

How Water Management in the Bay-Delta Threatens the Future of California's Salmon Fishery

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Foreword

by Dick Pool and Zeke Grader

On May 1, 2008, a quiet disaster unfolded along the coast of California and Oregon. Commercial and recreational fishermen and women did not set their lines. Rods did not bend, reels did not scream, and nets did not fly. Due to record low levels of salmon stocks, the salmon fisheries in California and most of Oregon were closed for the first time ever.

This closure is among the nation's worst man-made fisheries disasters. It is on par with the loss of the Atlantic cod fishery, and its economic impact for the fishing industry is comparable to the losses that followed the *Exxon Valdez* oil spill. And now all of us—especially the 2.4 million fishermen in the state—are paying the price.

The San Francisco Bay-Delta and its rivers are the backbone of our industry, accounting for two-thirds of California's salmon catch. But now the West Coast's largest estuary is imperiled. The amount of water exported out of the Delta has increased steadily. In 2005 California set an all-time record for diversions from the Bay-Delta. As a result we have seen a precipitous drop in our native salmon population in the last few years, and their numbers have dwindled to the point of collapse.

As part of a community that depends on healthy fisheries for its livelihood, we saw the signs early on. Corporate agricultural interests demanded more and more water, and the federal and state agencies let them have it. These agencies failed to uphold their obligation to protect fisheries. Political appointees skirted the law and overruled federal scientists to produce shoddy biological opinions. Yet more water—water needed to maintain salmon habitat—was taken out of our rivers.

The economic disaster of the salmon fishery collapse affects everyone we know. A survey of 49 leading charter boats from Monterey to Fort Bragg found that the income loss from the closure of salmon fishing will total \$5.4 million. Each charter boat has a crew, and those crews have families to support. How long can these boat operators weather this loss? We simply don't know. And this is just one part of the problem. Salmon support a quarter-billion-dollar industry in California, which includes restaurants, processors, and local businesses. The collapse affects consumers and restaurant patrons. In a typical year more than 5 million pounds of California premium salmon is enjoyed by diners all over the country. Salmon is one of the most healthful and high protein foods on the planet.

But the economic losses stemming from the salmon collapse don't paint the whole picture. The hundreds of thousands of men and women who fish commercially or recreationally know the deep connection between this iconic fish and the culture of California. Salmon fishing is our birthright as Californians. From the Smith River to the San Joaquin, our salmon ran wild from the beginning of our statehood. What we have now is a failure by the entire state to protect this shared resource.

We are fishermen, and we represent and work with fishermen across the state. We hear the blame placed on ocean conditions or overfishing. We don't buy it. Our people have done their part. We have limited our take. We have volunteered thousands of hours to cleaning up the bay and rivers. We pay to support restoration efforts. We have obeyed the law. We have given congressional testimony and have activated tens of thousands of fishermen across the state. We are on the front lines. And we know the solutions to this problem are in front of us. It's simple: Fish need water.

Today we must act to save the salmon, our industry, and our communities. To do this we must change the way we manage water in the state to allow more water to stay in our rivers—especially in the Bay-Delta ecosystem. To make sure that happens, our leaders must do all they can—including pursuing the real solutions outlined in the pages that follow—and we must each make choices in our own lives that help to conserve water. We believe that we can bring back our fishery. If we do the right thing and put water back in our rivers, we can save our salmon, and save our birthright.

Dick Pool is a recreational fisherman, tackle manufacturer, and organizer of the Water-4-Fish campaign. Zeke Grader is the executive director of the Pacific Coast Federation of Fishermen's Associations.

Executive Summary

Chinook are magnificent fish, and their presence is an indicator of a healthy ecosystem. They are prized as a healthful food, valued by recreational and commercial fishermen, and play a central role in the culture of many of California's Native American tribes. Chinook sustain local economies from the central coast of California to Oregon; commercial fishermen, charter boat operators, fish processors, hotels, and restaurants all depend on healthy salmon runs. But the future of salmon in California is at a crossroads.

California faces the possibility of becoming a state where salmon fishing is a thing of the past and where wild, locally caught California salmon permanently vanishes from restaurant menus and supermarkets. In April 2008, state and federal agencies took the unprecedented step of completely closing the commercial fishery for Chinook salmon and all but entirely closed the recreational fishery. The closure was necessary because the numbers of salmon returning to the Sacramento River, which have recently been the backbone of California's salmon fisheries, have fallen to record lows. And next year's run could be even worse.

Several causes have contributed to the decline of Chinook salmon and steelhead, including poor ocean conditions (possibly caused by global warming), water pollution, and invasive species. Although there are a complex host of factors, one of the most significant—and reversible—is the operation of the State Water Project and Central Valley Project. First, exporting water from the Delta has required changes to the operation of upstream reservoirs, which reduces the cold, clean water needed for salmon to migrate and spawn. Second, many dams block salmon from migrating to their spawning grounds. And third, the giant pumps in the Delta used to export this water kill tens of thousands of juvenile salmon each year. A federal judge recently found that approximately 40 percent of some populations of juvenile salmon are killed by the water projects before they reach the ocean, and that plans approved by the federal government in 2004 to operate the water projects to export more water could increase mortality rates up to 66 percent for some species.

Salmon Species in California



Migrating Chinook salmon

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Steelhead and the five species of Pacific salmon are anadromous fish, meaning that they are born in freshwater, migrate out to the ocean where they spend several years, and then return to reproduce in the rivers where they were born. Several species of salmon are native to California, most notably Chinook (“king”) salmon, coho salmon, and steelhead (steelhead are the anadromous form of rainbow trout).¹ Salmon and steelhead continue to spawn in rivers and streams up and down the Pacific Coast of North America and throughout California, from steelhead in Southern California, to coho in coastal

streams such as Lagunitas Creek, to Chinook in major rivers such as the Sacramento and Klamath. Historically, the largest salmon runs on the West Coast migrated up the Columbia River, California’s Central Valley river system, and the Klamath River.² Salmon runs across the West Coast have been in trouble for decades. Since 1989, when Sacramento winter-run Chinook were first designated as threatened under the federal Endangered Species Act, 26 unique populations of Pacific coast salmon have been listed as threatened or endangered.³ In recent years, Central Valley fall-run Chinook became the workhorse of California’s salmon fisheries as other salmon populations (especially Klamath River Chinook and coho in rivers throughout northern and central California) declined. Now the Central Valley fall run is succumbing to the same pressures that have befallen other runs.

The Central Valley runs support many of the state’s sport and commercial fisheries, and new information suggests that changes to state and federal water projects are putting these runs at even greater risk. The decline of the salmon runs (particularly Chinook) that migrate through the Delta to spawn on the Sacramento, San Joaquin, and other rivers provide a clear message. We must act now to save California’s salmon and steelhead, and the commercial and recreational fishing they support, or they may disappear forever.

The impacts of operating major water projects in the state with a business-as-usual approach that neglects the plight of salmon would be far-reaching: no locally-caught, wild salmon available on restaurant menus or at the market; fishing boats tied up at the dock, with fishermen, river guides, and local communities devastated by the economic losses; and the health of our rivers in jeopardy because of the loss of an integral part of the river ecosystem.

Fortunately, we can solve these problems and restore healthy salmon runs while still meeting the water needs of the public. We can reduce diversions from the Bay-Delta ecosystem and develop fish-friendly ways to replace the water needed for people, including investments in water conservation, efficiency, groundwater management, water recycling, and urban stormwater management. We can develop better ways to divert water so that some of the dams could be eliminated, allowing salmon to reach their spawning habitat. And we can restore fish habitat and improve water quality.



Salmon are tough, resilient fish. When we have made concerted efforts to recover California's salmon populations, the fish have returned. When we made more water available for Central California Chinook salmon in the 1990s, and made other changes to better protect salmon habitat, their numbers rebounded. In addition, although the Central Valley Project eliminated salmon from spawning in the San Joaquin River decades ago, state and federal governments, environmentalists, and water users are now collaborating on a historic multiyear effort to restore flows and salmon to the river. And habitat restoration measures in the past decade have dramatically increased the numbers of spring-run Chinook returning to spawn in Butte Creek.

These measures alone, however, are not enough. Restoring central California's salmon populations will require state and federal agencies and legislators to make salmon restoration a high priority and to take prompt and comprehensive action. If they fail to do so, California's Chinook salmon fishery could be lost forever. Unfortunately, state and federal agencies are considering several actions that could further worsen conditions for salmon in the San Francisco Bay-Delta watershed.

