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"*Bay in Peril*" was originally written as a seven-part series,¹ which appeared in the San Francisco Examiner during October 24-31, 1993. - Ed.

Bay in Peril

Jane Kay*

System Out of Kilter

Nearly 50 years ago, Ray and Earl Carpenter were fishing the ocean off Half Moon Bay, waiting for the return of the "south turners," the king salmon of the San Joaquin River that for centuries had turned left toward Monterey as they left San Francisco Bay. The father and son fishermen from Bodega Bay always were lucky when these first salmon of the season neared land on the way back to the San Joaquin via the Bay. But this was the third bad year in a row. "It occurred to us, just like that, what had happened," son Earl Carpenter recalls now. "We felt like a couple of goddamn old buffalo hunters. The Friant Dam had taken all our salmon." Their salmon were among the first victims of California's water projects.

The Friant Dam was the southern cornerstone of the Central Valley Project, a federal aqueduct system built to ship Northern California water to farms. It dried up 50 miles of the San Joaquin River, exterminating the entire run of 60,000 salmon. This aqueduct and the State Water Project, which also diverts northern river water from the Delta for cities and farms, take half the rain and snow melt that once flowed through the Bay. For fishermen, the diversion of water has meant loss of livelihood. But scientists warn of a broader peril to San Francisco Bay, the body of water that defines the region, sustaining life, commerce, and sense of place. They say the fate of the fish increasingly appears linked with the fate of this largest estuary on the West Coast of the Americas and the wild and civilized communities that thrive on its waters.

"San Francisco Bay, probably once the greatest estuary in the northeast Pacific, has been so abused for so long," says John McCosker,

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1. The series was the product of four months of research in which Ms. Kay interviewed more than 200 people, from landowners to environmental activists, scientists to politicians, and reviewed thousands of pages of books, periodicals, and reports.

[former] director of San Francisco's Steinhart Aquarium. "This incredible Bay has been filled, polluted, and they're still discharging in its waters." McCosker echoes a study by federal, state, and regional government scientists who say the Bay is in peril, but can be saved, at least what remains of it. "This is the crossroads," says McCosker. "Races of salmon are going extinct before our very eyes. It's heartbreaking. This is our last chance. If we don't save it now, it's not going to happen. I hope we seize the moment.

Dramatic Decline in Numbers

In the four genetically distinct runs of Chinook salmon that return to the Sacramento River to spawn, the drop has been dramatic. In the early 1960s, the number of winter-run Chinook returning to spawn each year averaged more than 200,000. After a series of catastrophes, including droughts and increased pumping of water from the Delta, only 191 fish were counted coming back upriver in 1991. About 1,150 returned in 1992; 341 were counted [in 1993], and 189, the lowest on record, in 1994.

The winter run is listed as threatened under the federal Endangered Species Act (ESA) and as endangered under state law.² The spring run in the Sacramento is down to 2,700, including hatchery fish; it was 25,400 in the 1980s and it might be the next run listed under the ESA. The Bay's largest run of salmon returns to spawn in the fall. It's fallen to 106,000 from 252,1000 since the 1980s, and more than a third are hatchery-raised. The Delta smelt, a 3-inch fish once so common that annoyed anglers would throw it back, also is listed by the state and federal governments as a threatened species. The population of striped bass, a game fish introduced to the estuary in the late 19th century, has dwindled from 3 million to fewer than 600,000. The longfin smelt, white catfish, American shad, threadfin shad, and Sacramento split-tail, the five most abundant species in the Bay, also are in serious decline.

Diversification of Water

No single factor explains the slow slide of a great ecosystem and an important resource, but one element has played a part in all the species' stories: the volume of water pumped out of the region's rivers and the methods used to take it before it can flow out through the Bay.

The state Department of Water Resources estimates that from 1921-90, 24 million acre feet of water a year reached the Delta.³ But now there are lots of dams, pumps, and siphons impounding or diverting water.

2. Under the law, an endangered species is one "in danger of extinction" and a threatened species "is likely to become an endangered species within the foreseeable future."

3. An acre foot is 325,851 gallons, the average amount an urban family of five might use in a year.

The pumps range from 6 inches to 24 inches in diameter and can suck up as much as 200 gallons of water per second. There are thousands of other such devices up and down the Sacramento and San Joaquin rivers and their tributaries. In the end, the natural flow of water in the rivers and streams running toward the Bay is greatly reduced. On average, only about half the water that might exit the Golden Gate under natural conditions actually flows into the ocean. During the recent drought, when natural flows were low but water pumping from the Delta and upstream rivers increased, the amount was far less than half.

