

# Environmental Activism in the San Francisco Bay Estuary

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**This paper presents a brief description of the San Francisco Bay Estuary and its modifications. Problems associated with habitat loss and degradation, pollutants, freshwater diversion, and dredging are described. The activities of environmental groups addressing these problems, including several examples, are noted.**

In the United States, where 75 percent of the human population lives within 80 kilometers of a coastline, environmental groups are striving to protect coastal resources and water quality. This is particularly true in the region of the San Francisco Bay Estuary. Within the Estuary basin lives a large urban population that is relatively sophisticated in its concerns about environmental quality. The financial and political support of this population enables environmental groups to address the Estuary's many problems.

The nearly three dozen environmental groups working to protect and enhance the Estuary and its resources are a well-organized, effective force. They articulate public concerns regarding the Estuary and influence the formulation and implementation of government policies and programs. They represent the desire of a large body of citizens that the Estuary's health and productivity be protected and enhanced.

In terms of the diversity of change, the San Francisco Bay Estuary is the most modified major estuary in the United States (Nichols et al., 1986). Even in its highly modified condition, its waters, wetlands, and surrounding habitats provide numerous benefits. It supplies 40 percent of the State's drinking water, as well as water for agriculture and industry. The Estuary supports commercial fisheries with an annual value of \$100 million, and an important sport fishery. It is a critical link for anadromous fishes that spawn in Central Valley streams, and provides important habitat for more than one million Pacific Flyway migratory waterfowl, as well as for resident wildlife species. Each year, more than 4,000 ships bring 55 million metric tons of cargo into the Bay. The Estuary's natural features and inherent beauty, so popular with tourists, encourage a vital tourism industry.

Although the Estuary is a valuable resource of national and international significance, it has been altered dramatically from its natural state. Intensively developed, the Estuary exhibits symptoms of stress common to urbanized estuaries worldwide.

## **The Estuary and the Evolution of its Problems**

The San Francisco Bay Estuary lies between California's Central Valley and the Pacific Ocean. Receiving fresh water runoff from some 40 percent (153,000 km<sup>2</sup>) of the state's surface area, it comprises more than 5,000 km<sup>2</sup> of farmland, marshes, and water. Its upstream margin, 130 kilometers inland from the ocean, includes the 2,979 km<sup>2</sup> Sacramento-San Joaquin Delta, a rich agricultural area converted from historic marsh and surrounding uplands. Downstream of the Delta are Suisun, San Pablo, Central, and South Bays, referred to collectively as San Francisco Bay. These embayments are generally shallow, open water bodies variously fringed with tidal flats, marshes, and urban land.

Major changes in the Estuary have occurred during a relatively short period. When the first Europeans arrived in 1769, the region was inhabited by some 10,000 to 20,000 Native Americans. After the discovery of gold in the foothills of the Sierra Nevada in 1848, the Estuary basin developed rapidly. From a small settlement of 400 people in 1848, the City of San Francisco grew to 25,000 in two years. Today, after 140 years of unabated population growth, some 6 million people inhabit the lands surrounding the Estuary (ABAG, 1987). In this brief period, the Estuary's waters and adjacent land have been modified to an extraordinary extent. Modifications include habitat loss and degradation, increased pollutant loadings, altered flow regimes and reduced freshwater inflow, and changes in channel configuration resulting from dredging and waterway modification.

*Habitat Loss and Degradation.* The Estuary's major modifications began shortly after gold was discovered. From 1853 until 1884, Sierra miners, using high pressure water streams to extract ore, washed tens of millions of cubic meters of soil and gravel into the Estuary's tributaries. This material smothered salmon spawning beds, blocked

navigation, and raised the elevation of parts of the Bay's bottom by as much as one meter (Nichols et al., 1986). Attendant with the human population increase initiated by the Gold Rush was a demand for food; to meet this demand, the Delta's marshes were diked and farmed. By the early 20th century, land reclamation was nearly complete with only remnants of the Delta's 1,400 km<sup>2</sup> of historic wetlands remaining. Filling of the Bay's tidal areas continued at a high rate until the late 1960s. Of the Estuary's original 2,200 km<sup>2</sup> of historic tidal marsh, only 125 km<sup>2</sup> remain today (Conomos, 1979). Uplands are still being rapidly developed.