The future of California's salmon, and the futures of the many people who depend on these fish, will be determined during the next few years. We must act quickly and adopt comprehensive solutions to protect this treasured resource and avoid disaster. We urge the governor, legislature, and state and federal agencies to take prompt action to:

- ▶ **Implement the State's Salmon Doubling Goal:** The Governor should issue an executive order making the recovery of salmon runs, and achieving the state's existing salmon doubling requirement, a high priority for all state agencies working on water issues, including the Department of Fish and Game, the Department of Water Resources and the State Water Resources Control Board. The executive order should require the state's doubling goal and salmon recovery to be key goals of the strategic plan under development by the Delta Vision Task Force and of the plan being developed by the Bay Delta Conservation Plan process.
- ▶ **Reduce Water Diversions:** Reduction of water withdrawals from the Bay-Delta ecosystem in order to meet the habitat needs of salmon and to restore environmental health and sustainable fisheries. To meet water supply needs, California should dramatically increase investments in fish-friendly water supply alternatives, including water conservation, water recycling, groundwater management, and urban stormwater management. In the current legislative session, the legislature and the governor can enact AB 2175, a water conservation bill that would reduce per capita water use by 20 percent by 2020.
- ▶ **Reform Management of the Water Projects:** A new state agency should be created to regulate the operations of the federal Central Valley Project and the State Water Project in order to ensure that they contribute to salmon doubling and the recovery of the Bay-Delta ecosystem. The Department of the Interior should reform CVP contracts to reduce water subsidies and incorporate needed reductions in pumping. Finally, an equitable funding mechanism should be developed to restore salmon populations and the Delta ecosystem, including the creation of a water user fee for all water diversions.
- ▶ **Restore Salmon to the San Joaquin River:** The historic San Joaquin River settlement agreement should be fully implemented to restore flows and reintroduce salmon to the river.

CHAPTER 1

The Collapse of California's Salmon Populations

The Central Valley once sustained four runs of Chinook, each of which evolved to return to fresh water during a different part of the year: fall, late fall, winter, and spring. California's once-mighty salmon runs formed a cornerstone for Native American cultures, sustained pioneers as they settled California's coast and river valleys, and fostered a booming commercial fishing industry.⁴ Historically, an average of 1.5 to 2 million Chinook traveled each year through the San Francisco Bay-Delta and spawned in the Central Valley rivers that are the lifeblood of the Delta, including the Sacramento and the San Joaquin rivers and their tributaries.⁵ Another 1 to 2 million steelhead also came through the Delta annually to spawn upstream.⁶ A century ago, fishermen reported catching Chinook up to 5 feet in length.⁷ Seventy years ago, salmon in the San Joaquin River remained so plentiful that farmers would use pitchforks to pluck them from the river.⁸ Today this iconic symbol of the American West is disappearing.

Precipitous Declines Threaten Salmon Survival

Like salmon up and down the West Coast, the populations of salmon species in California have declined so precipitously that most are listed as endangered or threatened under the federal Endangered Species Act (ESA). Two species of native California salmonids—pink salmon and bull trout—have already been eliminated from California waters.⁹ The Sacramento River winter-run Chinook was the first California salmon run listed under the ESA, in 1989.¹⁰ The listing of nine other California salmon runs quickly followed: two coastal coho species, five runs of steelhead, and two additional Chinook runs, including the Central Valley spring-run Chinook.¹¹ Only a few remaining salmon runs in California are not listed under the ESA. Although not listed as endangered or threatened, Central Valley fall- and late-fall-run Chinook are identified as species of concern under the ESA.¹²

In recent decades, as other runs declined, the Central Valley fall run became the workhorse of California fisheries, with a few hundred thousand fish, on average, returning to spawn each year.¹³ The fall-run population and fishery are heavily supplemented by the release of tens of millions of juvenile fish produced by hatcheries each year.¹⁴

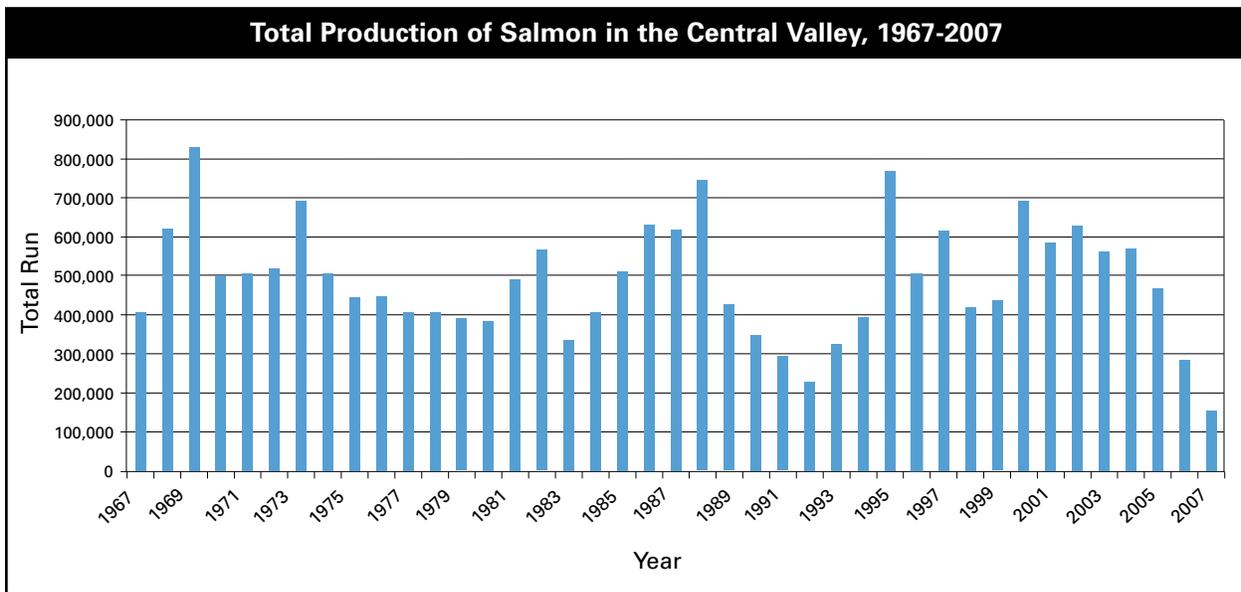
Learning From the Coho Salmon Fishery Collapse

Coho salmon, one of five species of Pacific salmon found in California, once thrived in a habitat of coastal waters and inland streams stretching from the north coast of Alaska to Monterey Bay, south of San Francisco.¹⁵ The annual commercial catch of coho ranged from 100,000 to more than 650,000 fish in the early 1960s and 1970s. From 1980 to 1990, the commercial fishery landed a yearly average of 54,300 fish and the recreational fishery an average of 29,300 fish.¹⁶

Coho salmon were able to survive changes in the Pacific Ocean and California river environment for millennia. But poor watershed management and habitat degradation (especially from timber harvesting, road building, and urban runoff) caused coho populations to dramatically decline, starting as early as the 1940s.¹⁷ In 1993 the National Marine Fisheries Service (NMFS) listed northern and central California coast coho as threatened under the Endangered Species Act (ESA).¹⁸ The commercial fishery was closed in 1993, and recreational fishing for coho was restricted in 1994 and closed in 1998.¹⁹

Despite these actions, coho continued to decline, and the populations that did survive were increasingly made up of nonnative hatchery stocks, which were detrimental to the health and genetic diversity of the coho and thus to the survival of the species.²⁰ In 2005, under greater danger of extinction, the NMFS listed the central coast population as endangered.²¹ Coho abundance has since continued to decline. Today there are fewer than 5,000 wild coho spawning in California, in population groups of 100 or fewer—too small a number to protect against the potential extinction of this irreplaceable wild salmon.²² There is no near-term prospect of restoring this once-rich fishery. The loss of the coho fishery is a stark reminder that without early action, sustainable fisheries can be lost for decades—if not permanently.

