Vital Statistics

Photo courtesy of David Hart and John Sanger

Flows

Recent Inflows

Normal or above normal rainfall has meant improved Delta inflows in recent years. Inflows to the Delta and Estuary were 21.6 million acre-feet (MAF) in water-year 2004 (October 1, 2003–September 30, 2004) and 21.8 million acre-feet (MAF) in water-year 2005 (October 1, 2004–September 30, 2005). Delta outflows were 15 MAF in 2004 and 15 MAF in 2005. (Interagency Ecological Program, 2005)

Diversions for Beneficial Use

Water is diverted both within the Delta and upstream in the Estuary's watersheds to irrigate farmland and supply cities. In-Delta exports have largely remained within the range of 4 to 6 MAF per year since 1974, but the percentage of Delta inflow diverted can vary widely from year to year. In water-year 2004, 6.1 MAF was diverted, and in 2005, 6.4 MAF. The average percentages of total Delta inflow diverted were 36.9 in 2004 and 36.7 in 2005. (Interagency Ecological Program, 2005)

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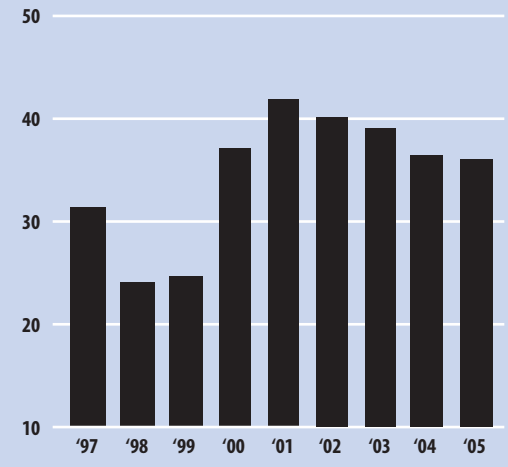
PERCENT OF INFLOW DIVERTED



Source: DWR, Exports TOT

Water Use Efficiency

Water use efficiency, conservation, and recycling projects within the Bay-Delta region aim to provide a "drought-proof" source of water to help meet the needs of cities, industries, and agriculture. As of 2004, CALFED's water use efficiency program had provided $43 million in water recycling grants, with additional funding provided by propositions 13 and 50. CALFED expects that these projects will make a significant contribution toward meeting its water use efficiency goals.

At the local level, the Bay Area Water Recycling Program's (BARWRP) Master Plan, now complete, calls for recycling 125,000 acre-feet/year in the Bay Area by 2010, and about 240,000 af/year by 2025. Many Bay Area agencies are forging ahead with the design, construction and operation of water recycling projects. For example, the Dublin San Ramon Services District (DSRSD) recycling facility's current treatment capacity is 3 million gallons per day (mgd), with 10 miles of distribution installed. Planned capacity for this facility is 9.6 mgd. DSRSD and the East Bay Municipal Utility District (EBMUD) are jointly developing the San Ramon Valley Recycled Water Program (SRVRWP), which will serve areas of Blackhawk, Danville, Dublin, and San Ramon. When complete, this multi-phased 6.7-mgd project is expected to deliver 3.3 mgd to DSRSD's service area and 2.4 mgd to EBMUD's service area with 1 mgd available to either. DSRSD has been delivering recycled water since November 2005. EBMUD customers including the City of San Ramon, the San Ramon Valley Unified School District, and Chevron's world headquarters began receiving recycled irrigation water in February 2006. Meanwhile, EBMUD currently produces almost 6 mgd of recycled water. In addition to its joint project with DSRSD, EBMUD's multi-phased East Bayshore Recycled Water Project (EBRWP) is currently under construction and is expected to begin delivery to Oakland customers in the late summer or fall of 2006, expanding to Albany, Berkeley, and Emeryville in 2007. The EBRWP will ultimately include nearly 30 miles of pipeline through parts of Alameda, Albany, Berkeley, Emeryville, and Oakland and will save 2.5 mgd (2,800 acre-feet/year) once all recycled-water customers are hooked up to the system. The first phase will supply up to 0.7 mgd. Eventually, EBWRP water may be used in wetlands restoration.

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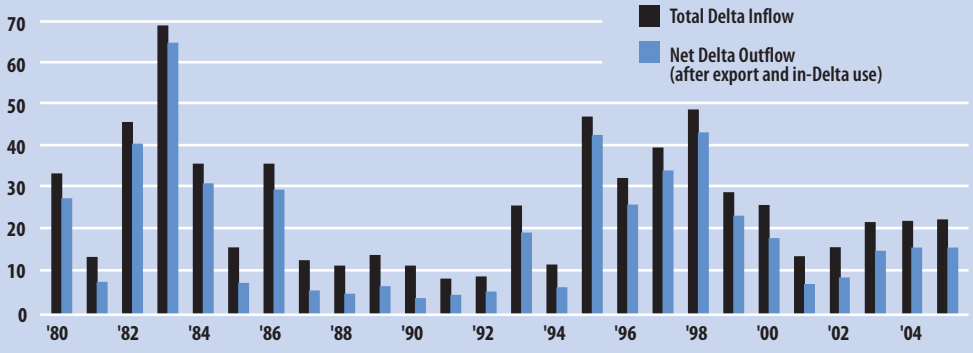
FRESHWATER FLOWS TO THE SAN FRANCISCO ESTUARY, 1980-2005
IN MILLIONS OF ACRE FEET



Source: DWR, Dayflow QTOT

Steelhead

Chinook Salmon

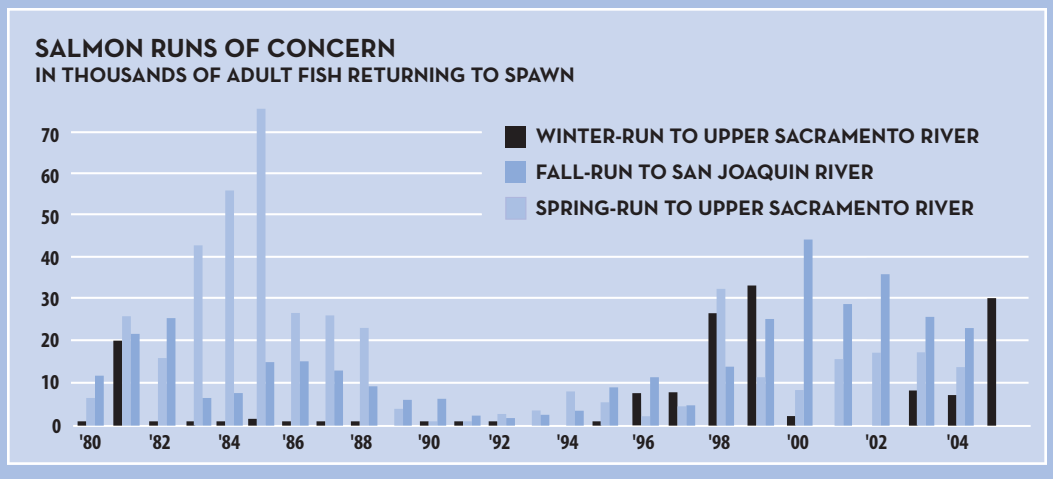
Illustrations: Bill Crary

Fish

Central Valley Salmon

Most populations of Central Valley chinook salmon seem to be holding relatively steady. Central Valley chinook salmon occur in four discrete runs—winter-run, spring-run, fall-run, and late fall-run (run refers to the season in which adults return to their native streams to spawn). The winter-run chinook salmon, with the lowest population, has been listed as both a state and federal endangered species since 1994. As a result of more regular interagency scrutiny of operations, a new counting method for chinook winter-run salmon critical to assessing "incidental take limits" is now in place. Federal incidental take limits for winter-run allow up to two percent of "juvenile production" to be lost at the pumps. The formula for setting take limits combines the number of offspring produced ("juvenile production") with the number of adult fish returning to spawn each year ("adult escapement"). The latter number—based on how many fish passed through the Red Bluff Dam fish ladders—became questionable in recent years as the dam gates remained open for longer periods and fewer fish had to use the ladders. An alternative method, counts of spawned female carcasses upstream, backed up by earlier surveys, revealed a variation of up to a factor of five in the total estimates of spawning adults. The new higher estimates of adult escapement translated into a higher estimate of juvenile production and meant that the take limit was never reached in 2001, for example, changing the need to reduce pumping and use EWA resources to protect fish. The winter-run population was 8,218 in 2003 and 7,785 in 2004. The 2005 winter run was estimated by the Department of Fish and Game as 15,000, of which 18 percent were hatchery fish—higher than the usual 5 to 10 percent. (*Sacramento Bee*, November 21, 2005)

