The State of the Birds San Francisco Bay 2011

PRBO Conservation Science and the San Francisco Bay Joint Venture

Purpose

This report summarizes the current state of knowledge on the bird populations of San Francisco Bay, while also recommending science-based actions needed to conserve them and the habitats they depend upon.

Within this report are population trends, threats, and recommended actions for land and water managers, policy-makers, non-profit conservation groups, and researchers.

The messages delivered through the report aim to enhance bird conservation in San Francisco Bay by (1) guiding habitat restoration, management, and acquisition; (2) increasing knowledge of the population status of San Francisco Bay's birds and the threats to their habitats; and (3) influencing public policy and public awareness of bird and ecosystem conservation needs.

Produced by PRBO Conservation Science and the San Francisco Bay Joint Venture.

PRBO Conservation Science (PRBO) is dedicated to conserving birds, other wildlife, and ecosystems through innovative scientific research and outreach. Our 120 staff and seasonal biologists use the studies of birds and their habitats to guide biodiversity conservation from Alaska to Antarctica. PRBO is especially active in San Francisco Bay wetlands, where we currently play a lead role guiding the restoration and management of thousands of acres of tidal habitats. PRBO also studies the ecosystem effects of climate change and uses scientific analyses to inform land managers and decision-makers about priority actions for conserving ecosystems and wildlife.

The San Francisco Bay Joint Venture is one of eighteen Joint Ventures established under The Migratory Bird Treaty Act and funded under the annual Interior Appropriations Act. It brings together public and private agencies, conservation groups, development interests, and others to restore wetlands and wildlife habitat in San Francisco Bay watersheds and along the Pacific coasts of San Mateo, Marin and Sonoma counties. The goal of the San Francisco Bay Joint Venture is to protect, restore, increase, and enhance all types of wetlands, riparian habitat, and associated uplands throughout the San Francisco Bay region to benefit birds, fish, and other wildlife.

Please cite as: Pitkin, M. and Wood, J. (Editors). 2011. The State of the Birds, San Francisco Bay. PRBO Conservation Science and the San Francisco Bay Joint Venture.

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South San Francisco Bay salt pond restoration area

Foreword

San Francisco Bay and its surroundings have always been in a state of change, but the rate and magnitude of changes have accelerated dramatically ever since gold mining in the mid-1800s deluged the Bay with sediments and contaminants. More recently, burgeoning urban development and the alteration of freshwater flows into the Bay – resulting from massive re-engineering of water distribution in the Sacramento-San Joaquin Delta – have increased pressures on natural ecosystems. And while the future is always uncertain, there is little question that sea level rise and storm surges will fundamentally alter both urban and natural areas around the periphery of the Bay.

In order to manage and conserve ecological systems in the context of past changes, and adaptively respond to ongoing and future changes, it is essential to understand where we are now. The State of the Birds: San Francisco Bay 2011 summarizes what we currently know about bird populations and their recent trends in the Bay Area.

San Francisco Bay is an area of hemispheric importance to migratory waterbirds. It harbors populations of species that have undergone evolutionary diversification in different parts of the Bay. Several of these populations are officially recognized as Threatened or Endangered, and others are of special conservation concern. In a broader sense, birds are indicators of the overall condition of habitats and ecosystems in the Bay – the proverbial "canaries in the coal mine." Tidal-marsh species can tell us not only about the condition of the marshes, but about the capacity of those marshes to provide huge benefits to people – ecosystem services – through flood protection and enhancement of water quality. And, at the end of the day, birds are an essential part of what makes San Francisco Bay a truly special place.

Shorebirds in San Francisco Bay

The State of the Birds report details the many factors that threaten bird populations in the Bay Area. Some of these – predators ranging from house cats to Peregrine Falcons; competition with invasive species such as Barred Owls; or continuing loss of habitat in the face of development – are clear and present dangers. Others, such as the drowning of marsh habitats due to sea level rise, are lurking in the future.

John A. Wiens (PRBO Conservation Science)

Yet others may be consequences of our own conservation work. A major effort is now underway to restore a network of artificial ponds once used for salt production to tidal marshes. This restoration will create new habitat for marsh-dwelling species such as Common Yellowthroats and Clapper Rails. At the same time, it will reduce the amount of shallow open-water ponds that some nesting birds, ducks, and wintering shorebirds currently use.

How these ripple effects play out may depend on whether other processes (such as sea level rise) create suitable habitat elsewhere and if habitat created specifically for ducks and shorebirds within the restoration project proves successful. This largest restoration project on the West Coast is something to be proud of, especially as it moves forward with ongoing monitoring helping to quantify the impact to birds, making course corrections as needed to ensure the most benefit for birds in the San Francisco Bay Estuary.

Dealing with the conservation challenges is not simple. But neither is it impossible. At a time when news reports seem to contain only discouraging messages about the state of nature, *The State of the Birds* indicates that populations of many species in the Bay Area are stable or increasing, and it highlights several examples of conservation success. These, together with the many specific recommendations for actions by managers, scientists, or the public that may help to counter downward trends for other species, give hope.

Arrowhead Marsh, Oakland shoreline

Above all, the report emphasizes the importance of monitoring. We know what we know now because populations of several species in the Bay Area have been monitored for more than a decade. Continued monitoring will enable us to spot troubling trends and take actions to address the root causes before they become emergency-room cases.

Overview

In this first ever State of the Birds report for San Francisco Bay, we learn that most bird populations are stable. Some species are clearly benefiting from conservation action while others are struggling. In the following pages, the report highlights these trends, challenges, and the actions people can take to make a difference.

Most bird populations are stable.

When we evaluated groups of birds for each habitat, we found that most are now stabilizing. This includes birds dependent upon subtidal (submerged) habitats, tidal flats, marshes, and oak woodlands and the endangered Spotted Owl.

Riparian birds and two endangered species have increased.

Riparian birds – species that require stream-side habitat – and two of our threatened and endangered species, the Snowy Plover and Least Tern, have shown some increases. Recently, the Snowy Plover has been increasing from very low levels, and the Least Tern may be starting to stabilize after years of population growth.

Grassland and coastal scrub-chaparral birds are losing habitat.

Species in these habitat types continue to be impacted by loss and degradation of habitat from development, invasive species, and lack of natural disturbances such as fire. These trends are consistent with the declining trend found in the National State of the Birds Report, 2009.

California Clapper Rail still struggles.

Perhaps one of the Bay's most iconic birds, this rail still struggles because of habitat loss, predator pressure, and invasive species. Sea level rise will make it even harder for rails to persist as they are pushed into marginal habitat with rising seas and strong storms. Tidal marsh restoration efforts and scientific monitoring must continue to ensure that this endangered bird can persist into the future, especially as the location and extent of marsh habitat change.

Over one million shorebirds use the tidal flats and shallow ponds of the San Francisco Bay each year.

All habitat types harbor species at risk.

Declines can be early warnings of a decline in ecosystem function. Causes of declines need to be investigated and actions should be taken to stabilize bird populations. Species to watch include: California Clapper Rail, Western Sandpiper, Forster's Tern, Caspian Tern, Black-crowned Night Heron, Snowy Egret, Canvasback, Northern Pintail, scaup and scoters.

Melissa Pitkin (PRBO Conservation Science)

Sea level rise is a critical threat.

Habitat restoration needs to take advantage of the best scientific modeling to predict the best places to restore marshes and guide restoration design to ensure that marshes, and the benefits they provide wildlife and people, are maintained.

Extreme weather events are predicted.

Climate models predict more frequent extreme weather events, such as strong storms and heat waves, as the climate changes. These unusually strong events can cause nest failure, facilitate predation, and cause individual bird death.

The amount of tidal flat habitat needed requires more study.

Keeping one million shorebirds in San Francisco Bay requires better understanding of how many acres of tidal flats are needed to maintain the Bay's high shorebird numbers. Understanding how sea level rise will change the amount and location of tidal flats is a high research priority.

Restorationists can learn from one another.