Yet in contrast to the abundance of a century ago, and despite the use of hatcheries, scientists estimate that less than 60,000 fall-run salmon will swim through the Delta in 2008 to reproduce upstream.²³ The 2008 run is a tiny fraction of historic levels, and far less than the minimum population of 120,000 fish thought to be necessary to sustain the fishery.²⁴



Source: California Department of Fish and Game, Anadromous Fish Restoration Program, www.delta.dfg.ca.gov/afrrp/index.asp

The best scientific information indicates that the 2009 returns will also be catastrophically low. Only 2,000 “jacks” (male salmon that have spent only one year at sea, instead of two or more, and return from the ocean early in an attempt to spawn)²⁵ returned to their spawning grounds in 2007, compared with a long-term annual average of about 40,000 fish and a previous record low of approximately 10,000.²⁶ These jacks provide an early indicator of the size of the following year’s run and strongly suggest that 2009 returns will also be disastrous.²⁷

Central Valley fall-run Chinook are doing so poorly that protections under the ESA may become necessary in the future unless strong actions are taken to reverse this trend. The Central Valley’s winter and spring runs are in even worse shape. Fewer than 2,500 winter-run Chinook returned to spawn in 2007, a decline of approximately 85 percent from the previous year. The National Marine Fisheries Service ranks the number of winter-run juveniles migrating to the sea in 2008 as “one of the lowest estimates on record” and predicts that “a second year of reduced winter-run juvenile production is very likely” if current dry conditions continue.²⁸ Annual estimates for the number of spring-run adults returning to spawn have been steadily declining for the last seven years. While a few spring-run populations are doing well, like those on Butte Creek, the Sacramento River’s population of spring-run Chinook—one of the populations most affected by water project operations—is doing especially poorly.²⁹ Fewer than 100 fish reached the holding and spawning habitat below Shasta Dam in four of the past eight years, and in 2003 and 2005 no spring-run fish spawned in the Sacramento River.³⁰



Commercial Fishing Boats in San Francisco

IMAGE BY WERNHER KRUTEIN/PHOTOVAULT.COM

Loss of Salmon Destabilizes Local Economies

The collapse of the fishery will have devastating impacts on the fishermen, river guides, and numerous other businesses and communities that depend on salmon. This year consumers will not find locally caught wild salmon on the menu or at the market. The California Department of Fish and Game estimates the economic loss caused by the failure of this year’s salmon run to be \$255 million and 2,263 California jobs.³¹

Salmon Is My Bread and Butter



Jacky Douglas, captain of the 'Wacky Jacky' charter fishing boat.

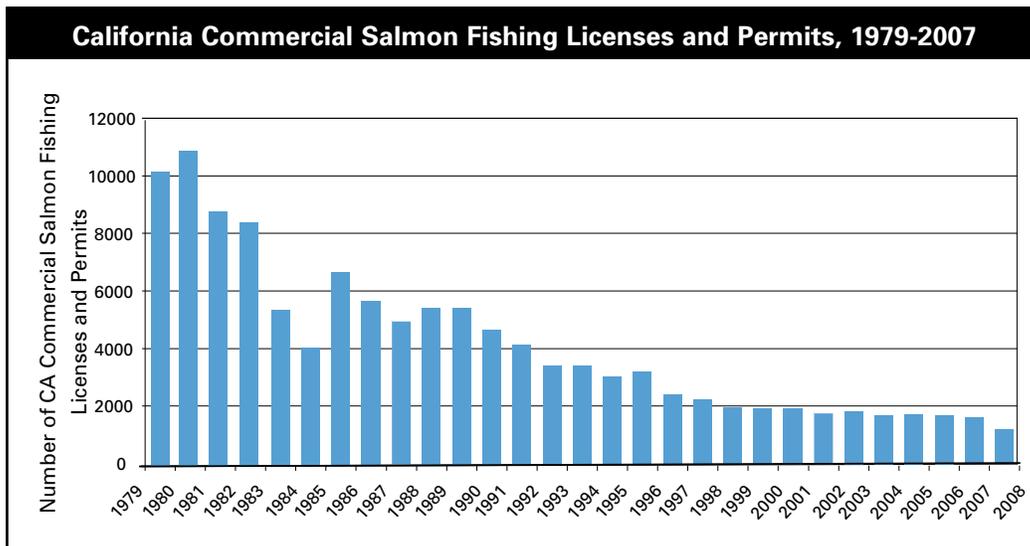
Jacky Douglas believes that she owes a debt of gratitude to the salmon. “Salmon is my bread and butter. I wouldn’t be here if it weren’t for that salmon. They put my kids through college,” Douglas says. She tears up as she recounts stories of introducing salmon fishing to families and the joy she has seen on the faces of children reeling in their first fish.

A veteran party-boat skipper out of San Francisco Bay, Douglas has been fishing since 1955 and has devoted her life to protecting salmon. Before the salmon closure she would take boatloads of recreational fishermen out of the Bay to the Farallon Islands and Point Reyes. Her passion for the fish led her to testify at congressional hearings and speak at press conferences, putting a human face on the industry.

Now she mourns the closure of the industry that has meant so much to her and to the families who introduced her to the business. While the closure pains her, it certainly wasn’t shocking news. “I knew something was wrong a few years ago, when we were just catching big salmon. When there’s no small fish there’s something happening,” she explains.

Douglas has had a lifetime of fishing, but she worries about younger generations and how the closure affects other industries. “Because I’m older I can look at it differently. If I have to, I can sell my boat, but I’m not worried about it. I’m thinking of everyone else. We could have avoided all this if we had put more effort into saving the salmon.”

The economic impact of the recent collapse is the exclamation point on a long-term decline in salmon fishing (see graph below). Moreover, the estimate of economic damage this year does not take into account the loss of a geographic and cultural icon that is also a delicious, local, high-protein, and healthy food source, nor the disappointment felt by parent wanting to take a son or daughter out fishing.³²



Source: California Department of Fish and Game, www.dfg.ca.gov/licensing/commercial/commercialinfo.html.

In addition, the loss of substantial numbers of salmon threatens the health of our river ecosystems and all the birds, fish, and wildlife that depend upon them. Chinook salmon die after they spawn. Salmon carcasses provide essential nutrients to aquatic invertebrates, plants, and animals, and scientists have found that salmon provide up to 25 percent of the nitrogen used by grapevines growing close to rivers. The same scientists conclude that “[l]oss of Pacific salmon can not only negatively affect stream and riparian ecosystem function, but can also affect local economies where agriculture and salmon streams coexist.”³³

The System Has Failed

Pietro Parravano feels the burden of the recently imposed closure of the 2008 salmon season in California. A commercial salmon fisherman working out of Half Moon Bay, Parravano has been fishing since 1982. This is the first time he has had to hang up his hooks.

Since the closure of the salmon fishery in May, many commercial salmon fishermen in California and Oregon have been out of work. Parravano’s crew has adjusted by fishing for Dungeness crab or halibut. But he wonders how long that will last, and whether they are shifting the burden onto another species of fish.

As Parravano describes it, the agencies have failed the fisherman. “We are losing our identity as a coastal community,” Parravano says. “Our identity is salmon fishing, and people are concerned with what will take its place.” Parravano feels that those responsible for managing California’s fisheries have simply not done their job. “For the first time in history, we’ve had to close down an industry. This speaks volumes about how awful the situation is.”

He believes that the salmon industry has been at the brink for decades, as competition for water resources and habitat loss has increased. The agencies didn’t take into account how vital Sacramento River salmon are to the entire industry. “This is a failure of many systems. The fact that failures in one river system can shut down fisheries in two states is beyond belief.”

Parravano says that salmon need improved fishery habitat and that salmon protection should be on a level playing field with agriculture in water management decisions. “If we had some level of equality, it would set the stage to resolving this issue.”



Pietro Paravanno, captain of the commercial fishing boat the *Anne-B*.

CHAPTER 2

The Role of California's State and Federal Water Projects in the Collapse of the Salmon Fishery

Many factors contributed to the historic collapse of the salmon fishery in 2008, including changes in ocean conditions that were unfavorable for salmon during the past several years.³⁴ Still, the operation of the State Water Project (SWP) and Central Valley Project (CVP) has played a critical and central role.

Salmon Depend on Healthy Freshwater and Ocean Ecosystems

Chinook salmon are an anadromous species, which means that they are born and spend up to a year in freshwater before migrating to the ocean, where they typically spend two to four years feeding before returning to their natal stream to lay their eggs.³⁵ As a result, healthy salmon populations depend on healthy freshwater and ocean ecosystems. Adult fish need adequate flows to migrate upstream to their spawning grounds and cold, clean water to reproduce. The fish need cold water for egg incubation. Juveniles must have sufficient food to eat while they remain in the rivers and the Delta, and adequate flows to migrate out to the ocean. Unfortunately, the CVP and SWP significantly, and adversely, affect all of these critical components of a healthy freshwater ecosystem.