Early habitat modifications were accompanied by major changes in the Estuary's biotic communities as intentional and accidental introductions of invertebrates and fishes completely altered the indigenous community composition. More than 100 invertebrate species were introduced (Nichols and Pamatmat, 1988). Of the 55 fish species found in the Delta today, one-half are introduced (Herbold and Moyle, 1989).

Commercial fisheries in invertebrates and fishes flourished until the early 1900s, when a combination of overexploitation, habitat loss and change, and changes in water quality led to declines in harvest and eventual fishery collapse (Skinner, 1962). Numbers of striped bass, the most important sport fish in the Delta, have dropped to record low levels. Much of the salmon and steelhead production now occurs at hatcheries (Herbold and Moyle, 1989). Migratory waterfowl populations dependent on wetlands have declined precipitously.

*Increased Pollutant Loadings.* As development of the Estuary and its basin occurred, loadings of toxic pollutants increased. Mercury used by gold miners was undoubtedly transported in the sediments reaching the Estuary (Phillips, 1987). By the end of the 19th century, there were reports of waste discharges causing declines of fish, shellfish, and bird populations (Skinner, 1962). Industrial development, particularly associated with oil refining and transportation, was an additional source of contaminants. Loadings of toxic pollutants associated with urban land use, industry, and agriculture increased markedly in the 1940s. The expenditure of over \$3 billion in state and federal funds on municipal wastewater treatment since the 1950s has reduced the total biochemical oxygen demand, loadings of suspended solids, and trace elements (Davis, et al., 1990). Loadings of oil and grease, BOD, and suspended solids in industrial wastewater have declined as well.

Although municipal and industrial loadings of conventional pollutants have decreased, large loadings of pollutants continue to enter the Estuary. Organisms are contaminated to various degrees with inorganic and organic materials (Luoma and Cloern, 1982; Nichols, et al., 1986). Many areas exhibit high concentrations of these compounds, particularly at localized sites near industrial discharges (CBE, 1987). The biological impacts of silver, selenium, copper, tributyltin, cadmium, polychlorinated biphenyls and polyaromatic hydrocarbons are well documented, and are of particular concern in the Estuary (Phillips, 1987). Runoff from agricultural, urban, and nonurban lands have been shown to be significant and largely uncontrolled sources of pollutants to the Estuary (Gunther et al., 1987).

*Altered Flow Regime and Reduced Freshwater Inflow.* The Estuary receives 90 percent of its fresh water from the Sacramento and San Joaquin Rivers and other, smaller tributaries flowing into the Delta. Only 10 percent of the fresh water inflow originates in the immediate watershed of San Francisco Bay. The diversion of some 60 percent of the historic (1850) flow of 34 km<sup>3</sup> of water from the Delta and its tributaries is considered by many to be the most critical biological and political problem facing the system today. Most of this water is used by agriculture.

Federal and state researchers have noted the impacts of fresh water diversions on Estuarine organisms. Impacts to species in the Delta, especially salmon and striped bass, have been well documented and include elevated springtime water temperatures, removal of young fish by the pumps, and diversion of fish from traditional migration routes (USFWS, 1987; CDFG, 1987). Water diversions and altered flow regime are considered to be largely responsible for declines in the populations of striped bass, salmon, and other species. The effects of altered flow regime and reduced inflow on the Bay's hydrodynamics and biological productivity are just beginning to be understood.