The South Bay Salt Pond Restoration Project will provide valuable lessons for future marsh restorations within the Bay.

Predator and invasive species control must continue.

Both animal and plant, and native and non-native predators and invasive species, remain an ongoing threat. Funding is needed for predator control, invasive removal, and outreach to the public on their role in reducing predators (such as feral cats) and invasive species.

Human activities can be designed to reduce impacts to birds.

Disturbance from human recreation, maintenance, and transportation activities is something we can control and reduce to lessen pressures to birds during their sensitive nesting period.

Restored wetlands in Sonoma Baylands.

Critical long-term monitoring research for Clapper Rails and Black Rails.

Science must continue.

Continued monitoring of the Bay's bird populations is necessary, to evaluate our success at maintaining healthy ecosystems. Birds are the proverbial "canary in the coal mine." Tracking their populations will help us solve problems before they become "emergency-room cases."

A mix of public and private funding is needed.

To ensure our ability to protect existing habitats, respond to new threats, and maintain and enhance the quality of Bay waters upon which birds and people depend, a mix of funding sources is necessary.

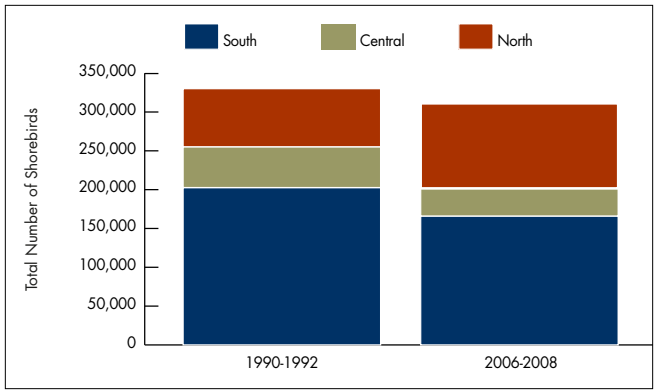
Tidal Flats

Dunlin feeding

Exposed twice a day by the Bay's low tides, tidal flats are teeming with life. Small clams, marine worms, and crustaceans feed more than one million shorebirds each year. Today, 42% of the Bay's tidal flats have been lost compared to historic levels.

In addition, shorebirds in San Francisco Bay are also dependent on salt ponds, many of which are now managed to maximize their value as shorebird breeding and foraging habitat. (See Managed Ponds, pages 8–11, for more information.)

San Francisco Bay is so critical to the health of shorebird populations that it has been designated a Site of Hemispheric Importance for Shorebirds (www.whsrn.org).



November high tide roost counts of shorebirds throughout San Francisco and San Pablo Bays.

Willet

Status — Overall stable, with a geographic shift from south to north.

Trends — Overall, the shorebird population in San Francisco Bay has remained stable since the 1990s, but an increase in the North Bay and apparent decrease in the Central and South Bays indicate a shift of shorebirds from south to north.

One of the more common species, the Western Sandpiper, appears to have declined Bay-wide.

Two other common species — Least Sandpiper and Willet — have increased greatly.

Keeping one million shorebirds in San Francisco Bay will require maintaining sufficient tidal flat habitat as well as other shallow water habitats, especially as sea level rises. The amount of tidal flat and other habitats needed by shorebirds should be determined.

Julian Wood and Gary Page (PRBO Conservation Science)

Threats

- **Primary threat: Loss of tidal flat feeding habitat** due to sea level rise, erosion from storm surges, and invasive plants (e.g., hybrid *Spartina*).
- **Loss of shallow water feeding habitat,** as former salt ponds transition to tidal marsh through active restoration or through levee failure due to impacts of sea level rise.
- **Reduction of food (invertebrates)** caused by invasions of non-native invertebrates, pollution, and climate change impacts.
- **Human-caused disturbance** to feeding and resting shorebirds, resulting in birds having less energy for migration and survival.
- **Loss of high tide roosting habitat** such as levees, islands, structures, and high ground as sea level rises, levees are removed or deteriorate, and islands within restored ponds are submerged.

Actions

Planning, Management, and Restoration

- **Plan for mudflat creation and sustainability** by conducting physical modeling exercises and assessing those results over time to ensure that current and future coastal defense (e.g., levees, rip-rap, and seawalls), salt pond restoration, and development does not reduce mudflats. Future restoration should focus on increasing both tidal flat and tidal marsh habitats.
- **Maintain shallow pond** feeding and roosting habitat, especially when tidal flats are inaccessible during high tides.
- **Control non-native plants** that colonize mudflats (e.g., hybrid *Spartina*).
- **Remove non-essential barriers** such as dams, culverts, levees, and other structures that inhibit natural flow and settling of sediment.
- **Restore watersheds** to facilitate movement of tidal flats to higher areas as sea level rises and to promote movement of sediment downstream to feed tidal flats.
- **Minimize pollution from runoff** on paved surfaces, allowing rainfall to soak into the ground; convey and treat storm water runoff using landscape features such as rain gardens and other water conservation systems.
- **Manage for a mix of pond conditions** with depths ranging from 2 to 5 cm and salinities from 120 to 200 ppt for optimum shorebird use.
- **Provide and protect roosting habitat** away from areas of frequent human use.
- **Reduce human-caused disturbance** (e.g., hiking, dog walking, boating) in areas where shorebirds feed in high densities (e.g., Napa River tidal flats, San Leandro Bay, and Hayward southward to southern San Francisco Bay). Collaborative planning between the San Francisco Bay Water Trail and the Bay Trail can consider actions to minimize disturbance.

Western Sandpipers

Scientists

- **Determine the amount of ponds, other shallow water habitat, and tidal flats** needed to support the Bay's breeding and migratory shorebirds.
- **Conduct early winter Bay-wide shorebird surveys** annually to spot potential declines quickly. Participate as a citizen scientist in the Pacific Flyway Shorebird Survey (www.prbo.org/pfss).
- **Monitor site-specific shorebird response** to restoration, and study how mudflat characteristics influence habitat quality for shorebirds.
- **Conduct research to better understand and predict changes in tidal flat habitat** in the context of sea level rise and potentially decreasing sediment supply.

Managed Ponds

Commercial salt ponds were constructed around the edge of San Francisco Bay beginning in the mid 1800s. Many former salt production ponds in San Francisco Bay have recently transitioned to public ownership and are being restored and managed for wildlife. These shallow ponds now provide habitat for hundreds of nesting terns, gulls, and shorebirds, and roosting and feeding habitat for hundreds of thousands of migrating and wintering shorebirds and ducks.

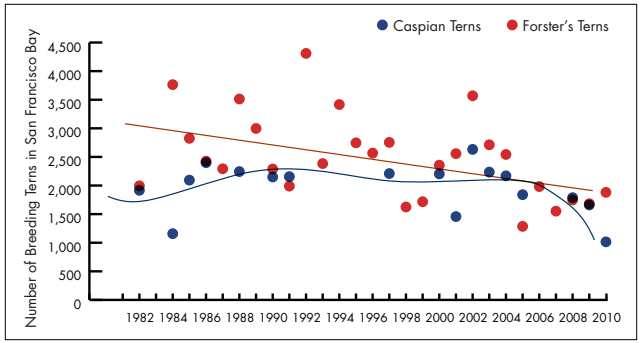
The South Bay Salt Pond Restoration Project (15,100 acres) plans to restore 50–90% of the South Bay ponds to a mix of tidal marsh and shallow managed ponds. The Napa-Sonoma Marshes Wildlife Area in the North Bay is restoring 4,200 acres of salt ponds to tidal marsh. Cargill Salt still manages about 11,000 acres for salt production, all in the South Bay.

Northern Shoveler female

Status: Mixed.

