *best* **5**

PHOTO: DAVID GIODANO

Coastal rainbow trout are all wild, native rainbow trout that spend their entire life cycle in fresh water. These fish are typically silvery in overall color, white on the belly, with black spots on the tail, adipose fin, dorsal fin, and back; tail spots are in radiating lines. There is a pink to rosy lateral band on each side and the gill covers are also usually pink. Color is highly variable so trout from small streams may be fairly dark on the back with a yellowish belly. The mouth is large with the upper jaw extending behind the eye. Small teeth line the jaws, tongue, and roof of mouth. Coastal rainbows consist of many different populations that presumably had independent origins from steelhead, including some that may naturally interbreed with steelhead or produce young that can emigrate to the sea. Many resident trout populations may have originated from hatchery strains and are of mixed stock.

CATEGORY	SCORE	EXPLANATION
Range	5	Coastal rainbow trout are abundant and widely distributed around the world
Population size	5	There are many fish in many populations
Intervention needs	5	While stream improvements and other activities greatly improve the habitat of native and introduced populations, most rainbow populations can survive on their own with the existing protective laws and regulations
Tolerance	4	Physiological tolerances are rarely an issue
Genetic risk	5	There is a large amount of gene flow among rainbow trout populations
Climate change	4	Management can help make up for habitat losses due to climate change
Overall status	5	
Reliability	5	Coastal rainbow trout are the most studied of California salmonids

California Trout is There for the Fish!

In 1971, California Trout helped instituted one of the most successful programs ever undertaken by the California Department of Fish and Game—the Wild Trout Program. As a result of California Trout's leadership, more than 1,000 miles of rivers and streams and more than 20 lakes are under protection from this program. Because coastal rainbow trout are one of the most abundant and easily recognized of the wild trout species, they now enjoy widespread protection of their native streams, rivers and lakes.

Coastal rainbow trout have a high diversity of life history strategies, which is a principal reason for their success. Resident fish usually spend most of their lives in a short section of stream and sometimes make short migrations for spawning. The trout mature in their second or third year, spawn one to three times, and rarely live more than five or six years. Depending on water flows and temperatures, spawning occurs between February and June. Fry live in shallow water in near-shore areas and gradually move into deeper water as they grow. Rainbow trout feed on aquatic and terrestrial insects as well as frogs and small fish. In lakes and reservoirs they frequently feed on open-water fish, such as threadfin shad.

DISTRIBUTION: Coastal rainbow trout were originally present in nearly all permanent coastal streams from San Diego north to the Smith River. They were also found in most rivers in the Central Valley, from the Kern River north to the Pit River. Resident forms were found wherever there was an evolutionary advantage to being non-anadromous. Today, where there is suitable habitat, resident trout are found in virtually all streams due to introductions. The expanded range of coastal rainbow trout includes most of the lakes and streams in the once-fishless portions of the Sierra Nevada north of the Upper Kern Basin.

ABUNDANCE: Wild, naturally spawning rainbow trout in California are much more abundant than they were historically because of their widespread introduction into suitable waters and their abundance in streams below large dams.

FACTORS AFFECTING STATUS: Coastal rainbow trout are negatively affected by, (1) over-fishing, (2) water diversions, (3) dams, (4) poor water quality, (5) poor watershed management from logging, agriculture, over-grazing, and road building, (6) mining, (7) channelization of streams, and (8) introductions of alien species. Because of their hardiness and value to recreational fisheries, many local coastal rainbow trout populations have persisted and have become the focus of restoration programs.

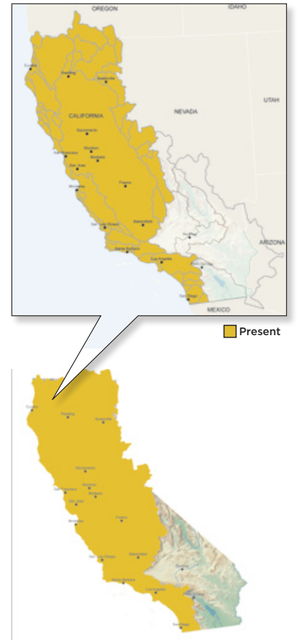
STATUS 5: Despite all the damage done to California's trout streams in the past 150 years, coastal rainbow trout continue to thrive in many areas. Populations are expanding at the present time due to conservation efforts.