*Dredging and Waterway Modification.* Dredging for navigation purposes has occurred in the Estuary since 1868. In 1986 and 1987, 5.8 million cubic meters of material were dredged and disposed of annually; eighty percent of this material was disposed of in San Pablo Bay and Central Bay. Increased turbidity and the release of toxic materials in dredged sediments have made dredging a key management issue (SFBRWQCB, 1987). With ports planning to deepen channels to facilitate a new generation of deep-draft container ships, the quantities of material dredged is expected to increase in the next several years. Likewise, the modification of channels for flood control purposes pose difficult problems, especially in the Delta (Gunther, et al., 1990).

### **How the Environmental Community is Addressing the Estuary's Problems**

There are more than 30 environmental groups active in the San Francisco Bay Estuary. Some of these groups — Audubon Society, Citizens for a Better Environment, Environmental Defense Fund, Natural Resources Defense

Council, and Sierra Club — are active at the national as well as local level. Others, such as United Anglers of California and the Planning and Conservation League, are involved in statewide and Estuary issues. Many groups, including the Save San Francisco Bay Association, CLEAN South Bay, and Citizens Committee to Complete the Refuge focus solely on problems affecting all or part of the Estuary.

Environmental groups employ a variety of activities to address the Estuary's problems. These include influencing legislation, involvement in government planning programs, public education, input into the regulatory process, and when necessary, litigation. Only a few groups are able to afford the luxury of full-time attorneys, technical experts, legislative lobbyists, and other highly-trained staff. All of the groups rely heavily on volunteers. To a large extent, the success of most environmentalists lies in the cooperative working relationships they cultivate with peers in government agencies, the regulated community, and the media. Decision makers in government and the private sector are well aware of the increasing influence the environmental groups have on public opinion and policy.

The Estuary's key environmental problems are well defined. Respondents to a questionnaire mailed to resource managers, elected officials, scientists, and public interest groups indicated that the four most important environmental problems are wetlands filling, habitat loss, toxics, and freshwater diversion (Tetra Tech, 1987). Dredging is also of concern (GAO, 1989), as is intensified land use. Nearly 64 percent of the questionnaire respondents indicated that the inadequacy of environmental law enforcement is one of the main causes of the Estuary's problems.

The environmental community is addressing the Estuary's major environmental problems in many ways. A few examples demonstrate the diversity of the problems, the kinds of activities the groups undertake, and the level of successes and setbacks:

*Cullinan Ranch.* In the early 1980s, developers proposed to build a marina, residential housing, and commercial development at Cullinan Ranch, a 600 hectare parcel of former tidal marsh near San Pablo Bay. In 1984, local environmental groups filed a suit to stop the development, based on an inadequate Environmental Impact Report; two State agencies also sued. In 1985, environmental groups and resource agencies convinced the U.S. Army Corps of Engineers not to issue a permit for placement of fill in wetlands at the site, based on inadequate mitigation for wetland losses and impacts to two endangered species (B. Salzman, Marin Audubon, pers. comm.). In 1989, as requested by the environmental community, Congress provided \$3 million towards purchase of the site. With the cooperation of the State Coastal Conservancy and the Solano County Farmlands and Open Space Foundation, it is likely that Congress will provide an additional \$3.7 million (L. Riddle, State Coastal Conservancy, pers. comm.). Once purchased, the site will be added to the San Pablo Bay National Wildlife Refuge and managed to maximize fish and wildlife values. The protection of such a large site is a significant step in the effort to protect important habitats.

*Harbor Bay Isle.* Recently, developers proposed to construct a commercial business park in the City of Alameda. The development included a ferry terminal that would enable ferry transit to San Francisco. Adjacent to the terminal site was the Bay's last major bed of eelgrass, a submerged aquatic plant of high value to fish and wildlife. Least terns, an endangered species, feed there. When the City concluded that the proposed project would result in insignificant environmental impacts, the Golden Gate Audubon Society sued, fearing the increased turbidity caused by ferries would destroy the eelgrass. After protracted negotiations, the City agreed to require the developer to monitor project impacts closely and, if necessary, to modify or cease ferry operation. Although Audubon was unable to stop the project altogether, it was successful in ensuring that the project would not adversely affect important Bay resources (A. Feinstein, Golden Gate Audubon, pers. comm.).