The next most sensitive stock, the spring-run, was state listed as threatened in 1998 and federally listed in 1999. The spring-run population was 17,564 in 2003 and 13,907 in 2004. Sacramento fall-run are the most



abundant chinook stock. Their population fluctuated from 569,976 returning in 2001 to 839,956 in 2002 (the estimated population for Battle Creek was the highest on record), dropping to 579,293 in 2003 and 346,277 in 2004. Returns of the San Joaquin fall-run in 2003, at 25,348, and in 2004, at 22,654, were both above the 1967–1999 average annual return of 20,470. The late fall-run (distinct from fall-run) population was 8,322 in 2003, increasing to 13,922 in 2004.

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Striped Bass

Native to eastern North America, the striped bass (*Morone saxatilis*) was introduced to California in 1879, when fish from New Jersey's Navasink River were released in the San Francisco Estuary. The species did well in its new environment, supporting a commercial fishery from 1888–1935, and is still the basis for an important sport fishery. However, the population began to decline in the 1930s, prompting tighter regulation of sport fishing and intensive research.

Abundance indices of striped bass in their first year of life (young-of-the-year or YOY) remain at very low levels. Where the peak Midsummer Townet Survey (TNS) index was 117 in 1965, the 2005 index was 0.9. The TNS index of 0.8 in 2004 was the lowest in the 45-year history of the survey. Where the peak Fall Midwater Trawl Survey (FMWT) index was 20,038 in 1967, the 2005 index was 121, up from 53 in 2004.

Calculations of recent adult striped bass numbers have not been completed, but catch-per-unit-effort and length-frequencies during 2005 spring tagging for the adult population study show recruitment has been substantial even though indices of young-of-the-year abundance were very low the years these fish were spawned. This relationship is the subject of on-going investigation.

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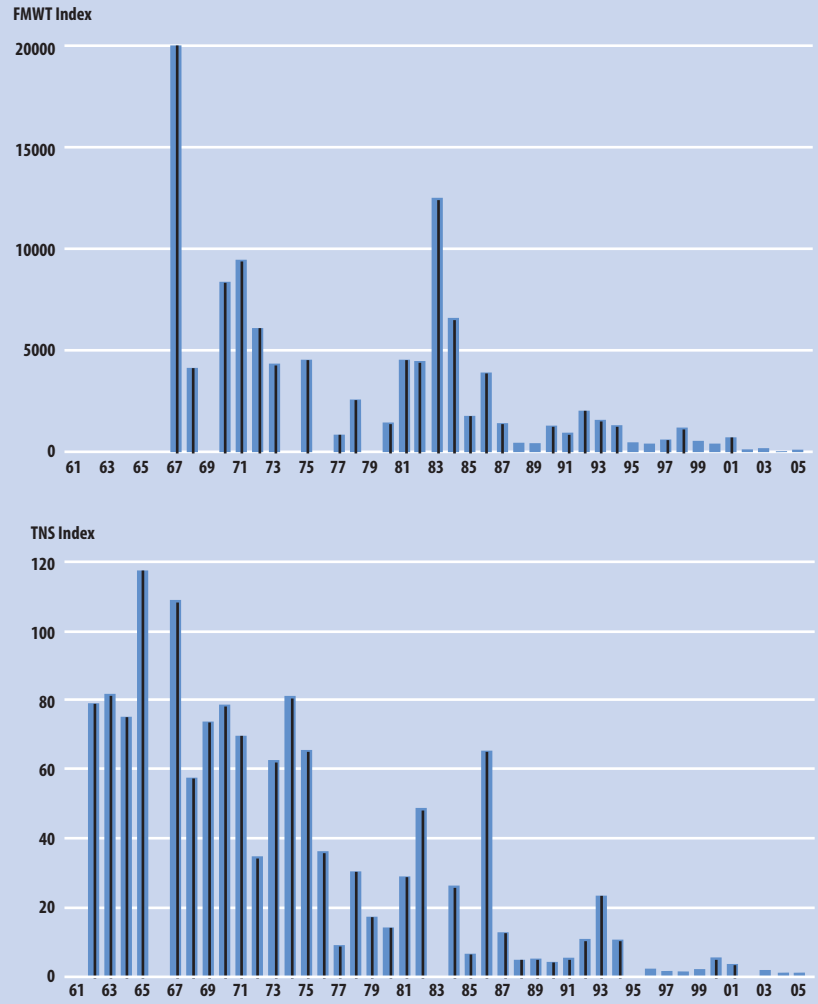
Delta Smelt

The Delta smelt (*Hypomesus transpacificus*), a 55–70 mm long osmerid, is endemic to the upper San Francisco Estuary. It was once quite common, but a dramatic decline in the 1980s led to the federal and state listing of this fish as a threatened species in 1993. It is the annual life cycle, limited diet, low fecundity, and restricted distribution within the Estuary that make Delta smelt environmentally sensitive. Possible reasons for the decline of Delta smelt include reductions in Delta outflow, extreme high flows (which displace them away from suitable rearing habitat), entrainment losses at major water diversions and power plants, prey item changes, competition, toxicants, disease, changes in salinity, and predation.

Delta smelt abundance generally increased during the 1990s, which may have been due to above-normal outflow conditions and reduced pumping exports, aiding in the transport of larval/juvenile fish from the Delta to their rearing grounds in the Suisun Bay area. To reduce the impact of Delta pumping operations on smelt, CAL-

STRIPED BASS INDEX
1961-2005



FED developed the Environmental Water Account (2000), which helps to reduce Delta smelt take by shifting the timing of pumping. It is still difficult to determine whether or not this effort is benefiting Delta smelt on a population level.

More recently, as of 2001, Delta smelt abundance indices have reached all-time lows for two of California Department of Fish and Game's (DFG) long-term monitoring surveys, Summer Townet Survey (TNS, since 1959) and the Fall Midwater Trawl (MWT, since 1967), despite respectable water years. For example, TNS indices from 2003–2005 are 1.6, 2.9, and 0.3 respectively (compared to the 2002 TNS of 4.7), while MWT indices for the same years are 210, 74, and 26 (compared to the MWT 36-year average of 556). Such abrupt decreases in Delta smelt and other pelagic fishes have prompted a special task force to address this Pelagic Organism Decline (POD).

Just recently (2005) a new monitoring survey called the Delta Smelt Larval Survey (DSLS) began, which targets larval Delta smelt. Information from the DSLS along with the 20 mm survey may aid in water management decisions in order to maintain a balance between preserving Delta smelt and providing California's water.