Water Projects Dramatically Alter the Region's Hydrology

The most visible impacts of the CVP and the SWP are the dams that have been constructed to store and divert water. Dams in the Central Valley have entirely cut off access to more than 80 percent of historic salmon and steelhead spawning grounds.³⁶ For example, construction of Friant Dam in the 1940s on the San Joaquin River created an impassable barrier, blocking salmon and steelhead from reaching historic spawning grounds. Demonstrating their remarkable resiliency, large numbers of salmon continued to spawn downstream from the dam until the federal government diverted so much water for irrigation that the San Joaquin River ran dry for 60 miles below the dam in all but the wettest years.³⁷ As a result, the San Joaquin River's annual spring run of hundreds of thousands of Chinook was eliminated, and the annual fall run of 50,000 to 100,000 salmon was reduced to struggling populations on downstream rivers like the Merced and Tuolumne.³⁸

Even when dams do not entirely obstruct access to spawning grounds, they may have a dramatic impact on salmon passage. The sole remaining population of winter-run Chinook, as well as populations of fall-run, spring-run, and steelhead, spawn upstream of Red Bluff Diversion Dam on the Sacramento River.³⁹ Red Bluff Diversion Dam (RBDD) has gates that can be opened and closed at will. For salmon and steelhead that spawn upstream of the dam, the current operation of the dam and its associated diversions block or delay almost 75 percent of spring-run adults, 25 percent of fall-run adults, 15 percent of winter-run adults, and 17 percent of steelhead adults from migrating above the dam. Closure of RBDD also impedes the downstream migration of approximately 40 percent of the juvenile salmon and steelhead trying to migrate out to the ocean. When the gates are closed and the dam is



The Red Bluff Diversion Dam on the Sacramento River blocks or delays migrating salmon.

U.S. FISH & WILDLIFE SERVICE

in operation, predators may eat up to half the juveniles trying to move downstream past the dam.⁴⁰

CVP and SWP dams and diversions also degrade downstream habitat by altering the amount and timing of water flows, thereby increasing water temperatures and preventing the creation of spawning habitat. In particular, CVP and SWP operations affect water temperatures in ways that can reduce survival and reproductive success of salmon.⁴¹ Salmon require cold water throughout their lifecycle, and even nonlethal temperatures dramatically affect their growth and survival.⁴² The CVP and SWP increase water temperatures by altering and reducing flows as well as by storing and then releasing

water that has warmed in the top layer of reservoirs.⁴³ Dams also affect downstream habitat by reducing or blocking the downstream flow of gravel, which salmon need for spawning.⁴⁴ Further, sudden changes in flows released from dams can result in the dewatering of incubating salmon eggs or the stranding of juvenile salmon in shallow water habitats, resulting in reproductive failure and the loss of thousands of juvenile fish.⁴⁵

Export of Water from Bay Delta Endangers Fish and Wildlife

The export of millions of acre-feet of water from the CVP and SWP pumps in the South Delta has both direct and indirect impacts on salmon. Pumping causes migrating salmon smolts to lose their way through the Delta and prolongs their migration, which increases mortality.⁴⁶ At times, pumping levels in the Delta are so high that they actually reverse the flow of water in the San Joaquin River, so that water flows upstream rather than out to the sea.⁴⁷ The huge pumps also entrain an average of 90,000 juvenile fall-run salmon each year, as well as thousands of winter- and spring-run salmon.⁴⁸ In addition to direct mortality from the pumps, juvenile salmon are eaten by predators as they migrate across the Delta in water being pulled toward the pumps. One study estimated that 63 to 98 percent of the juvenile fall-run salmon that are pulled into the Clifton Court Forebay by the SWP's pumps are eaten by predators.⁴⁹

The CVP and SWP also reduce water quality, to the detriment of salmon, other wildlife, and farmers and communities in the Delta. Withdrawals of freshwater from the Delta increase the salinity of water remaining in the Delta, requiring extensive regulation of flows and salinity levels to protect drinking water, water for agriculture, and fish and wildlife.⁵⁰ The water that does remain in the Delta is too often polluted by runoff laden with pesticides, ammonia, and other toxins from farms, roadways, sewage systems, and cities (see "Delta Water Quality and Habitat Impacts on Salmon" sidebar on page 16).

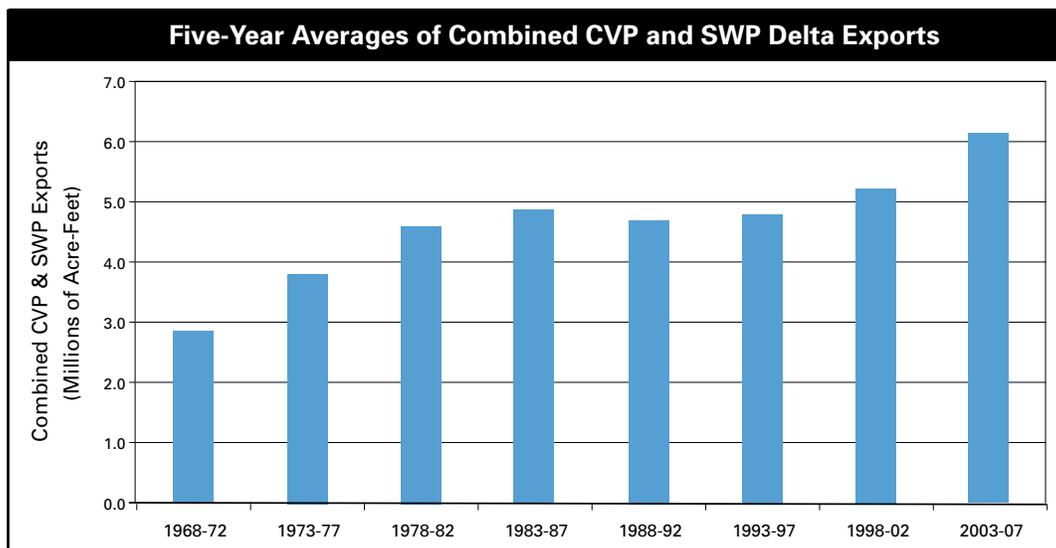
Delta Water Quality and Habitat Impacts on Salmon

Water pollution represents a significant threat to the health of the Delta and its fisheries. The simultaneous decline of numerous fish species throughout the Delta ecosystem in recent years suggests that water quality problems in this area may contribute to salmonid population declines.⁵¹ Recent studies have shown that ammonia from urban wastewater treatment plants may cause significant harm to the food chain in the Delta.⁵² Likewise, agricultural runoff from farms carries pesticides and herbicides that can be fatal to salmon and other species and may have harmful ecosystem effects.⁵³ Improving water quality in the Delta must be a priority if we are to recover salmon and other species. Doing so would provide the double benefit of improving drinking water quality for all who rely on the Delta.

Another threat to salmon in the Bay-Delta ecosystem has been the radical transformation of what was once a vast expanse of marshland and floodplain into agricultural land protected by levees, cutting off the river from its natural floodplains. Research shows that juvenile Chinook salmon grow faster and larger when they are able to forage in the floodplains of the Yolo Bypass than when they migrate through other Delta channels.⁵⁴ Creating a flood management system that allows some floodplains to flood, rather than relying solely on levees to confine rivers, would provide significant environmental benefits to fish, reduce the dangers of flooding to human life and structures, and increase groundwater recharge.⁵⁵ Creating more floodplains and allowing them to be inundated more frequently is a win-win solution.