*Shell Oil Spill.* On April 23, 1988, the Estuary's worst oil spill occurred when 1.5 million liters of crude oil spilled from a holding tank at the Shell Oil Company's Martinez refinery into Peyton Slough (EPA, 1988). The oil contaminated more than 40 ha of Shell Marsh and many kilometers of shoreline along the Carquinez Strait between San Pablo and Suisun Bays. Shell spent \$12 million on the cleanup (D. Glaze, Shell Oil Company, pers. comm.). With input from environmental groups, particularly the Save San Francisco Bay Association, and unprecedented cooperation of 16 local, state, and federal agencies, regulators and Shell agreed on a settlement of \$19.7 million. Funds from the settlement, the largest of its kind in the United States, will pay for agency cleanup oversight costs, penalties, impacts to local communities, research, and acquisition of wetlands to mitigate the spill's impacts (L. Kermish, EPA, pers. comm.; M. Carlin, SFBRWQCB, pers. comm.).

*Unocal.* In the early 1980s, operators at the Unocal oil refinery intermittently bypassed millions of liters of refinery processing water around the facility's treatment plant. The incompletely treated effluent was discharged into the Bay in violation of waste discharge permit conditions. When regulatory agencies, at the request of a Unocal employee, failed to take adequate action, the Sierra Club Legal Defense Fund took legal steps against the refinery. In an out of court settlement, Unocal agreed to pay \$4.2 million (SSFBA, 1990). \$3.7 million of the settlement were slated to restore wetlands and help designate a deep ocean dredged material disposal site.

*South Bay Water Quality.* In 1988, Citizens for a Better Environment, Save San Francisco Bay Association, and 42 other groups formed the CLEAN South Bay Coalition. This group is dedicated to protecting the South Bay from toxic contamination and the loss of endangered species habitat caused by the discharges from three municipal wastewater facilities; the average daily combined discharge of the three facilities is 625 million liters (Davis, et al. 1990). In early 1989, the State identified South Bay as highly contaminated. When Regional Water Quality Control Board permits failed to provide adequate safeguards for water quality, CLEAN appealed to the State Water Resources Control Board. After the State Board denied the appeal, Citizens for a Better Environment filed a suit to force timely clean up and protection of endangered species (SSFBA, 1990).

*Bay-Delta Hearing.* In 1987, the State Water Resources Control Board began a three-year process to examine evidence on water quality issues in the Estuary. The hearing is, by far, the most important event in California's water debate in more than a decade; its purpose is to determine how best to balance the various uses of the Estuary's waters. In more than 50 days of hearings, testimony has been presented by various interests including farmers, water contractors, environmental groups, and government agencies. In October 1988, the Board staff issued a draft plan that recommended reducing water exports in order to protect salmon and striped bass in the Estuary (SWRCB, 1988). Responding to swift action from powerful water interests — farmers and Southern California water purveyors — the Board declined to make the plan final. Instead, it revised the hearing process, now scheduled to be completed in 1992. The environmental community, dismayed with this turn of events, will continue to press for freshwater flows sufficient to protect the Estuary's living resources. In addition, environmentalists are planning efforts that may lead to the development of a statewide water policy (B. Davoren, Bay Institute, pers. comm.).

*Dredging in San Francisco Bay.* During 1988, environmental groups started to focus attention on dredging operations in the Bay. Led by sport and commercial fishing interests concerned with declines in fishing success in Central Bay, the groups began a dialogue with the primary regulatory agencies, the U.S. Army Corps of Engineers and the San Francisco Bay Regional Water Quality Control Board. With support from the state and federal fisheries agencies, the environmental groups were able to convince the regulators of the need to better manage dredging operations. In early 1990, the State adopted new policy that placed annual and seasonal restrictions on dredging in the Bay (M. Carlin, SFBRWQCB, pers. comm.). Congressional interest in this issue has prompted federal agencies to begin development of a long-term management strategy for dredging (GAO, 1989; USACE, 1990). Environmental groups will participate in that effort.