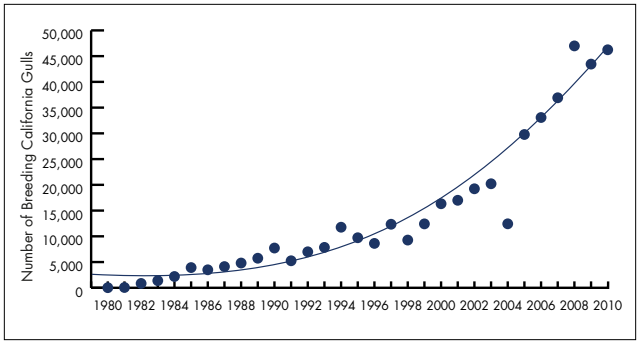
As restoration progresses, the bird community may change: tidal marsh species (pages 12–13) will colonize newly created salt marsh habitat; some waterbirds, such as shorebird and duck species that use open water or tidal flats, may move out. Ongoing monitoring will track how bird species and numbers change over time.

Forster's Terns at nest site

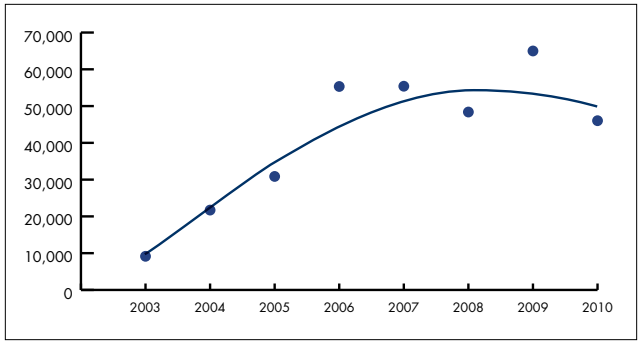


Forster's and Caspian Tern use of salt ponds – Declining; the Forster's Tern breeding population varies annually but is declining Bay-wide. Caspian Terns show a decrease, especially in recent years.

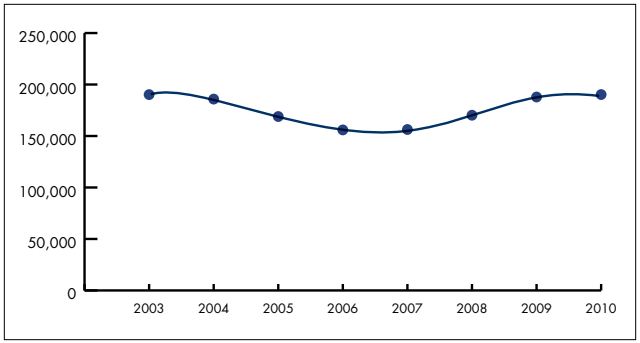
Josh Ackerman and Arriana Brand (U.S. Geological Survey);
Jill Demers and Catilin Robinson-Nilsen (San Francisco Bay Bird Observatory)



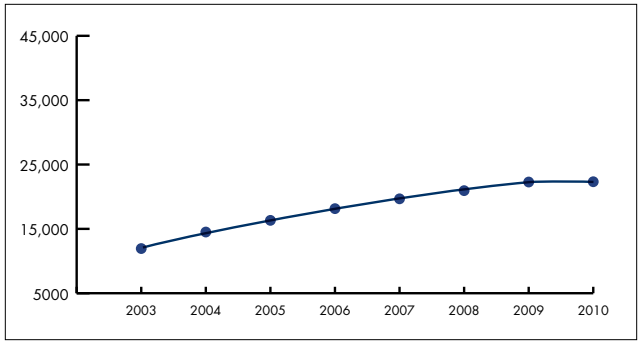
California Gulls (South Bay ponds) – Increasing rapidly; the population is now at 46,000 gulls.



Wintering Dabbling Ducks (South Bay ponds) – Have increased in the last seven years: see the Success Stories section, page 34.



Spring-Migrating Small Shorebirds (North and South Bay ponds) – Have remained relatively stable.



Spring-Migrating Medium-sized Shorebirds (North and South Bay ponds) – Have increased slightly, according to eight years of monitoring by USGS.*

*Data for medium-sized and small shorebirds and dabbling ducks come from peak counts for shorebirds (spring) and ducks (winter) in North and South Bay ponds.

Nesting Shorebirds (South Bay ponds) – Population trends unknown, underscoring the need for ongoing monitoring of breeding shorebirds. American Avocets and Black-necked Stilts are the most abundant nesting shorebirds; breeding American Avocets are estimated at 1,380 pairs, and Black-necked Stilts are estimated at 590 pairs, as of 2003.

Black-necked Stilt

Note: The Western Snowy Plover also nests in the salt ponds; see the Endangered Species section, page 24.

Threats, Actions

Please turn to page 10.

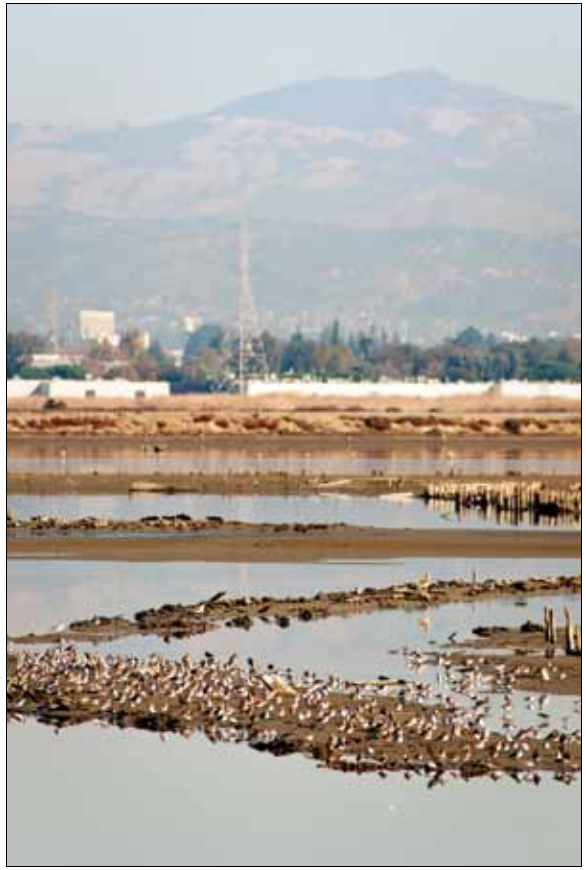
Managed Ponds

(continued from page 9)

Threats

- **Primary threat: Loss of shallow pond habitat** for roosting, foraging, and nesting waterbirds. Wintering and migratory shorebirds roost and feed in salt ponds at high tide. Ducks utilize shallow, low salinity ponds to forage and roost. Terns and shorebirds nest on islands and levees in pond habitat.
- **Rising sea levels** from global climate change may increase water depths or erode levees and nesting islands, impacting habitat for wintering, migrating, and nesting birds.
- **Nest predation and competition from a growing population of California Gulls,** which prey upon eggs and chicks or displace nesting waterbirds. Forster's and Caspian Terns have already been displaced from some of their historic nesting colonies by gulls.
- **Contaminants impairing bird reproduction.** Mercury, a legacy of years of mercury mining and use of mercury in gold mining, is a prevalent contaminant throughout San Francisco Bay. Mercury is especially high in the South Bay, where runoff from a large mercury mine in the upper watershed has released, and continues to release, mercury-laden sediments. Mercury impacts waterbird reproduction, specifically for the Forster's Tern, in which 48% of breeding adults are at or above high risk of impaired reproduction due to their present methylmercury concentrations.

American Avocets in breeding plumage



Shorebirds in managed pond habitat

Actions

Planning, Management, and Restoration

- **Convert a large proportion of salt ponds** to managed ponds. Maintain ponds with appropriate depths – and habitat of varying salinities – to benefit nesting, migrating, and wintering shorebirds and ducks.
- **Practice adaptive management** by monitoring waterbird responses to restoration and modifying restoration as needed (as in the South Bay Salt Pond Restoration Project).
- **Continue to create islands within managed ponds for breeding and roosting birds.** Experiment with adding vegetation to some islands to create cover for chicks.
- **Improve dissolved oxygen within managed ponds** by optimizing water flow between pond and Bay waters and reducing nutrient inputs from adjacent uplands.
- **Conduct an education campaign** to highlight the connection between urban waters and the Bay.
- **Slow the growth of the California Gull population** by reducing gull access to trash at local landfills and other areas. Evaluate whether removal of target gulls helps reduce predation pressures on nesting waterbirds.
- **Identify, protect, or manage key existing waterbird nesting areas Bay-wide,** given that waterbird populations may be affected by a reduction of pond habitat.