CONSERVATION RECOMMENDATIONS: Conservation efforts center primarily around improving existing populations to increase wild trout populations for recreational fisheries. Augmenting the number of stream miles designated as Wild Trout waters will benefit rainbows; however reduced summer flows, warmer water due to climate change, and continuing conflicts with the protection of endangered fishes will be factors in maintaining populations at present levels.

Upper Sacramento River. PHOTO: PETER MOYLE

1 **2** **3** **4** **5**

Coastal Rainbow Trout Distribution



Mountain Whitefish

Prosopium williamsoni

chances for survival:
better

4

1 2 3 4 5

PHOTO: THOMAS TAYLOR

Mountain whitefish are silvery in color and coarse-scaled with a large adipose fin, a small mouth on the underside of the head, a short dorsal fin, and a slender, cylindrical body. They are found throughout western North America. While mountain whitefish are regarded as a single species throughout their wide range, a thorough genetic analysis would probably reveal distinct population segments. The Lahontan population of mountain whitefish in California and Nevada is isolated from other populations and likely to be distinct. They inhabit lakes and clear, cold rivers.

In lakes, they generally live close to the bottom in fairly deep water, although they move into the shallows during spawning season. Mountain whitefish favor larger streams where they often feed in groups, primarily on bottom dwelling aquatic insects. Whitefish scatter eggs over gravel and rocks, spawning at dusk or at night in groups of more than 20 fish.

DISTRIBUTION: Mountain whitefish are distributed throughout the Columbia River watershed, the upper reaches of the Missouri and Colorado Rivers, the Bonneville drainage, and the Mackenzie and Hudson Bay drainages in the Arctic. In California and Nevada, they are present in the Truckee, Carson, and Walker River drainages on the east side of the Sierra Nevada, but are absent from Susan River and Eagle Lake.

CATEGORY	SCORE	EXPLANATION
Range	4	Present in three watersheds and widely distributed outside California assuming all mountain whitefish are the same
Population size	5	Numbers appear to be large in the Truckee River and other streams
Intervention needs	5	They persist on their own, despite being ignored
Tolerance	5	Whitefish are more physiologically tolerant than most salmonids, live at least five years, and spawn more than once
Genetic risk	4	Their genetics have not been studied but most populations are isolated from other large populations
Climate change	3	Mountain whitefish seem to be quite vulnerable to decreased flows, warmer temperatures and increased diversions that are likely to result from climate change
Overall status	4	
Reliability	2	Most reports are anecdotal although there is some gray literature

ABUNDANCE: Mountain whitefish are still common in California, but they are now divided into isolated populations. They were once harvested in large numbers by Native Americans and commercially harvested in Lake Tahoe. There are still mountain whitefish in Lake Tahoe, but they have been reduced in numbers since the 1950s. Mountain whitefish still seem to be common in the low gradient reaches of the Truckee, East Fork Carson, East and West Walker, and Little Walker Rivers. Small populations are still found in the Little Truckee River, Independence Lake, and in some small streams such as Wolf and Markleeville Creeks, tributaries to the East Carson River.

FACTORS AFFECTING STATUS: Factors affecting mountain whitefish abundance and distribution in California are poorly documented. Their general decline seems to be habitat-related, in particular because (1) they live primarily in the larger and most altered streams of the Sierras and associated lakes, (2) they have poor survival in most reservoirs, and, (3) they require high water quality.

STATUS 4: Mountain whitefish are locally abundant in many areas; however their distribution is presumably more limited in California than it was historically. They are unlikely to go extinct in the foreseeable future, but climate change may alter the distribution of suitable habitat for these fish. Present numbers of whitefish are likely a small fraction of their historic numbers, when they apparently were one of the most abundant fish in the eastern Sierra Nevada. They are considered a low-value game fish and apparently are able to sustain whatever harvest exists today. Mountain whitefish should be managed as a native salmonid that is still persisting in some numbers. They also are a good indicator of the "health" of the Carson, Walker, and Truckee Rivers, as well as Lake Tahoe and other lakes where they still exist. Whitefish populations in Sierra Nevada rivers and tributaries have been fragmented by dams and reservoirs, and are generally scarce in reservoirs. A severe decline in the abundance of mountain whitefish in Sagehen and Prosser Creeks followed the construction of dams on each creek. Thus, without attention to the management of this species, whitefish are likely to become increasingly scarce in California.