Low flows are just one culprit, though. When the pumps take their 10 million acre feet of water a year from the estuary, they turn nature upside down. Most water intercepted on the way to the Bay is drawn out of the Delta by the 20 pumps of the state-run California Water Project and the six pumps of the federal Central Valley Project and sent flowing south in twin aqueducts.

The pumping machines are so powerful, pumping up to 8,500 gallons of water a second, that they can actually reverse stream currents. During drought years, flow reversal is common. In 1987, Delta streams reversed flow on about 280 days; in 1988, on about 260 days. The changed flows are believed to confuse migrating fish, causing them to swim back upstream or into dead-end channels. The pumps also pull in thousands of fish and millions of fish eggs and larvae. In April 1992, biologists estimated that a third to half of 50,000 newly-hatched winter-run Chinook died in the pumps on their way to the ocean. The young fish were "ground up in the state pump," said Bay fishery expert Bill Kier. In 1992, Fish and Game also blamed the pumps of the federal and state water projects for the striped bass' decline from a peak sports catch in the '60s of 800,000 to the 1990 catch of 200,000.

Gold Rush Disaster

The salmon's first environmental catastrophe in California coincides with the first major industrial development, the Gold Rush. Mining a billion cubic yards of rock and soil damaged salmon streams. In the early 1900s, the threat to salmon was taken so seriously that the state legislature prohibited the creation of any structure on streams that would interfere with a run's "freedom of passage." But the laws weren't enforced, and, in the 1920s through 1940s, when the decisions were made about how to use Mount Shasta's great pure store of snowmelt to water Central Valley crops and Southern California cities, fish and wildlife were largely ignored.

The federal Central Valley Project's two big dams, Shasta, built in the '30s and Friant, in the '40s, have been devastating to salmon. Shasta Dam blocked half the possible spawning habitat in the Sacramento River basin. The Friant, on the San Joaquin River, obstructed passage for 50 miles. By 1950, the San Joaquin spring run was eliminated and others harmed. The state's other big dams, among them Oroville on the Feather River, Folsom on the American River,

Pardee on the Mokelumne River, New Melones on the Stanislaus River, and Hetch Hetchy on the Tuolumne River, had much the same effect.

To make up for the effects of the damming, officials tried to keep fisheries alive by artificially breeding salmon. They set up hatcheries or tried to set up artificial spawning beds. For the most part, the artificial facilities haven't worked. Research suggests that hatcheries produce salmon less hardy and more vulnerable to disease than their stream-born cousins. "It was an era when we thought we could do anything. Modern technology could solve all our problems," said UC Davis fisheries biologist Peter Moyle, who conducted much of the research and documentation that led to the listing of winter-run king salmon under the ESA. "If you wiped out a run on the river, you could build a hatchery and do better than nature. That was the era of DDT, thought to be the solution to all our pests. We sprayed with DDT and the insects went away. The economy was booming. It was a very optimistic era. In our era we've discovered our limits. It's not very pleasant to discover we have limits." Moyle added, "If it's a case of water versus extinction, it's a morality question. Do we really have a right to eliminate a species for short-term human gain, especially if we don't know the long-term value of the species?"

Cumulative Effect

The decline of the Bay did not begin with these great water projects, though. Two hundred years of uncontrolled hunting, 100 years of rapid development replacing rich marshlands, and 50 years of toxic chemical discharges have brought the Bay-Delta ecosystem to the verge of collapse.

The estuary is made up of various ecosystems, communities of interdependent organisms that share and interact in a common environment. The niches within an ecosystem are all important, interconnected in a web of plankton, insects, invertebrates, fish, birds, and mammals. This chain of life depends on seasonal intermingling of freshwater rivers, saltwater ocean tides, and sheltering wetlands. So the decline of wild salmon, striped bass, Delta smelt, starry flounder, longfin smelt, and Sacramento splittail are nature's sign that the system is out of kilter.

"People who say water for San Francisco Bay is wasted on the fish have a very narrow view of the world and where humanity's best interests lie," says Samuel Luoma, part of a U.S. Geological Survey team in Menlo Park that has conducted major studies of the Bay. "We evolved in a complex multi-species environment. We evolved in the jungle. What we're doing now is simplifying that ecosystem, and scientists debate how that will affect our ability to survive. The loss of the wild king salmon would be an unfathomable tragedy."