Scientists

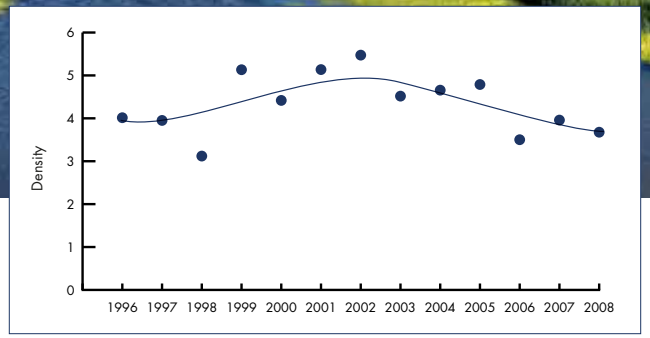
- **Monitor changes in abundance** of breeding, migrating, and wintering waterbirds over time to evaluate the overall effects of restoration.
- **Determine current breeding population size of nesting American Avocets and Black-necked Stilts.** Monitor their use, density, and reproductive success at created islands.
- **Assess habitat characteristics that enhance waterbird densities,** (e.g. water quality, water depth, salinity, invertebrate biomass, island characteristics), and provide restoration project managers with habitat characteristics that could maximize densities of waterbirds in the remaining ponded habitat as tidal marsh restoration proceeds.
- **Suggest ways to reduce the population growth of California Gulls** and their impact on other breeding waterbirds by identifying the causes of population growth and evaluating methods to control it.
- **Assess and track the changes in methylmercury concentration** in nesting Forster's Terns, American Avocets, and Black-necked Stilts as tidal restoration proceeds. Determine reproductive threshold concentrations of methylmercury in waterbirds to assess changes in risk of contaminant exposure as a result of tidal restoration efforts.

Northern Shoveler male

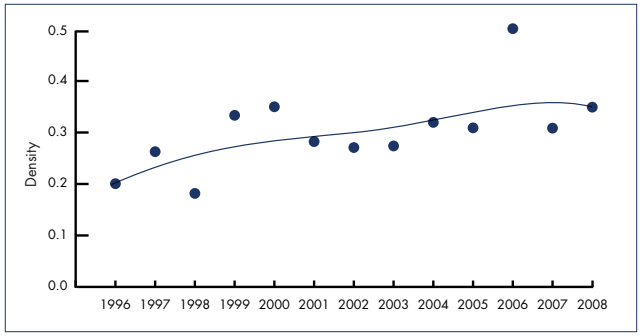
Success Story • South Bay Salt Pond Restoration Project – See page 34

Tidal Marsh

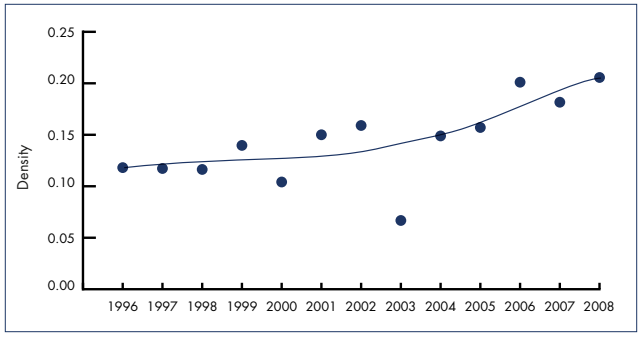
Tidal marshes are the vegetated, tidally influenced wetlands found along the edges of San Francisco Bay and associated channels. Pacific cordgrass, pickleweed, and other specialized plants adapted to salty water provide important habitat for many animal species, such as young salmon and other fishes, rails, songbirds, shorebirds, egrets, ducks, and the endangered salt marsh harvest mouse. Some animals, like the indicator species here and the salt marsh harvest mouse, are endemic to the tidal marshes of San Francisco Bay – meaning they do not occur anywhere else in the world. While 80% of historic tidal marsh habitat has been lost since the mid-1800s, growing marsh restoration efforts are reversing this trend and causing the acreage to increase again.



Song Sparrow – The most common tidal marsh bird is overall stable, but the last 10 years show declines.



Saltmarsh Common Yellowthroat – Prefers channels and brackish marshes and has increased since the 1990s.



California Black Rail – Recent increases give hope for this State-listed species.

Status: Stable to increasing

The three species chosen to indicate the state of the tidal marsh are Song Sparrow, Common Yellowthroat, and Black Rail. Data were collected from over 200 locations throughout San Francisco Bay Estuary using 5-minute point count surveys during April–May to assess breeding season density (birds per hectare).

Song Sparrow – Stable overall (decreasing North Bay and Suisun Bay; increasing South Bay)

Salt Marsh Common Yellowthroat – Slightly increasing.

California Black Rail – Recently increasing.

Note: For California Clapper Rail, see Endangered Species section, page 22.

California Black Rail

Julian Wood and Nadav Nur (PRBO Conservation Science)

Threats

- **Primary threat: Rising sea level** resulting in some marshes "drowning" or disappearing and other marshes transitioning from fresh water to brackish marsh or from high marsh to low marsh. Limited space remains along the Bay's shoreline for marshes to expand or regenerate.
- **Loss and conversion of restorable marsh** due to urbanization (especially in south and central Bay) threaten potential future marsh locations.
- **Extreme storm events** push water beyond typical high tide levels, eroding marsh habitat and flooding high marsh – critical as refugia for marsh birds. High water can flood nests and push rails and other marsh animals to higher ground and adjacent urbanized areas, where they are vulnerable to predators. High water events are predicted to become more severe and more frequent with climate change.
- **Invasive plants**, particularly invasive *Spartina* hybrids (crosses between native cordgrass and introduced cordgrasses), cover mudflat areas and channels, eliminating important feeding sites for shorebirds and marsh birds. Pepperweed invades marshes and channel edges, outcompeting gumplant and other native marsh plants required by Song Sparrows and Common Yellowthroats for nesting and cover.
- **Introduced and increased predators** such as non-native red foxes, Norway rats,and house cats, and native raccoons, corvids, and gulls prey upon birds nesting in marshes surrounding the Bay. Predator numbers are usually inflated near urban areas.
- **Pollution, contaminants, and toxic events** such as oil spills directly kill birds as well as vegetation, fish, and invertebrates. Mercury, PCBs, and other contaminants affect reproduction.

Actions

Common Yellowthroat

Planning, Management, and Restoration

- **Support and use sea level rise modeling tools** to better understand impacts on tidal marsh habitat due to climate change, and to prioritize areas for preservation and restoration of marsh habitat. For an example of a model focused on predicting Bay-wide changes to the tidal marsh ecosystem, visit www.prbo.org/sfbayslr.
- **Identify and protect upland areas** for marshes to move to as sea level rises.
- **Promote restoration in high-priority areas** like the Petaluma and Napa River systems and South San Francisco Bay that are better able to cope with rising sea levels.
- **Promote re-use of clean sediment** from dredged navigation channels to jump-start marsh restoration in subsided areas or to help marshes keep pace with sea level rise in the future.
- **Restore high-ground refugia,** such as broad levee slopes and gradual upland transitions, with native vegetation to offer birds and small mammals refuge from high tide events.
- **Support the South Bay Salt Pond Restoration Project,** and promote it as a model for future restoration efforts. This large restoration project can serve as a demonstration project, as it is being adaptively managed to ensure the most benefit to the San Francisco Bay ecosystem.
- **Halt development on existing or potential future baylands** including salt ponds, diked baylands, and uplands with future marsh potential.
- **Control introduced predators** such as red foxes and feral house cats, especially in areas with high concentrations of marsh birds. Educate the public about the impact of cats on bird populations, and remove feral cat feeding stations.
- **Reduce native predator populations** (raccoon, skunk, crow, and raven) by eliminating or securing food waste in parks, residential areas, businesses, and other sources near the Bay.
- Monitor and control introduced invasive plants early, when costs are lower, or when a direct threat to marsh birds is likely.