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Longfin Smelt

Longfin smelt (*Spirinchus thaleichthys*) in the Estuary represent the southernmost spawning population in North America, and their abundance continues to be positively correlated with Delta outflow during their December-May larval period (Baxter 1999). Since the extremely wet winter of 1998, Delta outflow for the December-May period has generally declined through 2005, and so has the abundance of longfin smelt, as measured by Cal Fish & Game's Fall Midwater Trawl Survey. Since 2003, the abundance index for longfin smelt has been below 200, and in 2005 it dropped to 129. These indices are close to the record low indices recorded at the end of the 1987–1992 drought (http://www.Delta.dfg.ca.gov/data/mwt/), and probably reflect poor early survival conditions resulting from recent low winter outflow years and changes in food web dynamics brought about by the introduced Asian clam, *Corbula amurensis* (Kimmerer 2002). On a positive note, for several years Cal Fish & Game has continued to collect 115–40 mm spawners (about three years old) in trawl sampling. These age-three females can produce over twice as many eggs as age-two females, and such spawners can help buffer against poor year-classes. (Baxter, Pers. Comm., 2006)

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Splittail

Abundance of young Sacramento splittail (*Pogonichthys macrolepidotus*) has been low from 2002 to 2005 based upon results from the Cal Fish and Game Fall Midwater Trawl (http://www.Delta.dfg.ca.gov/data/mwt/). For most of these years low abundance resulted from low river flow and lack of floodplain inundation during the splittail spawning period in late February–May. However, spring flows in 2005 appeared good and some recruitment was detected by US Fish and Wildlife beach seining and trawling surveys (www.Delta.dfg.ca.gov/data/rtm2005/), so low Fall Midwater Trawl abundance was not expected and remains to be investigated. Splittail are known to spawn on inundated terrestrial vegetation, and their recruitment appears most strongly associated with the magnitude and duration of floodplain inundation during the spawning period (Sommer et al. 1997, Moyle et al. 2004). In September 2003, US Fish & Wildlife removed splittail from the list of threatened species. The silvery-gold minnow, found only in tributaries to the S.F. Estuary and the Delta, is the only fish species to be de-listed for reasons other than extinction. Although splittail was de-listed, it remains a species of concern because of its limited access to spawning habitat during low flow years and the potential for future water management decisions to exacerbate its situation.

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Pacific Herring

Until 2005, the spawning biomass of Pacific herring (*Clupea pallasi*), which supports the Bay's largest commercial fishery, has remained below the long-term (since 1978) average of 52,234 short tons. In response to this decline, the Fish and Game Commission, which manages the fishery, lowered catch quotas. Although ocean productivity has been favorable for herring over the last several years, a large recruitment of young fish to the spawning population has yet to occur, and older age classes have been declining. Following record high biomass levels of 99,050 short tons in 1995–1996 and 89,570 short tons in 1996–1997, spawning biomass plunged to 20,000 short tons following the 1997 El Niño. Since then, spawning biomass estimates have been 39,500 short tons for 1998–1999, 27,400 short tons for 1999-2000, 37,300 short tons for 2000–2001, 35,400 short tons for 2001–2002, and 34,400 short tons for 2003–2004 (a biomass number was not finalized for 2002–2003 because of discrepancies

between spawn deposition survey data and hydroacoustic survey data). The 2004–2005 spawning biomass estimate was 58,934 short tons, a 71% increase from the previous season and the first estimate to exceed the long-term average of 51,825 tons used to set fishery quotas since the 1996–1997 season.

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Green Sturgeon

Limited evidence suggests that overall, the population of the anadromous green sturgeon (*Acipenser medirostris*) may be declining in California. It is known to spawn in the Klamath, Trinity, and Sacramento rivers, as well as the Rogue River in Oregon. Little is known about its historic or current distribution and movement throughout the Estuary, but abundance estimates do not suggest that the population has declined in the Estuary (Kelly & Klimley 2004, Cal Fish & Game 2001). While green sturgeon are long-lived (up to 70 years), delayed reproduction, combined with habitat destruction and pressure from fishing, makes it difficult for them to replenish their populations quickly. In 2001, a coalition of environmental groups petitioned NMFS to list the green sturgeon as either endangered or threatened. As part of its review, NMFS identified two distinct population segments: the northern population (found north of the Eel River along the coast) and the southern population (includes any coastal or Central Valley populations south of the Eel River, with the only known population in the Sacramento River). NMFS declined to list the green sturgeon in 2003, but placed both population segments on its list of species of special concern. Following litigation by the Environmental Protection Information Center and a March 2004 court decision remanding the determination, NMFS proposed listing the southern population segment as threatened in April 2005. The agency's supporting rationale included the concentration of spawning adults in a single river, loss of spawning habitat in the upper Sacramento and Feather Rivers, and negative trends in commercial bycatch and juvenile entrainment data since 1986. NMFS also noted that green sturgeons may be feeding on the exotic overbite clam which is known to bioaccumulate toxic selenium. A public hearing on the proposed listing has been held, and a final determination is pending. Meanwhile, scientists are studying parameters influencing sturgeon movement within the Estuary, preferred spawning locations and environments, and residence time within the river and Estuary system (Kelly & Klimley, 2004). The results of such studies could inform improved natural resource management and protection efforts for the species.

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Kern Brook Lamprey

Endemic to the San Joaquin Valley, the Kern brook lamprey (*Lampetra hubbsi*) is a primitive eel-shaped vertebrate with an unusual life cycle. Typical lampreys are predators, attaching to fish with suckerlike mouths, rasping a hole with a tongue covered with sharp plates, and feeding on the victim's blood and body fluids. However, several species have evolved a nonpredatory lifestyle. Instead of migrating to sea as larvae (ammocoetes), Kern brook lampreys and other nonpredatory species spend their entire lives in their natal streams. The larvae subsist on algae and detritus; after metamorphosing in the fall, adults spawn in spring in gravelly riffles and die without feeding.

First collected from the Friant-Kern Canal in 1976, Kern brook lampreys were later found in the lower Merced, Kaweah, Kings, and San Joaquin Rivers. As larvae, they occupy silty backwaters of foothill streams, preferring cool, shallow pools and other low-flow environments with sandy or muddy substrates. Many such habitats have been eliminated by channelization. Known populations are scattered through the San Joaquin drainage and isolated from each other. With one exception, all populations are below dams where sudden changes in flow may strand the larvae. Larvae have also been drawn into the siphons of canals from which they are unable to return to the spawning grounds.

A California species of special concern, the Kern brook lamprey was denied federal protection in a US Fish & Wildlife Service decision in January 2005. A listing petition for four western lamprey species had been submitted two years earlier by the Center for Biological Diversity and 10 other conservation groups. FWS claimed the petitioners had not provided specific information on threats to the Kern brook lamprey and another nonmigratory species, the western brook lamprey.

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Invasive Species

Green Crab

The European green crab (*Carcinus maenas*) is now established in every significant bay and estuary between Monterey, California and Gray's Harbor, Washington. It appeared in South S.F. Bay in the early 1990s and has spread north at least as far as the Carquinez Strait. Salinity limits the crab's distribution: crabs have been collected from water ranging from 5–31 parts per thousand (ppt) salt to water, but few have been collected from water with less than 10 ppt. A 10-year study in Bodega Bay found that in contrast to their slow growth rates in Europe, green crabs here grew rapidly and reached sexual maturity in their first year. Over the course of the study, the green crab severely reduced the abundance of three common invertebrate species, but did not impact the shorebird food web (Grosholz et al. 2000). Another consequence of green crab predation is the accelerated invasion of another invasive species, the eastern gem clam, which was introduced into Bodega Harbor nearly 50 years ago and is now much more abundant than it has been in past decades. While eradication is not possible at this point, the National Green Crab Management Plan includes several recommendations for local population control strategies. These include early warning methods for new range expansions, prevention measures against new introductions, and coordinated monitoring of population trends, new outbreaks, and losses to commercial fisheries.