CONSERVATION RECOMMENDATIONS: While mountain mountain whitefish are not at risk, they would benefit from a comprehensive review of their biology, including distribution, abundance and habitat requirements of all life stages. Mountain whitefish are a good indicator of the health of the Carson, Walker, and Truckee Rivers, and would benefit from the maintenance of adequate water flows and temperatures.

Carson River. PHOTO: JOE FERREIRA

Mountain Whitefish Distribution

Glossary

Anadromous describes fish that are hatched in freshwater, migrate to and mature in salt water, and return to fresh water to spawn

Barrier a manmade structure such as a dam or culvert which prevents fish passage in a stream

Broodstock a group of sexually mature individuals of a cultured species that is kept separate for breeding purposes

Caddisfly Larvae the wormlike larvae of mothlike aquatic insects that are often prey to trout

California Current a Pacific Ocean current that moves south along the western coast of North America, beginning off southern British Columbia, and ending off southern Baja California

Central Valley a large, flat valley that dominates the central portion of California; the northern half is referred to the Sacramento Valley and its southern half as the San Joaquin Valley

Climate Change since the mid-20th Century, refers to the increase in the average temperature of the Earth's near-surface air and oceans, and its projected continuation

Cobble naturally rounded rock fragments between 2½ inches and 10 inches in diameter

Creel data information concerning the number of fish caught by sport fishers on a particular stream or in a particular area

Critical habitat a specific geographic area, whether occupied by a special-status species or not, that is determined to be essential for the conservation and management of special status species

Crustaceans animals, including crabs, shrimp and crayfish, that have a hard shell instead of a skeleton and that usually live in water

DFG Department of Fish and Game, a California state agency whose mission is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public

Dissolved oxygen oxygen freely available in water and necessary for the lives of fish and other aquatic organisms

Distinct Population Segment a term with specific meaning under the Endangered Species Act when used for listing, delisting, and reclassification purposes to describe a population that may be added or deleted from the list of threatened and endangered species

Domestic strain a group of organisms within a native species

Dorsal fin the fin located on the back of fishes, and in front of the adipose fin, if it is present

Drainage a group of interconnected streams whose main channel enters an ocean, estuary, or the main-stem of a basin

DWR Department of Water Resources, a California state agency whose mission is to manage the water resources of California in cooperation with other agencies, to benefit the state's people, and to protect, restore, and enhance the natural and human environments

Ecosystem a recognizable unit on the landscape that includes organisms, their environment, and all the interactions among them

Effective Population Size the average number of individuals in a population that contribute genes to the succeeding generations

Emigration seaward migration of salmon or steelhead from their natal streams to the ocean; also called outmigration

Endangered Species under the Endangered Species Act, any species that is likely to become extinct within the foreseeable future throughout all or a significant portion of its range

Endangered Species Act the Endangered Species Act was enacted by Congress in 1973 in response to an alarming decline of many animal and plant species. The ultimate goal of the Act is to return threatened and endangered species to the point where they no longer need the law's protections

Endemic species a species native and confined to a certain region; usually with a comparatively restricted distribution

Estuary the area where fresh and salt water mix at the mouth of a river, used as rearing and feeding habitat by many fish species and other animals

Entrainment the incidental trapping of fish and other aquatic organisms in water diverted from streams, rivers and reservoirs; the process of drawing fish into diversions, along with water, resulting in the loss of such fish

Escapement those fish that survive natural mortality and harvest, and make up a spawning population

Evolutionary Significant Unit used by the National Marine Fisheries Service, a population or group of populations of salmon that is substantially reproductively isolated from other populations and contributes substantially to the evolution of the species

Extirpated a species that has been eliminated from a particular area, but still exists elsewhere; locally extinct

Fauna all of the animal life of any particular region or time

Flood Plain the low area along a stream or river channel into which water spreads during floods

Fry a stage of development in young salmon or trout; during this stage the fish is usually less than one year old, has absorbed its yolk sac, is rearing in the stream, and is between the alevin and parr stage of development

Genetic Risk the probability of an action or inaction having a negative impact on the genetic character of a population or species

Genotype the genetic makeup of an organism, as distinguished from its physical appearance (the phenotype)

Gill covers the outer covering of the gill chamber which opens and closes to allow water to pass over the gills for respiration

Gill Net Harvest the use of a gill net to collect or harvest fish

Gray literature refers to material that is not formally published, such as institutional or technical reports, working papers, business documents, and conference materials