Scientists

- **Monitor marsh bird population sizes and reproduction annually** to determine Bay-wide trends and to evaluate the success of conservation efforts. Make results known to conservation practitioners and the public.
- **Advance predictive modeling** of future habitat conditions and bird response, to guide habitat acquisition and restoration.
- **Assess contaminant thresholds** in birds, to evaluate impacts of mercury and other toxins to marsh birds.

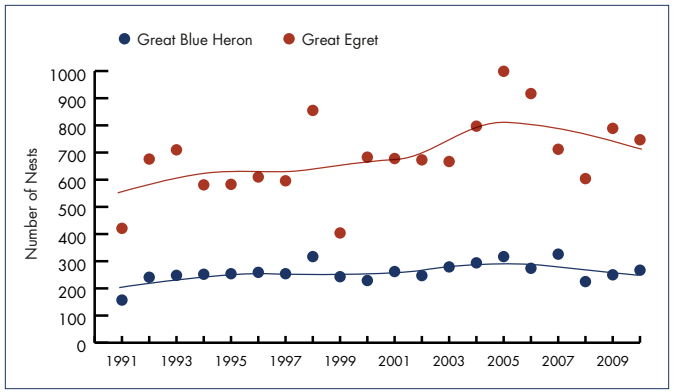
Success Stories South Bay Salt Pond Restoration Project – See page 34 Carl's Marsh restoration – See page 34

Tidal Marsh Herons and Egrets

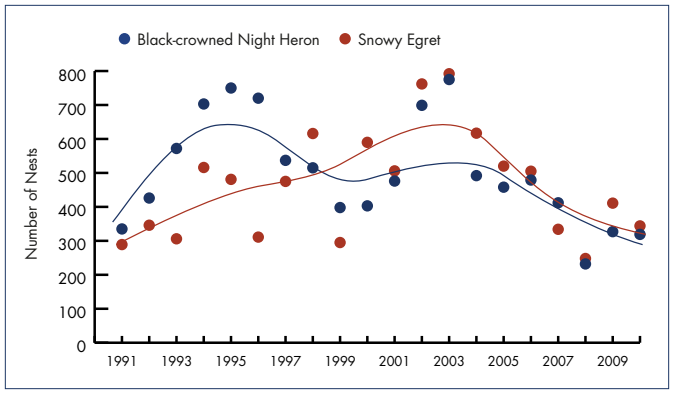
Nest colony on Sherman Island in the North Bay

San Francisco Bay's herons and egrets depend on large trees, dense types of vegetation, and man-made structures surrounded by tidal marsh, tidal mudflats, and non-tidal wetlands for nesting in spring and summer and for feeding year-round. Important feeding sites also include creeks and ponds.

View a map of the locations of all known egret and heron colonies in the San Francisco Bay Area: www.egret.org/googleearthheronries.



Great Blue Herons (blue) and **Great Egrets** (red) reveal dynamic but generally stable populations.



Black-crowned Night-Herons (blue) and **Snowy Egrets** (red) show dramatic variation in nesting abundances; however, recent trends (since 2005) suggest regional declines.

Status: Stable to decreasing.

The number of nests of herons and egrets throughout San Francisco Bay shows dramatic variation from year to year with an apparent decrease in the last 5–10 years. Large between-year declines are related to heavy rainfall, which can reduce the survival of young birds before they are old enough to breed.

Great Egret feeding half-grown chicks

John Kelly (Audubon Canyon Ranch);
Caitlin Robinson-Nilsen (San Francisco Bay Bird Observatory)

Great Blue Heron

Great Egret

Snowy Egret

Black-crowned Night-Heron

Threats

- **Primary threat: Loss or disturbance of colony nesting sites** from damage to nest trees or construction activities (noise) that scare birds away from nesting sites.
- **Loss of wetland feeding areas** close to the nesting colony (within 1–6 miles). Greater distance between nest and feeding areas reduces the chance of survival for their young.
- **Degradation of wetland feeding areas** and associated declines in prey (fish, small mammals, invertebrates).
- **Nest predation by native or non-native animals,** such as raccoons, feral cats, raptors, or ravens.
- **More intense winter storms**, as predicted with climate change, lower the survival of young egrets and herons.

Actions

Planning, Management, and Restoration

- **Protect and restore tidal marsh and tidal flat habitat within 1-6 miles of nesting sites**. This is the most urgent action needed to protect or sustain heron and egret nesting populations in San Francisco Bay.
- **Provide year-round protection to colony nesting sites.** They are frequently destroyed when trees or other habitat features are removed or damaged during the non-breeding season (fall and winter). Such protection depends on local action, recognizing that heron and egret use of surrounding areas depends on the year-round protection of colony sites.
- **Create 200-meter buffer zones** of no human activity around nesting areas during the nesting season (January–August).
- **Protect and restore wetland areas surrounding colony sites.**
- **Create and protect clumps of native trees** at distances of 5 miles or greater from existing colonies, preferably near open water.

Scientists

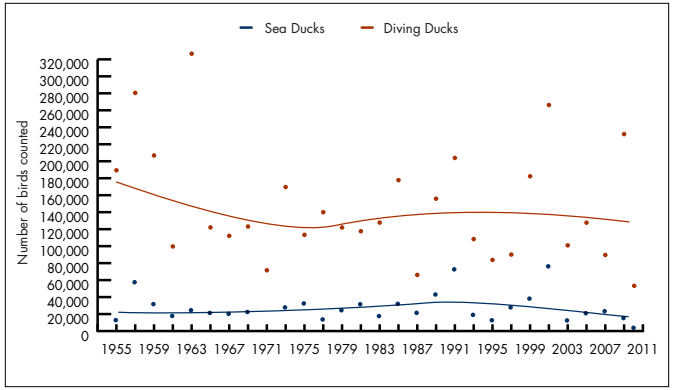
- **Improve models** of heron and egret habitat sensitivity as potential biological indicators of wetland condition, and identify factors that can determine the linkage between colonies and surrounding habitat.

Success Story West Marin Island National Wildlife Refuge – See page 35

Subtidal

Subtidal habitat is the habitat below the surface of San Francisco Bay, typically submerged. Birds using the subtidal habitat in the Bay feed on fish, shellfish (including mussels), invertebrates, underwater plants, and algae.

Canvasback



Sea Ducks (blue) – Overall stable but may be declining in the past two decades. **Diving Ducks** (red) – Populations are variable with no clear trend.

Greater Scaup

Surf Scoter

Status: Most diving and sea duck species are stable, but four species are declining.

The species of sea and diving ducks wintering in San Francisco Bay show stable populations, with the following exceptions:

Canvasback (a diving duck): Nationally, Canvasback numbers are highly variable around a long-term average of about 600,000. Locally, their wintering numbers in the Bay have shown long-term decline, perhaps due to habitat loss in the Bay or the creation of habitat in areas like the Central Valley.

Scaup (a diving duck) and scoters (sea ducks) are declining throughout North America as well as in the Bay. The San Francisco Bay populations of these two groups of ducks represent, on average, between 40% and 50% of all scaup and scoters counted in the Pacific Flyway. If conditions change in San Francisco Bay, a large percentage of the population may be affected.