Only a very small percentage of salmon smolts born each year reach the ocean, and the CVP and SWP operations are responsible for significant juvenile salmon mortality.⁵⁶ In 2008 a federal judge concluded that the direct and indirect effects of the operation of state and federal water projects (including mortality in the pumps, temperature impacts, and migration delays from dams and flows) kill approximately 42 percent of juvenile winter-run Chinook, 37 percent of juvenile spring-run Chinook, and 39 percent of juvenile steelhead.⁵⁷ Despite these dramatic figures, the operators of the CVP and SWP proposed to increase the amount of water exported through the Delta. The court concluded that these expanded operations would dramatically increase the number of fish killed, totaling as much as 62 percent of juvenile winter-run Chinook, 57 percent of juvenile spring-run Chinook, and more than 66 percent of juvenile steelhead.⁵⁸

SWP and CVP operations are not the only cause of the decline of salmon, nor are they the only cause of the crisis in the Delta. It is clear, however, that the management of the Delta—and the operations of the Central Valley



Source: California Department of Water Resources, Dayflow Database, www.iep.ca.gov/dayflow/output/index.html

Project and State Water Project in particular—play a critical role in the fate of Central Valley salmon populations. Following a low point for salmon populations in 1992, passage of a federal law requiring that more water be made available for salmon and other species, helped by the end of a five-year drought, resulted in some progress toward recovery. Unfortunately, since then water diversions have reached historic high levels and the salmon populations are now in crisis. The decline in California's native salmon populations corresponds strongly with the increase in CVP and SWP water project diversions and the Delta pumps that drain fresh water out of the Delta, reversing tributary flows and harming salmon traveling through the estuary. Blaming ocean conditions for declining salmon populations ignores the fact that many fish species that spend their entire lives in the Delta have experienced catastrophic population declines over the past five years, such as the delta smelt.⁵⁹

Notably, although unfavorable ocean conditions and some other factors implicated in the decline of the fall run are not directly within our control, the operation of these two water projects is. How we operate the CVP and SWP dramatically affects salmon populations and can make the difference between the collapse and the recovery of the salmon fishery. In fact, when ocean conditions are unfavorable, it is even more critical that we conserve the existing population by managing the CVP and SWP to maximize protection of salmon. As Peter Moyle, one of the nation's preeminent fish biologists, recently said:

Overall, blaming “ocean conditions” for salmon declines is a lot like blaming Hurricane Katrina for flooding New Orleans, while ignoring the many human errors that made the disaster inevitable, such as poor construction of levees or destruction of protective salt marshes. . . . The listings of the winter and spring runs of Central Valley Chinook as endangered species were warnings of likely declines on an even larger scale. . . . Continuing on our present course will result in the permanent loss of a valuable and iconic fishery unless we start taking corrective action soon.⁶⁰

A recent study by the Public Policy Institute of California agreed that the long-term survival of the salmon fishery is in jeopardy unless we change the way we manage water exports in the Delta. The study concluded that there is a 70 to 90 percent chance that the fall-run salmon fishery would not be viable in 2050, assuming that the existing system is used to convey water and that the amount of water diverted is equal to the average annual diversions from 1981 to 2000.⁶¹

If water exports increase above those levels or if other changes to the system that harm salmon occur, the likelihood of sustaining the fishery into the future would decrease even further. We can, and must, do a better job of managing the CVP and SWP if we are to protect and restore salmon populations.



The collapse of the salmon fishery diminishes cherished recreational fishing opportunities.

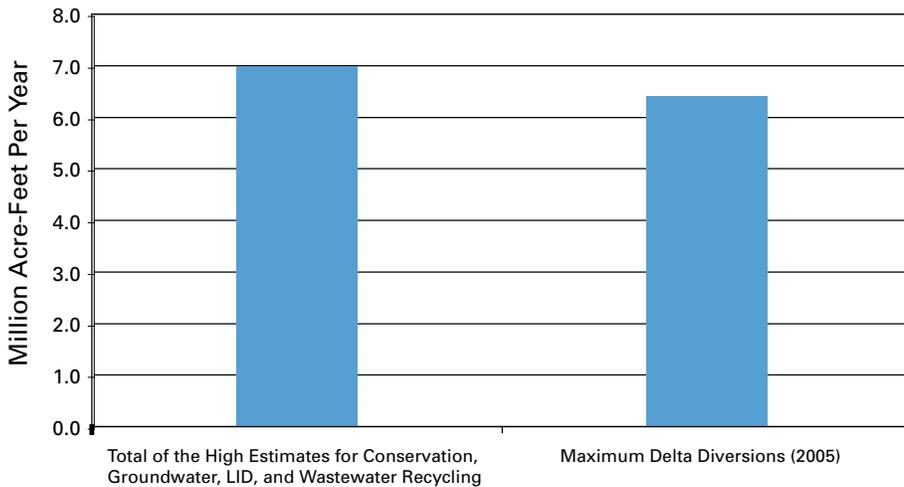
Tapping the "Virtual River" to Meet California's Water Supply Needs

In order to restore salmon and other wildlife, we need to keep enough water flowing in California's rivers. Moving toward science-based and environmentally sustainable flows in our rivers and the Bay-Delta will require reductions in the amount of water diverted from the ecosystem and the development of alternative water supplies that can reduce our dependence on the Bay-Delta.

Fortunately, California's future water needs can be met by expanding the water made available from fish-friendly sources like water conservation and efficiency, water recycling, groundwater cleanup and conjunctive use programs, and improved stormwater management. More than 7 million acre-feet of water is available from this "virtual river" each year, which is more water than has ever been diverted from the Delta, the state's single largest source of water today (see graph).⁶² In addition to protecting salmon and other wildlife, these water sources: (1) are more reliable and less vulnerable to global climate change; (2) generally require less energy than pumping from the Delta, saving energy and reducing air pollution and carbon emissions; and (3) provide additional benefits, including improved water quality at southern California's beaches through urban stormwater management (also called Low Impact Development, or LID).

This "virtual river" can help supply California's water needs for decades to come while at the same time protecting the environment and California's salmon fishing heritage. Urban water users agree that these tools are the key to adequate supplies in the future. For example, the City of Los Angeles recently announced plans to meet its growth in water demand over the next 20 years by emphasizing these tools—and at a fraction of the cost of traditional water supply projects. Building on the governor's call to improve water conservation by reducing per capita water use by 20 percent by 2020, local, state, and federal governments, water districts, and the rest of us must work together to develop the policies, projects, and leadership to tap into this virtual river for our homes, businesses, and farms.

Water Supply From the Virtual River Compared With Historic Maximum Diversions From the Delta



Source: California Department of Water Resources, *Bulletin 160-05: California Water Plan Update 2005*; Pacific Institute, *California Water 2030: An Efficient Future*, 33; California Department of Water Resources, "Dayflow Database," <http://www.iep.ca.gov/dayflow/output/index.html>.

CHAPTER 3

Existing Legal Protections for Salmon

Numerous state and federal environmental laws apply to the operation of the CVP and SWP, and they provide strong mandates to protect and restore salmon and the health of the San Francisco Bay-Delta. Unfortunately, state and federal agencies have often disregarded these legal requirements in their management of the water projects, leading to disastrous results for salmon, other fish and wildlife, and the people who depend on a healthy Delta for their livelihoods. Discussed below are some of the most important legal protections for fish and wildlife that are relevant to the operation of the CVP and SWP. Acting to realize the promise of these protections has often fallen to NRDC and other organizations dedicated to protecting and preserving our natural resources.

Federal Endangered Species Act

The goal of the federal Endangered Species Act (ESA) is to prevent the extinction of fish and wildlife threatened by human activities and to restore their populations to healthy levels. Species listed as endangered or threatened under the ESA are protected by two major requirements. First, the ESA requires the federal government to ensure that its actions do not jeopardize the continued existence or recovery of species listed as endangered or threatened. Second, the law prohibits any person (and any state) from killing or harming (“taking”) endangered or threatened species without a permit; such a permit must include mitigation measures to protect the species’ population.⁶³ Numerous fish and wildlife species living in the Delta, including several salmon runs, have been listed under the ESA, an indication that the Bay-Delta ecosystem is in trouble (see “Threatened and Endangered Fish Special of the Bay-Delta” on page 20). Actions taken under the ESA to protect listed species can also benefit other Species, such as fall-run Chinook salmon.