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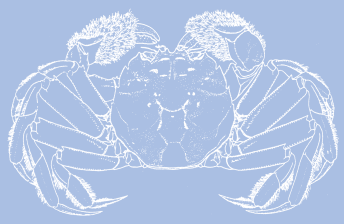

Chinese Mitten Crab

The Chinese mitten crab (*Eriocheir sinensis*) population has increased rapidly since it was first reported in the S.F. Estuary in the early 1990s. Numbers of downstream migrating adults peaked at the BurRec fish facility in 1998, while adult numbers in northern S.F. Bay peaked in 1998 and 2001. All data sources support a population decline from 2002 through 2004, with the 2004 count the lowest since 1996. No adult crabs were detected in Suisun Marsh in 2004, and only four public reports of sightings were made to the toll-free reporting line. When numbers are low, the mitten crab's major impact is stealing bait from sport anglers at some locations in the Delta and Suisun and San Pablo bays.

What controls mitten crab population in the Estuary is not understood, although winter temperatures and outflow are hypothesized to control larval survival and settlement time. A "boom-and-bust" cycle has been reported for some introduced species, although this may not be universally true for all introductions.

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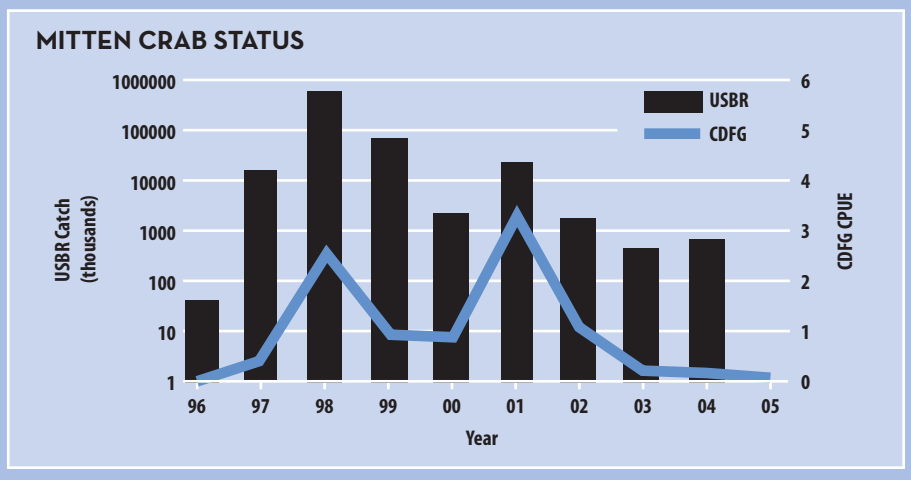
Northern Pike

The voracious Northern pike (*Esox lucius*), native to Canada and the Midwest, was illegally planted in the 85,000-acre-foot Lake Davis reservoir in the early 1990s. In 1997, the California Department of Fish and Game treated the lake with Rotenone to eradicate pike from the lake. The pike were significant predators on the rainbow trout and also presented a potential threat to the Delta ecosystem. The treatment temporarily shut the lake to all recreational uses and compromised local water supplies. In May 1999, about a year after more than a million trout were planted and the lake had reopened, the pike reappeared, possibly intentionally reintroduced. Biologists have pulled approximately 55,000 pike from the lake since 2000. In September 2005 DFG announced a new preferred pike-eradication proposal in which the lake's volume would be drawn down by 75 percent and another Rotenone treatment would be applied. This would not affect drinking water for the city of Portola, which now uses wells and springs. A joint EIR/EIS will be prepared by DFG and the Plumas National Forest. DFG is also working with community leaders to prevent



Total catch of adult mitten crabs at BurRec's fish facility (bars) and catch per unit effort (CPUE) of adult mitten crabs from Cal Fish & Game's S.F. Bay Study otter trawl survey (line), 1996-2005.

another reintroduction, a criminal offense with penalties including a fine of up to $50,000 and up to a year in jail. For current status, visit www.dfg.ca.gov/northernpike/index.html.

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Asian Clam

The Asian clam (*Corbula amurensis*) continues to be the dominant benthic organism in the North Bay. The seasonal decline of the bivalve continues to occur throughout the North Bay in winter of most years, and is followed by peaks in density after reproduction in spring and fall. There have been some short-duration phytoplankton blooms in the North Bay for the last several years during early spring, when *Corbula* biomass is at an annual minimum. These blooms have been earlier and shorter in duration than historic blooms. *Corbula* was first seen in the South Bay in 1988 and had become a dominant bivalve by 1990. Unlike in the North Bay, however, the South Bay phytoplankton bloom has not been depleted by *Corbula* filter-feeding. This is due to the seasonal cycle of *Corbula* in that part of the Bay—during the spring bloom period, clam biomass is very low and thus the clam's grazing pressure is too low to restrict phytoplankton bloom formation.

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Cordgrass

Species of *Spartina* (cordgrasses), introduced into the Estuary in the 1970s, have spread rapidly and pose a serious threat to the success of future tidal marsh restoration throughout the Estuary. The impacts associated with the spread of Atlantic cordgrass (*Spartina alterniflora*) include hybridization with and likely local extinction of native *Spartina foliosa*, regional loss of unvegetated tidal flat habitat, elimination of small tidal channels, and loss of pickleweed habitat essential to the endangered salt marsh harvest mouse. Infested acreage increased by 280 percent from 2001 to 2003, affecting both established and newly restored marshes—11,500 acres altogether. The rate of spread is greatest on mudflats and restored tidal marsh.

The invasion no longer consists of the pure parent genotype; many hybrid morphologies have been observed. Hybrids are more vigorous and reproductively fit than either of the parent species. Control efforts by the Invasive Spartina Project in 2005 targeted 132 subareas, with a goal of treating 70 to 80 percent of the infestation. Permits and funding are in place for 2006–2007. In the 2005 season, the previously used herbicide glyphosate (Aquamaster®, the aquatic version of Roundup®) was largely replaced by a new agent, imazapyr (Habitat®), only recently registered for use in California. Unlike glyphosate, treatment with imazapyr does not require a 6- to 12-hour post-application period without tidal inundation. Also, glyphosate tends to bind to sediment and become inactivated, and requires coating of the entire plant. Human health risks from imazapyr are reported to be low, and the herbicide is less toxic to aquatic organisms than glyphosate; however, there is a high risk of damage to non-target plants if inadvertently applied. One complication in the campaign against invasive *Spartina* has been the presence of high densities of the endangered California clapper rail (*Rallus longirostris obsoletus*) in some infested areas, including Arrowhead Marsh and Colma Creek. The presence of the rails will require treatment outside the birds' February-through-August breeding season and a phased approach involving revegetation with native species. With adequate funding, the Spartina Project expects to control the invasive *Spartina* by 2010.