From the U.S. Environmental Protection Agency (EPA) to the largest wholesaler of urban water in the world, Metropolitan Water District of Southern California, there is agreement that, with conservation, California has enough water. "Agriculture could cut use by 10 percent and provide enough water for the Bay," says EPA economist Patrick Wright. Conversely, California agribusiness says

the state's fish are not so threatened that agriculture must do with less. Jason Peltier, manager of the Central Valley Project Water Users Association, says, "We don't see the biological basis for taking water away from us."

History Of Decline

The Bay is the lifeblood of the region, yet those who settled here and thrived because of it have contributed to its failing health. Shortly after statehood, in 1850, wetlands that fed and sheltered migrating waterfowl and shorebirds started disappearing. Now, dried-up land, asphalt parking lots, highways, malls, houses, and farmlands cover once verdant pools, thickets of scented marsh grass, and softly-trickling streams. In 1993, 150 years after European settlement, the estuary may be a mere shadow of its early self, in the great days when the indigenous Ohlones saw the sky thick with ducks, herons, curlews, sandpipers, and the channels alive with beavers and river otters.

Scientists familiar with life cycles of the magnificent estuaries of the world are not surprised by what has happened here, nor are they undecided on the solutions. First, here are some critical problems they say plague San Francisco Bay:

Water diversions

Most of the Bay's environmental problems are linked to the loss of at least half the water that historically flowed through it. The pumps that divert the water to man-made aqueducts suck up eggs, larvae, and juvenile and even adult fish. They reverse river flows and confuse fish trying to migrate to spawning grounds.

Loss of fresh river water enables ocean salt water to move up to northern San Pablo Bay and Suisun Bay, then into the Delta. The invading salinity forces fish farther up into the Delta for reproduction. Deprived of the shallower, lighter, and warmer waters of the Bay, the striped bass, Delta smelt, and other species are less productive.

Dumping of dredge spoils

Some days, barges line up to dump dredge materials on the hour. The Bay turns muddy brown, with a plume stretching out the Golden Gate. The spoils smother bottom organisms, food for the marine life, and stir up toxic chemicals buried in the mud. Dumping two-thirds of the spoils near Alcatraz Island has created a small underwater mountain, a threat to vessels and fishermen.

Population & development

About 7.5 million humans in 12 counties squeeze together to call the Bay home. Over the last 140 years, open water has been reduced by a third,

to 478 square miles, for development. Ninety-seven percent of the Delta's wetlands and 82 percent of the Bay's original tidal wetlands are gone.

Wildlife

One quarter of the Bay's 389 species of wildlife are in trouble; five mammal, nine bird, and seven insect species, including the gray wolf, the grizzly bear, and the California condor, already are lost. Treated wastewater to the South Bay is the largest water supply left to maintain the historic Pacific Flyway for birds and ducks en route to Alaska and Mexico.

Toxic & sewage wastes

Chemicals are dumped in the Bay as if it were a big toilet. Sixty-five pollutants, 5,000 to 40,000 tons of them, are discharged each year. Most are transferred from water to mud to plants and animals. Arsenic, cadmium, chromium, copper, lead, mercury, and selenium exceed alert levels in some Bay shellfish. Selenium, produced by the six Bay Area oil refineries, is found in some fish and ducks at levels the state Department of Health Services says are potentially harmful to human beings who might eat them. DDT and PCBs, or polychlorinated biphenyls, in some Bay fish exceed levels set by the Food and Drug Administration as the maximum allowable in human foods. Seals carry high levels of heavy metals, selenium, DDT, and PCBs.

There are 300 industrial dischargers and 50 sewage-treatment plants poisoning the Bay. There is storm runoff, which carries with it asbestos from worn automobile brake shoes, petroleum hydrocarbons from leaking engine crankcases, bits of synthetic rubber from tires, fertilizer and organic pesticides from gardens, bacteria from pet droppings, and arsenic and clay particles from eroded soil.

What Must Be Done

The EPA, and scientists who have joined it in a study of the Bay, have agreed on what we need to do to avert an otherwise inevitable course of destruction: control toxic chemicals, restore wetlands, divert less water, build mass transit to retire polluting autos, save open space, and provide the Bay with the river water that naturally nourishes it.

The Bay and Delta are at risk, says John Wise, EPA deputy regional administrator. "We're right on the edge of saving it or losing it . . . If we do nothing further at this point, we will watch the Bay slide into an irreversible degradation. But we all acknowledge that today we have opportunities to restore the environmental values. The public shouldn't let go of it, but hold their government accountable."