*BayKeeper.* Although most environmental organizations attain their aims using similar time-proven approaches, a recently initiated effort takes an unusual tack. BayKeeper, started in 1988 and funded primarily by private foundations, is an on-the-water pollution prevention program modeled after successful, similar programs on the Hudson River, Delaware Bay, and Long Island Sound. It was formed in response to the acknowledged inability of the state and federal governments to enforce environmental laws adequately (Tetra Tech, 1987; GAO, 1988; GAO, 1989). BayKeeper's main role is to document suspected violations of environmental laws on the Bay and provide that information to the regulatory agencies. The heart of BayKeeper is a 26-foot boat from which observations are made at wharfs, marinas, and on the open Bay. The public is urged to report possible unusual activities to the BayKeeper hotline. Unlike other keepers, BayKeeper seeks to improve its ability to monitor by training public volunteers. In an eight-week course, trainees study the Estuary ecosystem, monitoring procedures, environmental regulations and the agencies responsible for their enforcement, and methods for documenting suspected illegal activities. In its first year, BayKeeper detected or followed-up on 150 incidents (M. Herz, BayKeeper, pers. comm.).

*San Francisco Estuary Project.* Recognizing that the Estuary's future will be influenced by government policies, many of the area's environmental groups are participating in a federally-sponsored planning effort, the San Francisco Estuary Project. This project, funded by the U.S. Environmental Protection Agency, is a five-year effort to develop a comprehensive plan to restore and protect the Estuary's water quality and living resources. Together with representatives of industry, agriculture, and government agencies, environmentalists are addressing five management problems including declines of biological resources, increased contaminants, freshwater diversion and altered flow regime, waterway modification, and intensified land use. After characterizing the causes and trends of these problems, project participants will prepare a Comprehensive Conservation and Management Plan. The plan, scheduled for completion in late 1992, will represent a consensus of the Project's participants, a kind of collective view of how the Estuary should be managed. Once signed by the Governor and the EPA Administrator, the plan will require government agencies to take specific actions to improve the Estuary (SFEP, 1987).

*Restoring the Bay Campaign.* Environmental groups are also involved in long-term planning of their own. Working together, groups have begun an effort known as the "Restoring the Bay Campaign." The Campaign's vision is that the Estuary, by the year 2020, will again be a healthy, ecologically diverse and productive natural resource, permanently protected and valued as essential to the well-being of the region it supports (B. Nelson, SSFBA, pers. comm.). As part of the Campaign, the groups will develop a restoration plan for the Estuary that will seek to:

1) Maintain and restore wildlife populations, 2) Protect and restore wetlands and creeks, 3) Develop an environmentally sound dredging and dredged material disposal program, 4) Improve water quality by reducing toxics, 5) Guarantee an adequate fresh water supply to the Estuary, and 6) Implement a broad-based educational effort among all segments of the community to support Bay restoration. The restoration plan, scheduled for release in late 1990, will be a catalyst for regulatory and legislative efforts to improve the Estuary.

## Conclusions

The San Francisco Bay Estuary is a highly modified, yet immensely valuable, coastal water body. It has undergone extensive change in the past 140 years and today exhibits compromised water quality and declining populations of living resources. Environmental groups seeking to improve the Estuary are effective due to their ability to influence regulatory decisions and long-term planning efforts. Through individual efforts and in coalitions, the groups are successful largely because they represent the sentiments of a large portion of the public, and because they are able to form cooperative working relationships with a variety of interests. Their technical expertise and, when necessary, ability to litigate, help secure their successes. If recent trends continue, the environmental community's influence on the attitudes and actions of the public, lawmakers, and regulators will strengthen the Estuary's protection. As development pressures increase, environmental groups will continue their efforts to protect the San Francisco Bay Estuary.

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