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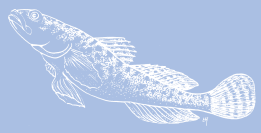
Gobies



Four species of non-native gobies inhabit the San Francisco Estuary, all believed to have been introduced via ballast water release. The California Department of Fish and Game's San Francisco Bay Study (Bay Study) catch-per unit-effort (CPUE) of the chameleon goby (*Tridentiger trigonocephalus*), shimofuri goby (*T. bifasciatus*), and shokihaze goby (*T. barbatus*) have been relatively stable since 2001. The yellowfin goby (*Acanthogobius flavimanus*) has historically been the most abundant and widespread of the introduced gobies. Yet in 2002 and 2003, Bay Study shokihaze goby catch exceeded yellowfin goby catch.

The shokihaze goby was first discovered near the Antioch Bridge in November 1997; it has since become one of the most abundant demersal fishes in Suisun Bay and the lower Sacramento River. The diet of juvenile and adult shokihaze gobies in the upper Estuary is dominated by gammarid amphipods, with isopods, clam siphons, copepods, barnacle cirri, polychaetes, mysids, and hydroids also contributing to a large part of the diet. The shokihaze goby is capable of killing and consuming fish, as observed in aquaria, yet fish are rarely found as a prey item. The impact of the shokihaze goby on native fishes in the Estuary by predation is believed to be minimal, yet its consumption of invertebrates and aggressive behavior could result in competition for resources with other fishes.

Shokihaze goby distribution has expanded downstream from the upper Estuary to the South Bay. Shokihaze gobies were collected near the Dumbarton Bridge in February 2002 and also in November and December 2004. Shokihaze gobies have been collected in salinities ranging from 0.09 to 28.81 parts per thousand in the Estuary. The potential exists for their range to continue to expand within the Estuary and also into other bodies of water within California.

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European Sea Squirt

A relative newcomer to San Francisco Bay, the European ascidian or sea squirt *Didemnum cf. lahillei* forms amorphous masses on docks, piers, rocks, gravel, and other hard surfaces. Taxonomy is controversial, and multiple species may be involved.

Ascidians, distant relatives of vertebrates, metamorphose from a tadpole-like larval stage into sessile filter-feeders. *Didemnum* is a colonial form and potentially one of the most significant fouling organisms in the Bay. Since its larval form is unable to survive long in ballast water, it most likely arrived on a ship's hull sometime prior to 1993 when it was first detected. It reproduces rapidly, tolerates a wide range of depths, and, like many exotics, has no known predators in local waters. Its spread appears to be limited only by salinity and substrate requirements.

Didemnum has already been identified as a problem on the Atlantic Coast, in Puget Sound, and in New Zealand and Japanese waters. Of particular concern to aquaculturists, it overgrows rafts and other structures on which mussels and oysters are grown. It poses a potential threat to oyster farms in Tomales Bay, where its presence was confirmed in 2001, and Drake's Estero. On the seabed, *Didemnum* smothers burrowing bivalves by growing over their siphons. It has been found covering more than 60 square miles of North Atlantic seafloor with a slimy monoculture at Georges Bank, and biologists fear it may become established on the Cordell Bank.

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Wetlands & Wildlife

Wetlands

San Francisco Bay Joint Venture partners completed several major acquisitions around the Bay, including Cargill properties in the South Bay (16,000 acres) and the Bahia wetlands in the North Bay(600 acres). Current efforts include restoration planning for the South Bay salt ponds and restoration projects on Petaluma and Triangle marshes, Simmons Slough, Pacheco Marsh, Hamilton Air Force Base–Bel Marin Keys, Napa-Sonoma Marshes, Cullinan Ranch, Napa River Flood Control Project, American Canyon, Dutch Slough, Eden Landing Ecological Reserve, West Stege Marsh, and Sears Point. In the North Bay, efforts are underway to acquire and permanently protect privately owned tidal wetlands and diked baylands. Nearly 300 other projects to protect and restore wetlands and riparian habitats are also in progress. Both the Central Valley and San Francisco Bay Joint Ventures are updating their implementation plans, and the Central Valley Joint Venture has identified the Delta as a high priority area for habitat work. In collaboration with Ducks Unlimited, the San Francisco Bay Joint Venture has created a new project tracking system. While waterfowl habitat will remain a key focus for both joint ventures, updated plans will also include specific goals for breeding and wintering waterfowl, shorebirds, grassland and riparian birds, and other wetlands-associated birds, and will address agricultural practices and protection. Central Valley partnerships have resulted in three North American Wetland Conservation Act (NAWCA) grants totaling nearly $3 million for wetland conservation activities in Suisun Marsh and in the Yolo and Delta basins. Meanwhile, regional interests continued with wetlands-related planning, partnerships, and fundraising. CALFED completed a draft regional implementation plan that includes eight restoration priorities and continued to provide significant funding for restoration projects and ecosystem planning and processes. As of 2004, CALFED had provided $177 million for restoration projects in San Francisco Bay, with additional funding under the Delta Regional Ecosystem Restoration Implementation Plan (DRERIP). The San Francisco Bay Area Wetlands Restoration Program (WRP), a partnership of 18 federal, state, and local public agencies, is working to implement the CCMP's wetlands action items and the broad recommendations of the *Baylands Ecosystem Habitat Goals Report*.

For a comprehensive list of wetland restoration projects that have been implemented around the Bay, see the database and maps compiled by Wetlands and Water Resources (www.swampthing.org). For wetlands creation, restoration, mitigation, and enhancement projects, see the San Francisco Estuary Institute's Wetland Project Tracker (www.wrmp.org/projectsintro.html), San Francisco Bay Joint Venture (www.sfbayjv.org), and Central Valley Joint Venture (www.cvjv.org). For detailed information about CALFED's extensive ac-

tivities and accomplishments, see the CALFED Bay-Delta Program Annual Report 2004 (http://calwater.ca.gov/AboutCalfed/AnnualReport2004). For information about restoration of the Cargill property, see www.southbayrestoration.org.

California Clapper Rail

Current Bay-wide population estimates of the endangered California clapper rail (*Rallus longirostris obsoletus*) are not available, but surveys in the 1990s estimated their numbers at 1,040 to 1,264, with up to 564 in Suisun and San Pablo Bays (1992–93 data) and up to 700 in South San Francisco Bay (1997-98 data). This represented an increase from a low of 300 to 500 individuals in the 1980s. A new Bay-wide survey began in January 2005. Results from the first year indicate the species has declined or been extirpated in some areas of the North Bay since the early 1990s. No clapper rails were detected at any of the nine Suisun Bay sites, or at the mouth of Sonoma Creek where the previous survey found approximately 25 individuals. Two former low-density sites, Richardson Bay and Point Pinole, also had no detectable rails in 2005. The population at White Slough near Vallejo also showed a sharp decline. It is unclear whether such small satellite populations are succumbing to predation or emigrating to other marshes. On the other hand, counts at Heerdt Marsh and Muzzi Marsh in South Marin were higher, and it is generally believed that numbers have increased in San Francisco Bay, especially the South Bay. In some San Francisco Bay locations such as Arrowhead Marsh and San Bruno Marsh, there appears to be strong association between increase in vegetation cover provided by *Spartina alterniflora* and increase in clapper rail densities (S. Bobzien, Pers. Comm., 2005). Studies by the Invasive Spartina Project suggest that rails have colonized *Spartina*-invaded sites in the South Bay that would otherwise have been too small to support them (H. Spautz, Pers. Comm., 2005). Whether this association is positive or negative in terms of clapper rail population viability is an open question. Further surveys in 2006 should provide a clearer picture of clapper rail distribution and population dynamics throughout the Bay.