Threatened and Endangered Fish Species of the Bay-Delta ⁶⁴		
Species	Federal ESA Status	State ESA Status
Winter-run Chinook	Endangered	Endangered
Spring-run Chinook	Threatened	Threatened
Fall- and late-fall-run Chinook	Species of concern	Not listed
Central Valley Steelhead	Threatened	Not listed
Delta smelt	Threatened	Threatened
Longfin smelt	Candidate for listing	Candidate for listing
Sacramento splittail	Not listed	Species of special concern
Southern green sturgeon	Threatened	Not listed

In recent years, working with other conservation and fishing groups, NRDC has won several landmark lawsuits holding that operation of the CVP and SWP violates the ESA, including a ruling in 2007 that required reduced water exports to protect the delta smelt.⁶⁵ As a result of that litigation and ongoing litigation in 2008 to protect salmon and steelhead in the Delta, the federal government currently is revising its long-term plan for operating the projects.⁶⁶

California Endangered Species Act

Like the federal ESA, the California Endangered Species Act (CESA) is designed to prevent the extinction of fish and wildlife.⁶⁷ Several Delta species are protected under the CESA, including spring- and winter-run Chinook salmon and the delta smelt.⁶⁸ Like the federal ESA, the CESA prohibits killing or harming endangered species unless the state approves a conservation plan to provide for the continued recovery of the species.⁶⁹ In 2007, in response to a lawsuit filed by a coalition of sport fishing groups, a state court judge ruled that the State Water Project had not complied with this law and ordered the state to develop a plan to protect listed fish from ongoing harm caused by the SWP.⁷⁰

Bay Delta Conservation Plan

The CVP, SWP, and the contractors who receive water from these projects have begun a process, pursuant to the ESA, CESA, and the Natural Community Conservation Planning Act, to develop a habitat conservation plan referred to as the Bay Delta Conservation Plan (BDCP). The BDCP would absolve them of legal liability under both endangered species laws for up to 50 years. Over the next two years, the state and federal government will determine what conservation measures will be required in this plan. If such a plan is adopted, the state and federal government would generally be unable to require additional restrictions on pumping, exports, or other CVP and SWP operations to restore salmon populations and other listed species—even if the salmon’s plight becomes worse and fall-run salmon become listed under the ESA.

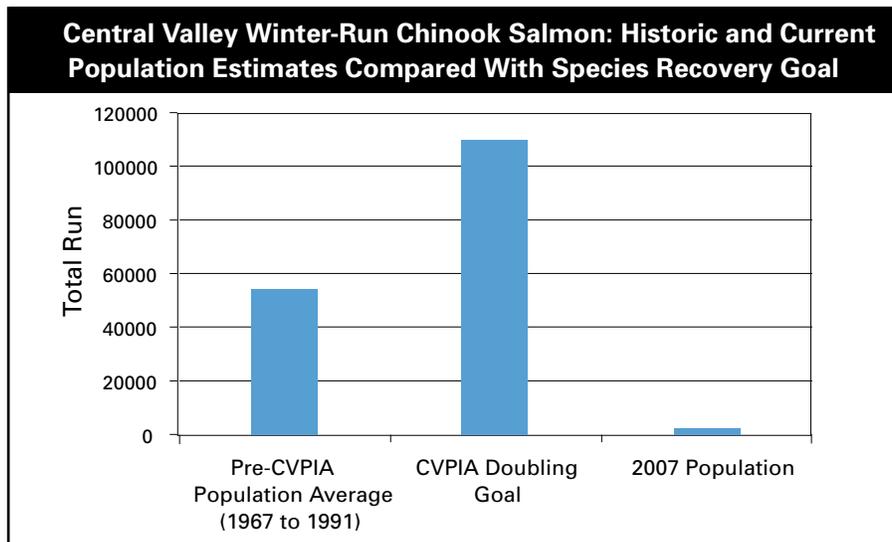
The BDCP participants have revived consideration of a controversial “peripheral canal” proposal, defeated by California voters in 1982, to take water from the Sacramento River around the Delta. Participants hope such a canal would reduce the number of delta smelt and other species killed by the pumps. However, there are concerns that such a massive new diversion canal could worsen the impacts of the state’s water projects on salmon in the Sacramento River. To date, there has not been sufficient analysis conducted to determine the extent of those potential impacts. Nor has there been sufficient analysis of the potential for reduced levels of diversions to benefit

salmon, smelt, and the entire Bay-Delta ecosystem. NRDC and other organizations are working to ensure that the BDCP will bring about the restoration of the salmon fishery and the recovery of salmon and other species.

Central Valley Project Improvement Act

The Central Valley Project Improvement Act (CVPIA) was passed by Congress in 1992 in order to operate the CVP in a manner that provides greater protection to fish and wildlife.⁷¹ There are three main provisions under the Act. First, the CVP was to provide 800,000 acre-feet of water per year for fish and wildlife purposes.⁷² Second, the Act established a goal of doubling the number of salmon and other anadromous species in the Delta by 2002.⁷³ And third, the Act imposed fees on water users and established a restoration fund to use those monies for the protection of fish and wildlife.⁷⁴

Unfortunately, in recent years the amount of water dedicated to salmon recovery has been significantly less than the original promise of the CVPIA. That water has instead been used to meet obligations that the U.S. Bureau of Reclamation is already legally required to meet, rather than being used for salmon recovery.⁷⁵ Today, more than five years after the deadline for doubling salmon populations mandated by the Act, fall-run Chinook—as well as populations of delta smelt and other species—have collapsed. Despite these ecological disasters, many who profit by receiving cheap, subsidized water under the existing system have filed numerous lawsuits against the federal government in recent years, claiming that the water projects are dedicating too much water to environmental purposes and that the taxpayers owe them millions of dollars in compensation.⁷⁶ NRDC is opposing those efforts in court.



Source: California Department of Fish and Game, Anadromous Fish Restoration Program, www.delta.dfg.ca.gov/afrp/index.asp

California Resources Agency Policy of Doubling Anadromous Fish Populations

In 1978 the California Resources Agency adopted a state policy to double salmon populations.⁷⁷ This was followed by enactment of a state law in 1988, the Salmon, Steelhead Trout, and Anadromous Fisheries Program Act, mandating state policies to increase salmon populations and protecting existing salmon habitat, as well as requiring the adoption of a program to double the naturally spawning populations of salmon and steelhead.⁷⁸ These state policies inspired the anadromous fish doubling goal of the CVPIA, and the State Water Resources Board subsequently incorporated this doubling goal in its water quality control plan for the Bay-Delta in 1995. The plan

included the following objective: “Water quality conditions shall be maintained, together with other measures in the watershed, sufficient to achieve a doubling of natural production of Chinook salmon from the average production of 1967 to 1991, consistent with the provisions of state and federal law.”⁷⁹ Despite these goals, overall salmon populations have declined since 1992.

Section 5937 of the California Fish and Game Code

Section 5937 of the California Fish and Game Code is a long-standing provision of state law that requires the operator of any dam to provide sufficient water below the dam to protect fish downstream. A version of this law has been on the books since the mid-1800s, yet it has rarely been enforced.⁸⁰ In 2004, after 16 years of litigation, NRDC won its claim that the Bureau of Reclamation’s operation of Friant Dam on the San Joaquin River, which frequently causes the river to run dry, violates section 5937.⁸¹ Today NRDC, the Friant Water Users Authority, state agencies, and the federal government are working together to implement the historic settlement of this litigation, which will restore salmon and natural water flows to the river in the coming years.

Federal Clean Water Act and California Porter-Cologne Water Quality Control Act

Under the federal Clean Water Act and the Porter-Cologne Act (California’s complementary state law), the CVP and SWP must be operated in a manner that protects water quality in the Delta for drinking water, agricultural uses, and fish and wildlife needs. Although much of the focus of agencies implementing these laws has been on salinity regulations, which are dramatically affected by the withdrawal and export of freshwater from the Delta, greater attention must be paid to water temperature regulation, as well as to pesticide pollution and other runoff from farms, cities, and industrial users. Protecting water quality provides benefits to salmon and all those who use water from the Delta.

Public Trust and Reasonable Use Doctrines

These two principles of California law make clear that California’s water and its aquatic resources must be used for the benefit of the public as a whole and cannot be squandered. The reasonable use doctrine was adopted as part of the State Constitution in 1928.⁸² It provides, in part, that water rights are “limited to such water as shall be reasonably required for the beneficial use to be served, and such right does not and shall not extend to the waste or unreasonable use or unreasonable method of use or unreasonable method of diversion of water.” Similarly, the public trust doctrine requires that the public trust resources of the state (including water, fish, and the environment) be protected for the benefit of the public; such protections may include limiting the exercise of water rights.⁸³

Delta Vision

In 2006, Governor Schwarzenegger approved state legislation and issued an executive order creating a blue ribbon task force to develop a sustainable vision for management of the Delta.⁸⁴ In November 2007 the task force issued its final Delta Vision report, which included 12 recommendations to achieve the primary, coequal goals of ecosystem restoration and reliable water supplies.⁸⁵ The task force is now developing a strategic plan to implement those recommendations, and its final report is due in late 2008. Many of the recommendations of the strategic plan will likely require new legislation to be implemented.