Habitat the physical, chemical, and biological features of an area that supplies food, water, shelter and space necessary for a particular species' existence

Half Pounders immature steelhead that enter the river in the spring, feed instream until the following winter, then migrate to the ocean again before returning to the river to spawn

Headwaters the source or upper part of a stream or river

Hybridize to breed plants or animals of different varieties or species in order to create offspring having characteristics of each

Introgression the spread of genes from one population or species into another as a result of hybridization

Invertebrate an animal without a backbone

IRWMP Integrated Regional Water Management Planning, a new planning process created by state water agencies to promote cooperative, "big picture" water planning at the regional level

Iteroparous reproducing more than once in a lifetime

Juvenile fish from one year of age until sexual maturity

Kype the distinctive hooked jaw that male salmon develop during spawning

Macroinvertebrates animals without backbones that are big enough to see with the naked eye; examples include most aquatic insects, snails and crayfish

Natal stream stream of birth

Native Species an indigenous stock of fish that has not been substantially affected by genetic interactions with non-native stocks or by other factors and is still present in all or part of its original range

NMFS National Marine Fisheries Service, a federal agency and division of the Department of Commerce, responsible for the stewardship of the nation's living marine resources and their habitat

Parr the stage in sea-going trout and salmon prior to the smolt state and migration to salt water

Parr Marks distinctive vertical bars on the sides of young salmon or trout

Peer Reviewed Literature scientific writing or research that has undergone evaluation by other experts in the field (peer review) to judge if it merits publication or funding

Pikeminnow a torpedo-shaped fish with an olive-green and gold back, and white belly; a major predator on juvenile salmonids in the Eel River

Piscicide a chemical which is poisonous to fish; the primary use for piscicides is to eliminate a dominant species of fish in a body of water, as the first step in attempting to re-populate the waterbody with a different fish

Pool a relatively deep, still section in a stream

Reach a section of stream defined in a variety of ways such as the section between tributaries or a section with consistent characteristics

Refugia locations in which species have persisted while becoming extinct elsewhere

Resident describes species of fish which spend their entire lives in fresh water

Restoration hatchery a hatchery designed to produce fish for restoration purposes rather than for recreational purposes

Riparian Habitat the terrestrial habitat adjacent to streams, lakes, estuaries or other waterways

Salmonid any member of the taxonomic family Salmonidae, which includes all species of salmon, trout, char, whitefish and grayling

Salmon run the time at which salmon swim back up the rivers in which they were born to spawn

Sedimentation fragmentary material that originates from the weathering of rocks or the additions of materials from manmade activities into a river

Smolt the third stage in the development of a trout, salmon or char, when the fish has begun its migration from fresh water to the sea.

Spawn the release and fertilization of eggs

Spawning run the migration of fish to the place where they mate and lay their eggs

Steelhead a form of rainbow trout that migrates from the stream in which it was born to the sea and back to its home stream to spawn

SWRCB State Water Resources Control Board whose mission is to develop and enforce water quality objectives and implementation plans that will best protect the state's waters, recognizing local differences in climate, topography, geology and hydrology

Taxon (plural: taxa) a taxonomic category such as family, genus, species that refers to a distinct natural group

Terminal Lake a lake which has no significant outflow, either through rivers, or underground diffusion

Threatened any species which are vulnerable to extinction in the near future, as defined by the federal Endangered Species Act

Tributary a stream that feeds into a larger stream; also called a feeder stream

Trophy fish a prized, large-sized fish

Tui Chub a type of minnow which is an important food source for other fish, including cutthroat trout

Watershed the area of land that water flows across or under on its way to a river, lake or ocean; includes all surface waters and adjacent estuaries and marine areas

Zooplankton microscopic animals in water which form the important beginnings of food webs for larger animals

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About the Authors

J. SCOTT FEIERABEND a native of Louisiana, was born in the small delta town of Port Sulphur in the heart of bayou country. Scott received his B.Sc. in Biology from Emory University and M.Sc. in Wildlife Biology from West Virginia University and has worked in the non-profit conservation community for 28 years. Starting as an intern with the National Wildlife Federation, Scott served the organization in a variety of capacities, including staff scientist, lobbyist, director and vice president. His career with NWF eventually took him to Anchorage, Alaska, where he supervised the Federation's Western Field Operations before going to work for The Nature Conservancy's Alaska Chapter as its Director of Conservation Programs. After two years in this position, Scott and his family moved to California where he was hired as the Marin Conservation League's Executive Director in October 2002. He left the League in October 2006 to begin serving as California Trout's Conservation Director. Scott is married to Janel Worsley Feierabend and has two sons, Dashiell and Tristan, both currently living and working in the great state of Alaska.