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Black Rail

Tidal marshlands of the S.F. Bay region support most of the California black rail (*Laterallus jamaicensis coturniculus*) population in the western United States (Manolis 1978, Evens et al. 1991). For the most part, the breeding distribution of black rails, state listed as threatened, is confined to remnants of historic tidal marshlands in the Estuary's northern reaches, primarily those associated with San Pablo and Suisun bays (Manolis 1979, Evens et al. 1989, Evens et al. 1991). Black rails occur in the South Bay as well, but mostly during winter, and with breeding limited to very few locations (e.g., Dumbarton Marsh). Small numbers have also been discovered recently in small wetlands in the Sierra foothills and at a few isolated marshes in the Delta. A 1996 study estimated approximately 14,500 black rails in the entire S.F. Bay system, with approximately 7,200 black rails in the San Pablo Bay system and a similar number in Suisun Bay and Carquinez Strait, but the true number may be higher or lower (Evens & Nur 2002); new population studies are currently underway. Key predictive factors in black rail distribution are vegetation height, absence of amphipods (indicators of lower elevation marsh), and, in San Pablo Bay, presence of *Frankenia* (an indicator of high-elevation marsh habitat) (Evens et al. 1986). According to the 2002 study, other variables may include marsh size (rail abundance tended to increase as the size of the marsh increased), marsh distribution (the distributional relationship of each marsh to other marshes likely influences rail presence and abundance), marsh configuration (broader marshes tended to support rails in higher abundance than linear marshes), predator populations (sites bound by levees or riprap provide access and habitat to mammalian predators), hydrological cycles (tidal marshes with full tidal influence provide the best habitat for rails), and fluctuations in water level (inundation above a certain depth may exclude habitat to black rails) (Evens et al. 1989, Flores & Eddleman 1993, Evens et al. 1991).

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Least Tern

California least terns (*Sterna antillarum browni*), state and federally listed as endangered, continue to nest at Alameda Point, formerly the Alameda Naval Air Station. While disturbances from gulls and raptors have increased, human disturbance from trespassers has decreased to almost none. Although the number of tern pairs using the base increases each year, the number of successful fledglings continues to fluctuate. In

2005, 424 breeding pairs produced 260 fledglings, down from a previous all-time high of 320 in 2001. Those fledglings represented between 8 and 18 percent of the state's total fledgling population.

Farther north, the number of terns at the Southern Power (formerly PG&E) cooling ponds in Pittsburg decreased from 13 pairs in 2001 to four in 2005, none of which bred successfully. Southern Power is continuing PG&E's voluntary monitoring program at the site. A colony site was started in 2000 on Caltrans property in Albany, with somewhere between eight and 12 pairs in 2000; however, it has not been used since 2001. The East Bay Regional Park District recently established a least tern breeding site on the Hayward Regional Shoreline. Terns nested at this site for the first time in 2005, but all 8 nests failed due to disturbance and trampling by gulls. Least terns have abandoned the Oakland Airport as a breeding site probably due to predation by feral cats and the non-native red fox (last reported breeding attempt in 1995).

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Salt Marsh Common Yellowthroat

Surveys of tidal marshes in 2000 detected few yellowthroats (*Geothlypis trichas sinuosa*), a state species of special concern, in S.F. Bay itself; likely only a few hundred are present. In San Pablo Bay, the estimated density was also low, with an estimated total population of 3,000 or fewer breeding individuals. In many marshes in San Pablo Bay, yellowthroats were completely absent. In Suisun Bay, however, densities observed were quite high (10-fold higher than in San Pablo Bay); Point Reyes Bird Observatory scientists estimate 10,000 to 15,000 breeding individuals in Suisun Bay. An additional unknown number are present in brackish and freshwater marshes, which may be their primary habitat. Point count surveys in 2004 yielded results consistent with earlier findings: highest densities in Suisun Bay, lowest in San Francisco Bay. Based on a small sample, nest success rate in the 2004 study was a relatively low 21.9 percent. Salt marsh yellowthroats appear to respond to specific vegetation composition and are more abundant where there is a greater amount of alkali bulrush (*Scirpus maritimus*). In Suisun and San Pablo Bay, yellowthroats, unlike other salt marsh birds, show a positive association with the invasive perennial peppergrass (*Lepidium latifolium)*. In addition, they are more abundant where the vegetation structure is more complex; for example, where there is more diversity in the height of herbs. Finally, salt marsh yellowthroats are more numerous in marshes that are more compact in shape, rather than elongated or irregular in shape.

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Salt Marsh Song Sparrow

Reproductive success of salt marsh song sparrows has been increasing slowly since 1998, which was the poorest year recorded to date. Despite this increase, the overall success observed at most marshes (usually between 15 percent and 20 percent of nesting attempts result in any fledged young at all) may be below the level necessary to ensure a stable population. Reproductive success varies among marshes, with landscape characteristics (such as proximity to the water's edge) being good predictors of nest survival. Success is lowest in Suisun Bay. The greatest cause of nest failure is predation by both native (common raven, American crow, raccoon) and non-native (house cat, red fox, Norway rat) species; rodents are likely the most common predator in most marshes. In addition, about 10 percent of nests fail each year due to flooding during the highest tides. Nest survival rates in a 2004 study were similar to long-term averages. Estimated numbers of breeding Alameda song sparrows (*Melospiza melodia pusillula*), restricted to Central and South S.F. bays, range from 13,400 to 20,000 individuals; of Suisun song sparrows (*Melospiza melodia maxillaris*), found in Suisun Bay, from 43,000 to 66,000; and of San Pablo or Samuel's song sparrows (*Melospiza melodia samuelis*), found in San Pablo Bay, from 81,000 to 90,000. Population densities of the Alameda subspecies have increased since 1996, while densities of the Suisun and San Pablo subspecies appear stable. The presence of salt marsh song sparrows is not strongly linked to any one, or even several, species of plants, though the three subspecies of song sparrows do appear to respond positively to gumplant and coyote brush and negatively to rush. Nevertheless, the population density of song sparrows is well correlated with landscape features. Density is greatest where land adjacent to the marsh contains less urbanized areas and less agriculture and a greater extent of natural uplands. Conversely, density is lowest in small, isolated marshes. All three song sparrow subspecies are state species of special concern.

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Least Bell's Vireo

A small grayish neotropical migrant songbird, the least Bell's vireo (*Vireo bellii pusillus*) made national headlines in 2005 when a pair nested at the San Joaquin River National Wildlife Refuge, apparently rearing two broods. The birds were first detected by PRBO Conservation Science biologist Linette Luna, who recognized the male's distinctive song. This was the first confirmed breeding record for the San Joaquin Valley since 1919, and an encouraging sign of the effectiveness of riparian restoration.

Once common in riparian areas throughout the Central Valley, the endangered subspecies has suffered from loss of habitat and from brood parasitism by the brown-headed cowbird, a relative newcomer to California. Unlike songbirds that co-evolved with cowbirds, the vireo lacks an effective nest defense. Female cowbirds destroy or eject the hosts' own eggs and replace them with their own, leaving the victims to raise a clutch of cowbirds rather than vireos. By the time the least Bell's vireo was federally listed in 1986, the California population had fallen to 300 breeding pairs, mostly in San Diego County.

With effective cowbird control and riparian restoration, the vireo began to regain portions of its lost range. Appropriate nesting habitat had been created at the San Joaquin River refuge in a project coordinated by the US Fish & Wildlife Service, involving PRBO Conservation Science and River Partners. In addition to willows and other streamside trees, River Partners planted a herbaceous understory of mugwort and other species to attract songbirds such as the yellow warbler. The second vireo nest (a presumed second brood attempt), discovered by PRBO CS field biologist Julian Wood, was in an arroyo willow screened by mugwort.