CHAPTER 4

Emerging Threats to Salmon From Water Projects

The trouble in the Bay-Delta ecosystem has been decades in the making, and the warning signs many: the listing of many Bay-Delta species as threatened and endangered, the failure to achieve the state and federally mandated salmon doubling requirement, the need for intervention by state and federal courts to uphold statutory requirements, and now the alarming crash of the salmon fishery in California. Despite these warning signs, all indicators point toward state and federal water project operators' continuing to provide unsustainable quantities of water, much of which is highly subsidized by taxpayers to grow crops in the Central Valley. All too often these deliveries come at the expense of the families and communities who depend on salmon fishing for their livelihood.

NRDC has significant concerns with several ongoing actions and new proposals that could significantly worsen conditions for salmon in the San Francisco Bay-Delta ecosystem. The following proposals (some in the analysis stage and others already approved) have—or could—increase the amount of water withdrawn from salmon habitat, reduce water dedicated for salmon recovery, and otherwise degrade salmon habitat:

Possible New Peripheral Canal to Expand Water Exports

In May 2008, the California Department of Water Resources (DWR) released its initial analysis of the potential impacts of a peripheral canal—a new aqueduct to export water from the Sacramento River before it reaches the Delta.⁸⁶ All of the scenarios analyzed by DWR include massive increases in the amount of water to be diverted upstream of the Delta. The analysis indicates that diversions could reach 8.5 million acre-feet. This is 2 million acre-feet more than the CVP and SWP have ever pumped from the Delta and is enough water to supply 12 cities the size of Los Angeles (although most of this water goes to agricultural uses). The analysis acknowledges that such deliveries would reduce storage in upstream reservoirs, but DWR's analysis pointedly ignores the potential impacts on salmon of diverting more freshwater out of the Sacramento River and the Delta.

New Water Rights Applications

There are numerous applications for new water rights pending before the State Water Resources Control Board. These applications would appropriate a total of approximately 4.8 million additional acre-feet of water per year from the Sacramento, San Joaquin, and other rivers that feed the Delta.⁸⁷ This amount, which does not include the

increased quantities that many users claim under their existing water rights, dwarfs the amount of water currently exported to Southern California each year. These huge new demands threaten to overwhelm the already overtaxed Delta.

New CVP Water Contracts

Between 2001 and 2006, the U.S. Bureau of Reclamation signed more than 170 long-term contracts with water districts around the state promising to increase significantly water deliveries from the Central Valley Project for the next 25 to 40 years.⁸⁸ The Bureau is currently contemplating signing additional long-term contracts with at least 33 more water districts.⁸⁹ The Bureau aims to increase total deliveries under all the contracts to more than 5 million acre-feet of water per year over the life of the contracts.⁹⁰ This is 2.6 million acre-feet more than the Bureau has delivered on average over the last 20 years.⁹¹ The Bureau informed Congress that it intends to deliver these full contract quantities to water users by the end of the contract terms. Approximately 90 percent of CVP water is used for agricultural irrigation at prices that average 2 percent of what an average city pays for water.⁹² Often, agricultural deliveries are used to grow water-intensive, low-value crops like cotton, rice, pasture, and alfalfa hay that contribute little to the state's agricultural economy.⁹³

Reductions in the Amount of Water Dedicated to Salmon Restoration

One of the principal requirements of the Central Valley Project Improvement Act was to dedicate more water to the restoration of fish and wildlife. In the words of the Ninth Circuit Court of Appeals:

Section 3406(b)(2) [of the Central Valley Project Improvement Act] provides that the “primary purpose” to which the 800,000 acre-feet should be dedicated is the implementation of “fish, wildlife, and habitat restoration purposes authorized by this title ...” ... If Interior were required to deduct some or all the water it uses for water quality and Endangered Species Act purposes from the (b)(2) dedication, the water needed for implementation of the Improvement Act's restoration mandate could be relegated to a secondary role, or perhaps no role at all. Such a scenario would directly conflict with the Interior's mandate to give effect to the hierarchy of purposes established in Section 3406(b)(2).⁹⁴

Despite this explicit mandate, the Bureau of Reclamation continues to use so-called “b(2)” water first to meet existing water quality and other legal requirements, and, only if there is water left over, to use it as Congress directed to recover salmon populations. This frequently leaves little water for salmon recovery purposes, even in the face of dramatic recent salmon declines. In May 2008, “[a]ccording to Reclamation, the amount of [b(2)] available for water year 2008 has already been expended in the Delta for court-ordered pumping reductions needed to protect Delta smelt.”⁹⁵ Thus, even before the start of summer, when b(2) water is most needed to maintain water temperatures, the Department of the Interior has chosen to allocate all of this water to purposes other than restoring salmon.

Reductions in Available Sacramento River Spawning Habitat

Despite the collapse of the salmon fishery and the problems facing the fall-, winter-, and spring-run populations, the Bureau of Reclamation proposed in 2008 to reduce the amount of suitable spawning habitat below Shasta Dam to less than 15 miles—half the amount of habitat that has been provided in the last 12 years.⁹⁶ This reduction would squeeze the salmon that spawn below the dam, including the last remaining population of winter-run, into a smaller and smaller space, lessening their chances of successfully reproducing and increasing their vulnerability to a catastrophic event. The Bureau's own modeling shows that this reduction could kill up to 45 percent of winter-run eggs and fry (young) and 80 percent of the Sacramento River spring-run population's eggs and fry.⁹⁷ Similar proposals for the operations of Folsom, Oroville, Whiskeytown, New Melones, and Red Bluff Diversion Dams are

unlikely to provide sufficient flows or cold water for salmon and steelhead to survive in the long term or to recover from their current depleted condition.⁹⁸

Reduced Protections for Salmon in New Plan for SWP and CVP Operations

As a result of litigation by NRDC and its partners, the state and federal governments prepared a new operations criteria and plan (OCAP) for the State Water Project and Central Valley Project. The current proposal eliminates several long-standing provisions intended to protect salmon and steelhead. Although the plan will almost certainly be changed as it undergoes review for compliance with the ESA, the current proposal calls for (1) eliminating the requirement to maintain 1.9 million acre-feet of carryover storage (water retained in reservoirs at the end of the year, so that cold water can be released into the rivers the following year) in Lake Shasta, a change that would increase mortality for all runs, particularly in dry years when the plan estimates that 60 percent of the spring-run salmon in the Sacramento River would be killed; (2) continuing to operate Red Bluff Diversion Dam in the “gates in” position for four months of the year, which causes significant mortality to fall-run salmon as well as other salmon and steelhead; and (3) reducing minimum flows on Clear Creek to 30 cubic feet per second, which would “likely be too low for spring-run to migrate upstream.”⁹⁹

CHAPTER 5

Conclusion and Recommendations

A continuation of the current strategies for water management in the San Francisco Bay-Delta ecosystem could doom California's salmon fishery. Just as the state lost the coho salmon fishery in the 1990s, we could lose our Chinook salmon fishery in the next few years. Protecting and restoring the salmon population to a level capable of supporting a healthy, sustainable commercial and recreational fishing industry will require wise leadership and significant changes in California's water policies. We believe that strong leadership today can restore this fishery and the health of the Bay-Delta ecosystem, and that it can ensure a healthy future for the many communities and people who depend on these resources.

What You Can Do to Help Restore Salmon

We can all pitch in to help restore the salmon. In addition to writing to our elected officials to support the recommendations in this report, one of the most important things we can do is to conserve water. You can reduce our consumption by fixing leaky plumbing; installing low flow shower heads, faucets, and toilets; and using drought-tolerant landscaping, to name a few measures. More water saving tips are available online at www.nrdc.org/cities/living/gover.asp#water. By working together to conserve water, we can reduce the need to divert water from the Bay-Delta and help protect salmon.

While a number of actions are required to protect salmon populations over the long term, changing the way we manage water in the Bay-Delta ecosystem is probably the single most important step we can take to restore our salmon resources and ensure the continued health of California's salmon fisheries. Fortunately, we already know a great deal about the impacts of water projects on salmon habitat, and solutions are readily available. We recommend the following comprehensive actions and policy reforms:

- ▶ **Governor Schwarzenegger** should issue an executive order making the protection and restoration of California's commercial and recreational salmon fishery a top priority. This order should reiterate the existing state and federal policies calling for the doubling of salmon populations and should call for an enforceable plan for meeting the doubling requirement in the near term.