Mark Herzog, Josh Ackerman, Susan W. De La Cruz (U.S. Geological Survey);
Jill Demers (San Francisco Bay Bird Observatory); Cheryl Strong (U.S. Fish and Wildlife Service)

Threats

- **Primary threat: Reduced quality and quantity of wintering habitat** from increasing contaminants (selenium, cadmium, and mercury); loss of deep pond habitat; and changes in prey species composition.
- **Climate change and sea level rise,** resulting in changed salinities and water depth. This could alter prey composition and herring spawning.
- **Loss of herring stock** in San Francisco Bay and along the Pacific Coast. Herring spawn is important in diving duck diets, particularly for scoters during spring migration, but also is used heavily by scoters and scaup throughout the winter.
- **Disturbance from boat traffic** flushes resting or foraging ducks off the surface of the water.
- **Winter oil spills** have the potential for catastrophic impact to duck populations.
- **Declining availability of quality breeding habitat** in Alaska, Canada, and the northern Intermountain West Region.

Actions

Planning, Management, and Restoration

- **Ensure that wintering habitat remains available** for sea ducks and diving ducks, by restoring and preserving deeper and less saline water ponds within restoration areas such as South San Francisco Bay and Napa-Sonoma Marsh.
- **Minimize pollution from runoff** by working with local governments and communities to create programs that reduce runoff (e.g. reducing impervious surfaces) and upgrade storm water and sewage treatment plant facilities.
- **Reduce contaminant release** when conducting restoration activities by maintaining deeper water depths. Special care should be taken to minimize actions that increase contaminant release (mercury, selenium, and cadmium) or methylmercury production in shallow water areas.
- **Minimize disturbance** in key foraging areas from recreational and ferry boats, especially in the following areas: in northern San Pablo Bay; near eelgrass beds; and within the central part of San Francisco Bay from the Bay Bridge to the San Mateo Bridge.
- **Encourage restoration of eelgrass,** which is a substrate for herring spawn and prey species like crabs, mussels, and small fish.
- **Implement the Subtidal Habitat Goals Report recommendations** for the restoration, protection, and science needed to protect this habitat type – www.sfbaysubtidal.org.

Scientists

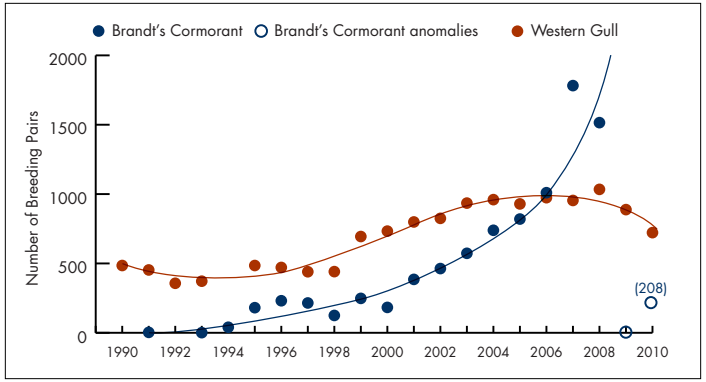
- **Continue the USFWS mid-winter waterfowl survey,** which has provided a consistent record of winter waterfowl populations since 1955.
- **Study prey density and waterfowl feeding behavior** to determine high-quality habitat that should be protected or enhanced (e.g. eelgrass, creek mouths, ponds, shoals).
- **Model carrying capacity** of intertidal and subtidal habitats to help set wintering population goals. Current efforts have shown the value of San Pablo Bay subtidal habitats, and they point to prey distribution and fish and shorebird competitors as key elements in future modeling efforts that incorporate all sub-bays.
- **Evaluate the effects** of human disturbance on foraging and roosting birds.
- **Model sea level rise, salinity, and sediment** to help predict how benthic prey availability in subtidal and intertidal habitats may change in the future.
- **Determine habitat connectivity** among San Francisco Bay, migratory corridors, and breeding areas to help establish flyway-wide conservation efforts year-round.

Human-created Habitats

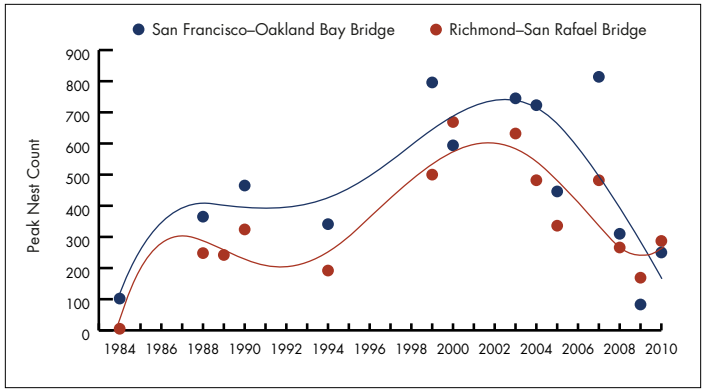
Several human-created habitats are used by birds: levees, bridges, and buildings, to name a few. Data on the bird use of all these habitats are not available. In this section we discuss two key places, Alcatraz Island and some of the Bay's bridges, where bird monitoring data exist.

Alcatraz, once a barren sandstone rock originally inhabited by seabirds, faced a long period of human settlement. In the last 20 years, the island has once again begun to attract seabirds that use its human-created structures as home.

Over100 feet above the water the I-beams and other support structures under the roadways of the Richmond–San Rafael Bridge and the San Francisco–Oakland Bay Bridge serve as nesting platforms for Double-crested Cormorants.



Brandt's Cormorants (blue) and **Western Gulls** (red) – Alcatraz Island reproductive success.



Double-crested Cormorants – Number of nesting pairs on Bay bridges.

Status: Stable

Seabirds are long-lived birds; thus their populations can withstand occasional years of poor reproduction or reduced reproductive effort. Because of this, evaluating the status of a nesting colony is done by looking at the reproductive success or breeding population size. The figures at left present over two decades of data on reproductive effort for cormorants and gulls.

Western Gull and Brandt's Cormorant: Stable. In 20 years of monitoring the nesting success of these long-lived seabirds, reproductive success has remained largely constant until 2009 and 2010. The complete nesting failure in 2009 and 2010 was likely due to a low anchovy population throughout the Central California coast region.

Double-crested Cormorant: Stable, though their reproductive success has varied over the last 26 years. In 2009 and 2010, these cormorants showed a sharp decline, but they appear to be recovering. The low number of nesting pairs in 2009 was likely due to a low anchovy population throughout the Central California coast region.

Meredith Elliott and Sara Acosta (PRBO Conservation Science);
Mark J. Rauzon (Laney College)

Threats

- **Primary threat: Human disturbance,** including maintenance activities, tourism, and boating, can cause seabirds to abandon the nesting colony.
- **Lack of food** due to steep declines in common prey species, as evidenced by the 2009 region-wide anchovy crash, can cause seabirds not to breed.
- **Losing nesting sites on human-created structures.** On Alcatraz, if nesting areas are opened for public tourism during the spring and summer, nesting habitat will be lost.
- **Contaminants accumulation in adult birds,** in high concentrations, can affect reproduction and chick survival. Cormorants are fish-eating birds and are at risk of accumulating contaminants (e.g., mercury, lead) from San Francisco Bay.
- **Climate change effects** such as extreme high temperatures result in heat stress in nesting birds (nausea, dizziness, seizures, death) and nest abandonment, as witnessed in 2008 on Alcatraz Island.

Actions

Planning, Management, and Restoration

- **Adjust timing of maintenance and construction activities and manage tourism** to reduce bird disturbance during the months of February–July. If not possible, maintenance and construction personnel should work with biologists on ways to limit disturbance.
- **Create new habitat on bridges and piers** when possible. Explore using methods of social attraction to draw birds to newly built 'cormorant condos' (artificial nesting structures on the new San Francisco–Oakland Bay Bridge).
- **Re-install historic buoys at Alcatraz** and work with the Bay Conservation Development Commission to implement seasonal closures to create a boat-free buffer zone during the seabird nesting season.
- **Educate tourists on Alcatraz about the sensitivity of nesting seabirds.** National Park Service programs should continue to increase tourist awareness of nesting seabirds on Alcatraz, especially with regard to closed areas during the nesting season.