The CALFED grant for the restoration expired in 2005. Refuge personnel and biologists are hoping for additional funding to monitor possible nesting attempts in the next breeding season, if the vireos return from their Mexican wintering grounds.

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Riparian Brush Rabbit

Populations of the federally listed (endangered) riparian brush rabbit (*Sylvilagus bachmani riparius*) are largely restricted to riparian habitat along the Stanislaus River in Caswell Memorial State Park, the San Joaquin River National Wildlife Refuge, and two small parcels of private land along the San Joaquin River. The rabbits were thought to be restricted to the habitat in Caswell until surveys discovered the two additional populations (one of which was recently found to be more extensive than first thought), and a cooperative state/federal effort began a breed-and-release program on the refuge. The captive breeding program was begun in early 2002, with three male and three female rabbits released into an enclosed pen during the winter. The rabbits successfully bred, and 49 young rabbits were later released into natural riparian habitat at the refuge. The program was expanded in 2003, with two additional enclosures and 194 young rabbits released into the refuge. As of December 2005, 100 more were waiting for release (M. Kinsey, Pers. Comm. 2005), and 30 had been released at a second site, on a privately owned ranch near Vernalis. The rabbits are not released into the wild until they are large enough to successfully survive the translocation. All rabbits are screened by a veterinarian before being released.

The numbers in Caswell were extremely low in 2001, but rebounded slightly in 2002 and 2003. The population remains too small to allow population size estimation tools to function properly, so the exact size of the Caswell population is not known. Efforts are underway in the park to improve the habitat for rabbits, as well as for federally listed (endangered) riparian wood rats (*Neotoma fuscipes riparia*).

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Harbor Seal

San Francisco Bay harbor seal (*Phoca vitulina*) numbers have remained fairly stable over the past decade, and are estimated to be over 600. Although approximately 12 haul-out sites are known in the Bay, harbor seals are found in the greatest numbers throughout the year at three sites: Mowry Slough, Yerba Buena Island, and Castro Rocks. Mowry Slough, the largest pupping site in the Bay, is used predominantly during the pupping (mid-March–May) and molting (June–mid-August) seasons. Since 2000, approximately 300 harbor seals and over 100 pups have been counted at Mowry Slough each pupping season. In the winter (mid-November–mid-March) months, when Pacific herring (*Clupea pallasi*) spawn in the Bay, the number of seals at Yerba Buena Island increases to 200 to 300 harbor seals (1998–2004).

Additionally, the number of seals using Castro Rocks, a chain of rock clusters just south of the Richmond Bridge and the second-largest pupping site in the Bay, has increased greatly during the winter season since 2000, with a maximum of 300 to 600 seals recorded during recent years. The increase in seals hauling out at Castro Rocks in the winter may be related to shifts or increases in herring spawning closer to Castro Rocks. Castro Rocks is used by an average of 100 seals year-round (2000–2004). Seismic retrofit work began on the Richmond Bridge in early 2001, and researchers from San Francisco State University monitored what effect the construction had on seal numbers and behavior. Despite an early shift in site use to rocks located farther from the bridge when construction was underway in the immediate area, and an increase in disturbances due to construction activity, seals maintained use of the Castro Rocks haul-out site for the duration of construction work (2001–2005). (Green, Pers. Comm., 2006)

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Salt Marsh Harvest Mouse

It is not known whether the population of the Bay's endangered salt marsh harvest mouse (*Reithrodontomys raviventris*) has changed significantly over the past five years. Population studies are conducted only when development projects or changes in land use threaten the mice, and few such studies have been required during this time. When such studies are conducted, their piecemeal nature makes it difficult for scientists to get a take on overall population trends. Several marsh restoration projects that could impact mouse populations are underway in the North Bay, and large scale salt pond restoration has begun in the South Bay, but it will take years to decades for new marshes to be produced and hence increase mouse populations. Meanwhile, recent surveys document that there is very little mouse escape cover left in the South Bay, where what was once miles of high marsh vegetation has been reduced to a maximum width of 8 to 9 feet or eliminated completely. (Shellhammer, Pers. Comm., 2005)

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California Red-Legged Frog

The once-abundant California red-legged frog (*Rana aurora draytonii*), federally listed as threatened, has disappeared from approximately 70 percent of its historical range. It is now found only in coastal wetland areas and freshwater streams from Marin County south to Ventura and in scattered streams in the Sierra Nevada. Range-wide, only four populations contain more than 350 adults. Habitat loss, stream sedimentation, pesticides, and predation all threaten the frog, the largest native to the western United States. In spring 2004, the US Fish & Wildlife Service renewed a proposal to declare 4.1 million acres across California, including parts of the Bay Area, as critical habitat for the frog. Following litigation, FWS issued a revised proposal in November 2005 which eliminated 82 percent of the area in the original proposal, including many of the core areas delineated in the 2002 recovery plan. In the Bay Area, the new proposal eliminates almost all critical habitat in eastern Contra Costa County based on a habitat conservation plan. The revision also exempts routine ranching activities on private land from federal coverage. In 2005, a court decision required the Environmental Protection Agency to consult with FWS on the registration of 66 pesticides with potential impacts on the frog.

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Western Snowy Plover

In the Bay Area, the federally threatened Pacific Coast western snowy plover (*Charadrius alexandrinus nivosus*) is primarily associated with commercial salt evaporation ponds and levees, which means that land managers have not to date been able to actively manage habitat or resources for this species. However, the recent purchase of more than 15,000 acres of salt ponds in south S.F. Bay by Fish & Wildlife and Cal Fish & Game could aid in plover recovery. Future pond management will include managing several of these ponds as plover nesting and foraging habitat, as well as conducting predator control and minimizing human disturbance. These actions are outlined in Fish & Wildlife's draft recovery plan for the plover, which calls for increasing the S.F. Bay breeding population from its current level of 150 to 200 individuals to 500. While the Bay did not historically support 500 snowy plovers, managing salt evaporation ponds for plovers is an opportunity for it to play a significant role in the recovery of this species, especially because many of the plover's historic coastal breeding and wintering sites have been degraded by human disturbance and

urban development. Off-leash dogs also pose a significant threat to snowy plovers at coastal breeding sites. Breeding season surveys conducted in 2004 by the S.F. Bay Bird Observatory and the Don Edwards National Wildlife Refuge indicate that approximately 113 plovers used Bay salt ponds during the breeding season, an increase from 2003, with the highest concentration in DFG's Eden Landing Nature Reserve. In that year 59 nests were found and followed through to completion to determine hatching success. Due to late rains in 2005, plover breeding habitat was severely reduced as many of the ponds were flooded until midsummer. Twenty nests were found in 2005. Many were on Refuge property, since much of Eden Landing was flooded. The breeding season window survey conducted in May 2005 found 124 plovers mostly in salt pond habitats around the Bay (Strong Pers. Comm., 2006). Avian predator surveys were conducted in 2004 and 2005 to determine which predators may be posing the highest risk to plover success. Common ravens were found to be the primary avian predator of concern in both years, but California gulls may also become a problem due to the exponential growth of their colony in salt pond A6. The US Fish & Wildlife Service's final determination of critical habitat for the plover, issued in 2005, eliminated half of the area originally proposed, including all Bay Area habitat: the South Bay salt pond restoration area was excluded because it must also provide habitat for least terns, clapper rails, harvest mice, and waterfowl, and resource managers will therefore need flexibility in managing the site. Concurrently, a petition to de-list the plover is under agency review.