- ▶ The **Delta Vision Task Force** should incorporate the restoration of a sustainable salmon fishery into its ecosystem restoration goals for the San Francisco Bay-Delta estuary. The specific recommendations below should be incorporated into the Delta Vision strategic plan currently under development.
- ▶ The **Bay-Delta Conservation Plan** under development should include the goal of doubling the salmon population as one of its ecosystem restoration goals. In order to ensure the restoration and preservation of a sustainable salmon fishery, the draft plan should be peer reviewed by the CALFED Independent Science Panel, and the plan should also incorporate the specific recommendations below. The BDCP should avoid providing guarantees under the ESA, such as specific amounts of water deliveries or certain project operations, which interfere with efforts to restore healthy and commercially viable salmon populations. The BDCP plan must be designed to achieve restoration of endangered species and recovery of salmon populations, not just minimum compliance with the state and federal endangered species laws.
- ▶ **Salmon Doubling Recommendation**
 - The **Central Valley Project Improvement Act** Independent Review Panel should analyze the effect of the emerging threats to salmon identified in this report on the state and federal salmon doubling programs. Its final report should consider the potential of the water management, habitat restoration, and dam removal recommendations in this report to contribute to achieving the doubling goal.
 - The **Department of Fish and Game** should prepare an update to the state's salmon doubling program, building upon the recommendations of the CVPIA Independent Review Panel and this report.
 - The **State Water Resources Control Board** (State Board) should ensure that its actions under the Strategic Workplan for Activities in the San Francisco Bay/Sacramento-San Joaquin Delta Estuary significantly contribute to the state's salmon doubling goal and the preservation of the state's commercial and recreational salmon fishery.
- ▶ **Water Management Recommendations**
 - Long-term average diversions from the San Francisco Bay-Delta ecosystem must be reduced. The State Board and/or a new state "Delta Water Master" agency should adopt fully protective flow standards for the estuary that meet the needs of the Delta ecosystem and salmonids. Such a standard must cap and reduce total diversions, based on the best available science. It is important to note that reducing average diversions does not necessarily require reducing water diversions in all water year types.
 - The State Board should declare the Bay-Delta system a fully appropriated system (meaning that there is no more water that can legally be diverted) and cap water rights. Any new water rights issued by the State Board should be accompanied by corresponding reductions elsewhere in the system. The State Board should aggressively investigate and enforce compliance with existing water rights.
 - The Department of the Interior should implement changes to the current management of the 800,000 acre-feet of water dedicated to salmon restoration by the Central Valley Project Improvement Act. Consistent with the primary purpose of Section 3406(b)(2) to achieve anadromous fish doubling, the bulk of this water should be dedicated to salmon protection, rather than compliance with ESA or water quality requirements.
 - As the Bureau of Reclamation negotiates new Central Valley Project water contracts both south and north of the Delta, it should reform the contracts to eliminate subsidies and reduce water quantities to levels that enable salmon restoration.
 - State and federal agencies, the BDCP, and Delta Vision should carefully analyze potential impacts to salmon before they make any long-term decisions regarding changes to the water conveyance system in the Delta.
 - Project operators should maintain adequate "cold water pools" in Central Valley reservoirs located on rivers that support spawning salmon and should provide fully protective temperature conditions below terminal reservoirs. Fully protective carryover storage and temperature standards should be required by the

State Board, DFG, and NMFS. On the Sacramento River, these protective measures should be at least as protective as those included in the 1993 winter-run biological opinion.

- The Secretary of the Interior, in partnership with the state, should fully implement the San Joaquin River Settlement agreement, restoring flows to the San Joaquin River in 2009 and reintroducing salmon no later than 2012.
- California water agencies should dramatically increase investment in fish-friendly water supply alternatives to meet California's future water needs in a manner that is compatible with the reduction of Delta diversions, including urban conservation, water recycling, groundwater management, and urban stormwater management.
- The state legislature should devote water supply funding in any future water bonds to those alternatives that most cost-effectively reduce reliance on the Delta and for which local partners are most willing to provide cost-sharing investments.
- DWR and the Bureau of Reclamation should increase their capacity to support and encourage conservation, improved groundwater and stormwater management, water recycling, and integrated planning efforts.

▶ **Agency Reform Recommendations**

- The legislature should empower a new state Delta Water Master to ensure balanced project management and regulate the operations of the federal Central Valley Project and the State Water Project. The Delta Water Master should ensure that future adaptive management efforts are designed primarily to improve salmon and ecosystem protection, not simply to increase water diversions.

▶ **Restoration Funding Recommendations**

- The legislature, the State Board, or a new Delta Water Master should create a water user fee for all water diverters that will support an effective restoration program to address cumulative impacts on salmon. This fee could be modeled on the CVPIA restoration fund, which requires some water users to fund system-wide restoration efforts, and would complement existing funding provided through the California commercial fishing salmon stamp program and the federal excise tax on recreational fishing equipment.
- Any future water and parks bonds should make salmon restoration a priority for funding.

▶ **Dam Removal and Operations Recommendations**

- Red Bluff Diversion Dam on the Sacramento River should be operated in a permanent "gates up" position, and fish-friendly pumps should be installed that eliminate the need for a diversion dam.
- The antiquated hydroelectric dams on Battle Creek should be removed, restoring more than 40 miles of Chinook salmon habitat.
- Daguerre Point Dam on the Yuba River should be removed, restoring access to 12 miles of upstream habitat.
- Evaluations should be completed regarding the potential removal of Englebright Dam on the Yuba River.

▶ **Wetland and Riparian Habitat Restoration Recommendations**

- The Delta Vision Task Force's strategic plan should call for implementation of a delta-wide habitat restoration program supported by the best available science, drawing on the detailed habitat restoration recommendations submitted by NRDC and several other environmental groups.
- A flood bypass for the South Delta, such as that proposed on the San Joaquin River by several environmental groups, River Islands LLC, and the state, should be implemented to provide increased flood protection and floodplain habitat, for fish and wildlife.

- The need for functioning floodplain habitat should be incorporated into the Central Valley Flood Protection Plan and the Department of Water Resources FloodSAFE program, to provide flood protection, habitat and groundwater recharge.
- ▶ **Water Quality Recommendations**
 - The State Board should ensure that discharges from agricultural users, waste treatment plants, urban runoff, and other sources are not harming salmon and other wildlife. Harmful discharges must be reduced or eliminated.
 - The State should develop a statewide program to encourage agricultural water users to transition to drip and other highly efficient water irrigation systems that can reduce water use and agricultural runoff while increasing yields.

Endnotes

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- 2 W. F. “Zeke” Grader Jr. and Glen Spain, “Why the Klamath Basin Matters,” Pacific Coast Federation of Fishermen’s Associations, www.pcffa.org/fn-aug01.htm.
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- 4 California Advisory Council on Salmon and Steelhead Trout, “Restoring the Balance,” 1988 Annual Report.
- 5 Ronald M. Yoshiyama, Frank W. Fisher, and Peter B. Moyle, “Historical Abundance and Decline of Chinook Salmon in the Central Valley Region of California,” *North American Journal of Fisheries Management* 18:3 (August 1998); testimony of Peter B. Moyle, Center for Watershed Sciences and Department of Wildlife, Fish, and Conservation Biology, University of California, Davis, before the California Joint Committee on Fisheries and Aquaculture, April 17, 2008.
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- 7 Ronald M. Yoshiyama, Frank W. Fisher, and Peter B. Moyle, “Historical Abundance and Decline of Chinook Salmon in the Central Valley Region of California,” *North American Journal of Fisheries Management* 18:3 (August 1998): 487-521.
- 8 *Tales of the San Joaquin River*, Dir. Christopher Beaver (CBFilms, funded by CA Resources Agency for CALFED Bay-Delta Program, 2003).
- 9 Peter B. Moyle, *Inland Fishes of California* (Berkeley, Los Angeles, and London: University of California Press, 2002), 243.
- 10 “Endangered and Threatened Species; Critical Habitat; Winter-Run Chinook Salmon,” 54 Fed. Reg. 32085 (August 4, 1989); “Designated Critical Habitat; Sacramento River Winter-Run Chinook Salmon,” 57 Fed. Reg. 36626 (August 14, 1992); National Marine Fisheries Service, Northwest Field Office, “Chinook Salmon,” www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/Chinook/Index.cfm.
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