Scientists

- **Assess contaminants through studies of nesting birds.** Failed-to-hatch eggs have been collected opportunistically from the bridge colonies, but eggs should be collected and analyzed for contaminants on an annual basis. Relating cormorant contaminants with prey contaminants can help identify which fish species carry the most contaminants in San Francisco Bay. Further research on lethal levels of these contaminants in Double-crested Cormorants should be considered.
- **Prey studies are needed.** A better understanding of Double-crested Cormorant diet is needed, since food affects the survival of this population.
- **Conduct complete annual monitoring** of all known Double-crested Cormorant breeding sites, especially the South Bay power towers.

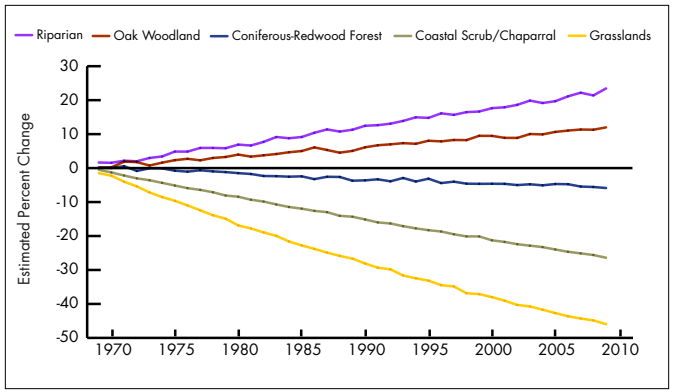
Double-crested Cormorant

Success Story
Seabirds on Alcatraz Island – See page 35

Western Gull at nest site, Alcatraz Island

Upland Habitats

Surrounding the waters and wetlands of San Francisco Bay are a variety of 'upland' habitats including the five most common types – coastal scrub-chaparral, coniferous-redwood forests, grasslands, oak woodlands, and riparian (streamside) forests. These vegetation communities vary in their mix of native and non-native plant species and the composition of bird communities they support.



Birds in Upland Habitats – Data are from the Breeding Bird Survey for 14 routes in eight Bay Area counties.

Savannah Sparrow in grassland

Acorn Woodpecker in oak woodland

Status: Mixed

Each upland type was assigned a suite of indicator species that best represent that habitat in the Bay Area. Over the 42 years of study:

Indicators for **riparian birds show an increase** of greater than 20%. Riparian habitats are recognized as one of the most important upland habitat types in the West for birds and other wildlife. Streams were heavily impacted in the past. In response to the listing of imperiled salmonids and concern for water quality, stream restoration has increased dramatically over the past several decades, benefiting birds as well.

Indicators for **oak woodland and coniferous-redwood forest birds are stable.**

Coastal scrub-chaparral and grassland birds are declining, coastal scrub by 27% and grassland by over 45%. Species in these habitat types continue to be impacted by loss and degradation of habitat. These trends are consistent with the declining trend found in the National State of the Birds Report, 2009.

Tom Gardali and Leo Salas (PRBO Conservation Science)

Threats

- **Primary threat: Habitat loss and degradation** caused by land-use changes such as open space conversion to housing or intensive agriculture, **invasions of native and non-native species,** and **lack of ecological disturbances** such as fire. For example, the two habitat types with the greatest bird declines, coastal scrub-chaparral and grasslands, are transitioning to other habitat types due to lack of disturbance and the invasion of native species (such as Douglas fir), non-native plant species (such as broom), and annual grasses that alter fire regimes.
- **Lack of appreciation for the habitat value of scrub-chaparral and grasslands**. Not typically thought of as beautiful or in need of protection, scrub-chaparral is seen as an eyesore or fire hazard, and a "clear the brush" attitude reduces habitat.
- **Climate change** affects vegetation type and water availability, thereby altering the amount, type, and quality of habitats available to birds.
- **Gaps in scientific knowledge** that is needed to inform and evaluate land management decisions and policy actions.

Wilson's Warbler in riparian habitat

Wrentit in coastal scrub-chaparral

Actions

Planning, Management, and Restoration:

- **Adopt and implement** the Uplands Habitat Goals and Bay Area Critical Linkages documents: www.bayarealands.org.
- **Control the most destructive invasive species,** and support and participate in the Bay Area Early Detection Network (www.baedn.org).
- **Use disturbance** (e.g., fire and grazing) to create and maintain diverse upland habitats.
- **Promote conservation on private lands,** including thorough use of economic incentive programs.
- **Continue to restore riparian areas**.
- **Promote wise water use** in order to maintain stream flows and groundwater recharge.
- **Educate the public** on the value of habitats such as coastal scrub-chaparral and grasslands.

Scientists

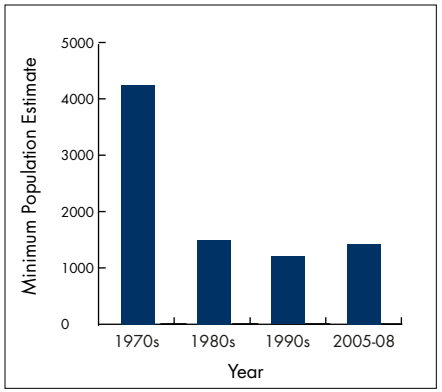
- **Determine which species are most vulnerable to the effects of climate change.**
- **Map future distributions** of species under climate and land use change scenarios.
- **Monitor upland birds** to track distribution and abundance changes and nest success and survival.
- **Identify Bay Area species population targets**, working with the San Francisco Bay Joint Venture.
- **Study the use of grazing** and other disturbances as vegetation management tools.

Success Story Riparian restoration on Chileno Creek (Marin County) – See page 36

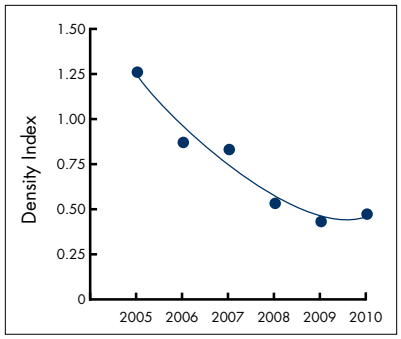
Endangered Species

Clapper Rail

California Clapper Rails nest in the tidal marshes of San Francisco Bay, and recovery of this species has been a major impetus for marsh restoration around the Bay. Unfortunately, the Clapper Rail struggles to survive because of habitat loss, predator pressure, and invasive species. The growing threat from sea level rise also threatens the Clapper Rail.



Clapper Rail populations have declined since the 1970s. Population estimates using different methods from published and unpublished sources should be interpreted with caution.



Standardized Bay-wide point count surveys for Clapper Rails show a steep decline that may be leveling off.

Status: Decreasing

Clapper Rails in San Francisco Bay have decreased dramatically from the tens of thousands that roamed the undiked marshes before the California Gold Rush.

Hunting, then development reduced populations and pushed Clapper Rails into smaller marshes separated by urban landscapes.

More recently, the rail population hit a low point in the early 1990s, likely due to predation by non-native red foxes. The Clapper Rail's rebound during the 1990s was possibly due to fox control but also coincided with the rapid invasion of a tall non-native plant (invasive *Spartina*). This invader benefited rails because it provided nesting habitat and protection from predators and high tides.

Beginning in the mid-2000s, the rail population declined sharply, due in part to the removal of invasive *Spartina*, which threatens tidal flat and marsh ecosystems as a whole. This recent decline may be leveling off, but the future of Clapper Rails in San Francisco Bay remains tenuous. However, we can be hopeful that as thousands of acres are being restored to tidal marsh habitat, California Clapper Rails will be back on the road to recovery.