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Western Burrowing Owl

The diminuitive, long-legged western burrowing owl (*Athene cunicularia hypugaea*) was once common throughout the West but has declined precipitously in California in the last several decades—breeding owls have been eliminated from at least 8 percent to 10 percent of their former range in the state and are trending toward extinction in another 25 percent. Currently, estimates are that more than 70 percent of California's breeding owls live in the margins of agricultural land in the Imperial Valley. Locally, burrowing owl population declined 50 percent from the 1980s to the 1990s. The owl has been extirpated as a breeding bird from San Francisco and Marin counties and from most of San Mateo and Sonoma counties. Breeding owls can still be found in scattered spots in the East Bay, primarily in eastern Alameda and Contra Costa Counties, and in Santa Clara County, where a census seven years ago estimated only 120 to 141 pairs remained. Burrowing owls nest in the burrows of ground squirrels and other mammals. They require open fields with adequate food supply for foraging, low vegetative cover (to watch for predators), and adequate roosting sites. Burrowing owls are threatened primarily by habitat loss due to urban development and by the corresponding eradication of ground squirrels and other burrowing rodents. Other factors contributing to the decline of owls statewide include burrow destruction through disking and grading, pesticide impacts, increased predation by non-native or feral species, habitat fragmentation, and other human-caused mortality from vehicle strikes, electrified fences, collisions with wind turbines, shooting, and vandalism of nests. The state-approved practice of relocating owls from development sites is accelerating local extirpations from rapidly urbanizing areas. Owls typically nest in the same burrow year after year and often try to return to their former homes. One study found that only one relocation in eight resulted in successful nesting at the new site. The owl was listed as a state species of special concern in 1994. In December 2003, the California Fish & Game Commission denied a petition seeking threatened or endangered status for the owl under the state Endangered Species Act. A statewide census is planned for 2006, and a new petition may be filed if continuing decline is documented.

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Soft Bird's-Beak

Soft bird's-beak (*Cordylanthus mollis ssp. mollis*), state and federally listed as endangered, survives in only 19 widely scattered sites in the coastal salt and brackish tidal marshes around San Pablo and Suisun bays and in Contra Costa, Napa, and Solano counties, with individual populations fluctuating from year to year.

The hemiparasitic bird's-beak is photosynthetic and can fix its own carbon for growth requirements. It also attaches to a variety of hosts, including pickleweed, saltgrass, and exotic forbs and grasses. In turn, it supports native bee pollinators and moth species whose larvae eat its seeds. Ninety percent of its historic habitat has been lost with conversion of tidal marsh to farmland. Water pollution, muted tidal hydrology, host association with exotic winter annual plants, competition with invasive plants, habitat fragmentation, exces-

sive seed predation associated with reduced tidal hydrology, mosquito abatement activities, trampling by over-grazing or human activity in sensitive marshes, and naturally occurring events also threaten the plant.

Researchers planted soft bird's-beak seeds in test plots at Rush Ranch in 2000. They found that the plant does best in patchy habitat, with gaps to provide sunlight for seedlings, and that clipping back the vegetative canopy gives the parasites a crucial boost, although exotic plants take advantage of the gaps. High seedling mortality at the reintroduced and natural population sites was linked to host association with non-native plants. The Rush Ranch population is expanding by natural dispersal, and many seedlings have established outside the experimental plots. However, other populations have been displaced by invasive plants within the last two years. (B. Grewell, Pers. Comm. 2005)

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Water & Sediments

Bay Contaminants

Water and sediment of the Estuary meet cleanliness guidelines for most pollutants. However, a few problem pollutants are widespread in the Estuary, making it rare to find water or sediment in the Estuary that is completely clean. Several pollutants are present at levels of concern. A fish consumption advisory remains in effect due to concentrations of mercury, PCBs, dioxins, and organochlorine pesticides of potential human health concern in Bay sport fish. A duck consumption advisory is also in effect due to selenium concentrations of potential human health concern.

Over the long term, the Estuary has shown significant improvements in basic water quality conditions, such as oxygen content, due to investments in wastewater treatment. Contamination due to toxic chemicals has also generally declined since the 1950s and 1960s. Long-term trends for pollutants of current concern vary from pollutant to pollutant. Mercury concentrations in striped bass, a key mercury indicator species for the Estuary, have shown little change in 30 years. PCB concentrations appear to be gradually declining. Concentrations of DDT, chlordane, and other legacy pesticides have declined more rapidly and may soon generally be below levels of concern. On the other hand, concentrations of chemicals in current use, such as pyrethroid insecticides and polybrominated diphenyl ethers (PBDEs) are on the increase. Aquatic toxicity has declined in the past few years, possibly associated with reduced usage of organophosphate pesticides. Sediment toxicity, on the other hand, has consistently been observed in a large proportion of samples tested over the past ten years.

There are indications that the current levels of contamination may be harming the health of some wildlife species. Mercury concentrations appear to be high enough to cause embryo mortality in clapper rails, an endangered species found in Bay tidal marshes. PCB concentrations may be high enough to also cause low rates of embryo mortality in Bay birds and to affect immune response in harbor seals. Selenium concentrations appear to be high enough to cause abnormalities in early life stages of Sacramento splittail and white sturgeon. Pollutant mixtures appear to similarly affect early life stages of striped bass. Assessments of benthic communities in the marine and estuarine regions of the Bay indicate that some areas may be impacted by pollutants. The frequent occurrence of sediment toxicity is another indicator of pollutant impacts in Estuary sediments.

During the past two years considerable progress has been made on several cleanup plans ("TMDLs") for pollutants of concern. The San Francisco Bay Regional Water Board is nearing completion of TMDL projects addressing mercury, PCBs, diazinon, pathogens, and sediment. There are currently 270 San Francisco Bay Region listings on the State's 303(d) list of impaired waters. Upon completion of these TMDL projects that are scheduled for Water Board action by June 2006, we will have resolved over 100 impairment listings in the Region. Other projects in the works include TMDLs for mercury in the Guadalupe River Watershed, and sediment in San Francisquito Creek and Sonoma Creek.

MORE INFO? www.waterboards.ca.gov/sanfranciscobay/tmdlmain.htm

Delta & Upstream Contaminants

The freshwater side of the Estuary does not have a systematic monitoring program to evaluate contaminant levels in water, sediment, or biota. However, contaminants documented to exceed either water quality objectives or concentrations toxic to aquatic organisms in the Delta have been given the highest priority by the Central Valley Regional Water Quality Control Board for development of regional load reduction and control programs (TMDLs) under the Clean Water Act.

In 2004–2005, the Board adopted amendments to its Basin Plan to address water quality problems in the Delta associated with elevated levels of diazinon and chlorpyrifos, and low dissolved oxygen levels in the Stockton Deepwater Ship Channel. The Basin Plan amendments for each include an implementation plan with a schedule, and monitoring to assess compliance. Each plan contains a reopener clause after about five years to ensure that monitoring results and new scientific findings are incorporated into the revised implementation plans. A methyl mercury basin plan amendment is scheduled for Board adoption in the summer of 2006.

In the Sacramento basin in 2005, the Regional Board adopted Basin Plan amendments to control methyl mercury in Harley Gulch and Cache Creek. An amendment to control methyl mercury levels in fish in the lower American River is scheduled for 2006–2007.

In the San Joaquin basin, the Board adopted amendments for chlorpyrifos, diazinon, boron, and salt in 2005. The pesticide basin plan amendment included a formula for additivity when multiple insecticides were simultaneously present in water. Ongoing monitoring shows that concentrations of diazinon and chlorpyrifos continue to fall throughout both the Sacramento and San Joaquin watersheds, most likely because of decreased agricultural use.

MORE INFO? www.swrcb.ca.gov/rwqcb5/

Photo courtesy of PWA.