JOSHUA A. ISRAEL's first experiences with conservation and ecology of fishes were with community-based restoration organizations in northern California and public lands along Oregon's coast a decade ago. Before these experiences, Josh received a B.Sc. in Biochemistry and Molecular Biology from the University of California, Santa Cruz. He remains active in educating watershed practitioners and biologists about restoration science while promoting recovery of California salmonids as a Director with the Salmonid Restoration Federation. Josh's recent Ph.D. dissertation in Ecology from the University of California, Davis, focused on precautionary management and genetic monitoring for North American green sturgeon. His current projects include conservation genetics of longfin smelt and green sturgeon, the relationship between genetic diversity and adaptability in aquatic organisms, and ecological and genetic risk assessment of fisheries and water management strategies. Josh is a researcher in the Department of Animal Science and the Center for Watershed Science, University of California, Davis.

PETER B. MOYLE has been studying the ecology and conservation of freshwater and estuarine fishes in California, including salmonids, since 1969. In recent years, much of his research has centered around developing conservation strategies for native fishes in California streams and estuaries. Recent projects include evaluation of the health of mountain meadow systems, long-term trends in fish populations in two Sierra streams, and developing restoration strategies for endangered trout. He was a member of the National Research Council's Committee on Endangered and Threatened Fishes in the Klamath River Basin. He is helping to restore Chinook salmon runs to 150 miles of dry San Joaquin River, based on his work on restoring fish to Putah Creek and on the biology of Central Valley salmon. He is author of Inland Fishes of California (2002), Fishes: an Introduction to Ichthyology (with J.J. Cech, 5th edition, 2002), and a co-author of Envisioning Futures for the Sacramento–San Joaquin Delta (Public Policy Institute of California, 2007). For his work, he was given the national Award of Excellence by the American Fisheries Society in 2007. Peter is professor of fish biology in the Department of Wildlife, Fish, and Conservation Biology and the Center for Watershed Sciences, University of California, Davis.

SABRA E. PURDY is a graduate student in Ecology at the University of California, Davis. She has a B.Sc. in Environmental Science and Management, also from U.C. Davis. Sabra worked for three years as a research scientist at U.C. Davis studying the health of streams in Sierra Nevada meadows, as well as contributing to studies of the effects of hydropower on streams and fish ecology in Suisun Marsh and elsewhere. She continues to pursue her studies in montane meadow ecosystems and most recently conducted mountain yellow-legged frog and Yosemite toad research throughout the Sierra Nevada. Sabra is most interested in the intersection between people and natural systems and how to minimize conflict and maximize conservation values. Sabra also works with community groups, agencies, and private land owners on conservation, research and integrating knowledge.

About California Trout

The mission of California Trout is to protect and restore wild trout and steelhead waters across California.

Founded in 1971, California Trout was the first statewide conservation group to focus on securing protections for California's unparalleled wild and native trout diversity. California Trout employs conservation science, education, and advocacy to craft effective public policy to protect California's water resources and fisheries.

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Your personal support of California Trout can make a difference in protecting and increasing remaining populations of salmon, steelhead and trout. The stewardship circles below offer benefits to major supporters of California Trout's work. For more information on supporting California Trout at any level, please contact Melanie Hamburger, Director of Development, at 415-392-8887 x111, or mhamburger@caltrout.org

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- Two-day guided steelhead trip for two anglers
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- Recognition in the annual report as a major donor

The fish don't lie! The story they tell is that California's environment is unraveling. Their demise is symptomatic of a much larger water crisis that, unless addressed, will severely impact every Californian in the years to come.

—Dr. Peter B. Moyle

CALIFORNIA TROUT

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How to become a member of California Trout

The basic annual membership is $35. To join, go to www.caltrout.org or send a check or credit card number with the amount you wish to give to: California Trout, Membership Dept., 870 Market Street, Suite 528, San Francisco, CA 94102. Membership benefits include a California Trout decal, logo hat and a one-year subscription to our newsletter, *The Streamkeepers Log,* to keep you up to date on fish and water issues in California.

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