Julian Wood, Len Liu, and Nadav Nur (PRBO Conservation Science)

Threats

- **Primary threat: Predators**, including introduced species such as Norway rats, house cats, and red foxes prey on Clapper Rails and their nests. Some native species of raptors, snakes, and mammals also prey on Clapper Rails.
- **Invasive non-native plant species** can reduce nesting and foraging habitat for Clapper Rails, even changing the invertebrate community on which they feed. Perennial pepperweed reduces high-tide refugia, and hybrid *Spartina* may reduce channel and mudflat areas important for foraging rails. However, invasive plant control/removal decisions should always consider short-term and long-term effects on birds (e.g., invasive *Spartina* eradication may have contributed to significant reductions in Clapper Rail populations at some sites and should proceed with caution).
- **Pollution, contaminants, and toxic spills** (including oil spills) directly kill rails, vegetation, fish, and the invertebrate community that sustains marsh wildlife. Toxins (e.g., mercury, lead) accumulate in rails, impairing their reproduction and survival.
- **Rising sea levels from global climate change** will drown some marshes and increase nest flooding, making the habitat unsuitable for Clapper Rails. See www.prbo.org/sfbayslr to view maps of projected change in marsh habitat and changes in bird and plant species distribution.

Success Story Carl's Marsh – See page 34

Actions

Planning, Management, and Restoration

- **Prioritize sites**: Use the most current and thorough scientific modeling of climate change scenarios to prioritize areas for acquisition and restoration (an example is PRBO's sea level rise modeling tool: www.prbo.org/sfbayslr).
- **Acquire and restore uplands and diked areas** where current shoreline marsh may migrate as sea level rises.
- **Control predators** by eliminating cat feeding stations, supporting predator control programs, and keeping marshes, public parks, and adjacent housing areas free of garbage.
- **Enforce regulations** on unlawful recreation in sensitive marshes.
- **Conduct active marsh planting** in restored areas where plants are not regenerating on their own, or in sites where non-native plant removal has reduced overall plant cover.
- **Restore high ground adjacent to marshes,** such as levees and uplands with dense vegetation, to offer birds refuge from high-tide events.
- **Locate public access points** and trails to the Bay shore away from Clapper Rail habitat.
- **Continue funding and support for tidal marsh restoration** such as the South Bay Salt Pond Restoration Project, which aims to restore over 15,100 acres of former salt ponds to a diversity of habitat types to benefit all birds, including tidal marsh-dependent species.

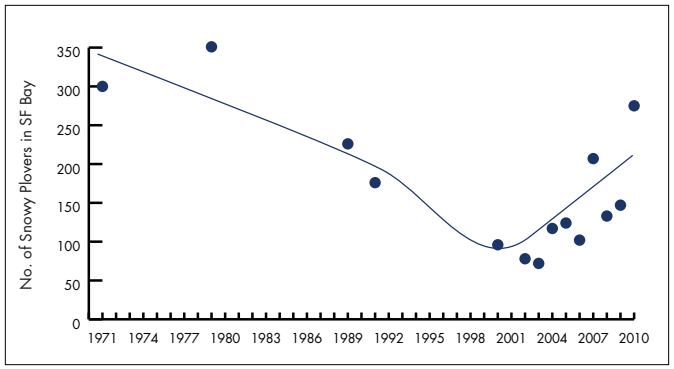
Scientists

- **Support research** that seeks to understand marsh development processes in the face of sea level rise, as well as potential management actions that can mitigate these impacts.
- **Study the effect of trail use** on Clapper Rails – both direct impacts from disturbance as well as potential increased predator access from trails.
- **Support research** on Clapper Rail population trends (including reproductive success, which has not been closely studied at a Bay-wide scale), habitat use, and the impacts of invasive hybrid *Spartina* and its removal.
- **Support research** that can inform how to create upland transition zone habitat as refugia for Clapper Rails.
- **Update habitat models** as new data become available, to better predict areas where tidal marsh will persist given sea level rise.

Endangered Species

Western Snowy Plover

The Western Snowy Plover is a federally threatened species under the Endangered Species Act. Primarily found nesting on coastal beaches, a subset of the population nests in San Francisco Bay. Plovers use dry pond bottoms, isolated islands, and levees in managed ponds as well as active salt ponds for nesting.



How long will it take **Snowy Plovers** to rebound to their 1970s level?

Snowy Plover chicks

Status: Uncertain – appears to be recovering in the South Bay.

Snowy Plovers in San Francisco Bay have decreased from historic numbers but more recently show an increasing trend, possibly reflecting improved survey effort. Snowy Plover reproductive success is low in the Bay and has decreased over the past four years.

Gary Page and Lynne Stenzel (PRBO Conservation Science);
Caitlin Robinson-Nilsen (San Francisco Bay Bird Observatory)

Threats

- **Predators** impact Snowy Plovers by preying upon their eggs and chicks. Nest cameras have documented a large suite of predators, including California Gulls, Common Ravens, Northern Harriers and the native gray fox. Maintaining predator control measures is costly, and funds are scarce.
- **Habitat loss** from salt pond conversion projects is a threat to the Snowy Plover, as some of the ponds it nests in are former salt ponds that are now being converted to marsh in the North and South Bay.
- **Rising sea level** from global climate change may submerge the shallow ponds where Snowy Plovers nest.
- **Disturbance to nesting plovers** by the public, from future public access and recreation trails.

Actions

Planning, Management, and Restoration

- **Continue to control predators** in San Francisco Bay, to reduce depredation of plover eggs and chicks.
- **Remove feral cat feeding stations** near plover nesting areas in the South Bay, and educate the public about the need for this action.
- **Continue to create and improve plover nesting** within restoration projects. Specifically, continue to create nesting islands, shallow ponds, and cover for plover nests and chicks.
- **Maintain 500 nesting plovers in San Francisco Bay**, as set by the U.S. Fish and Wildlife Service Western Snowy Plover Recovery Plan. The South Bay Salt Pond Restoration Project aims to support 250 breeding Snowy Plovers. Other federal and state agencies need to collaborate to develop a strategy to support at least 250 additional plovers within San Francisco Bay.
- **Provide dry spring nesting habitat and late season nesting habitat.** Initiate managed pond draw-down early enough in the spring to provide dry early season nesting habitat, and continue to draw down ponds throughout the season to create optimal late season nesting habitat.
- **Prevent avian predators from nesting and perching** near nesting plovers by modifying the design of power towers and by removing predator perches (e.g. sign posts, old duck hunting blinds).
- **Prevent California Gulls** from establishing colonies near plover nesting habitat.
- **Practice adaptive management.** Support ongoing monitoring of managed ponds and nesting islands to determine their effectiveness in supporting plovers. Employ an adaptive management approach to pond design, acreage, and public access if the current plan proves to be ineffective.
- **Conduct public outreach** to reduce disturbance to nesting plovers from public access and use of recreation trails. Close trails seasonally around nesting habitat.

Scientists

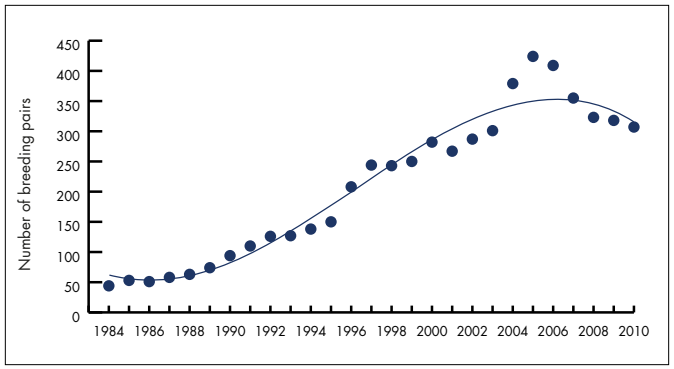
- **Experiment with substrates that provide cover.** Test the effectiveness of oyster shells on the pond bottom to camouflage Snowy Plover nests and chicks, reduce predation, and increase nesting density.
- **Assess the implications of public access on nesting plovers** to determine the level of disturbance likely from future public access and trail use. Determine consequence of disturbance on flushing rates, nest temperatures, incubation duration, and nest success of the plovers.

Endangered Species

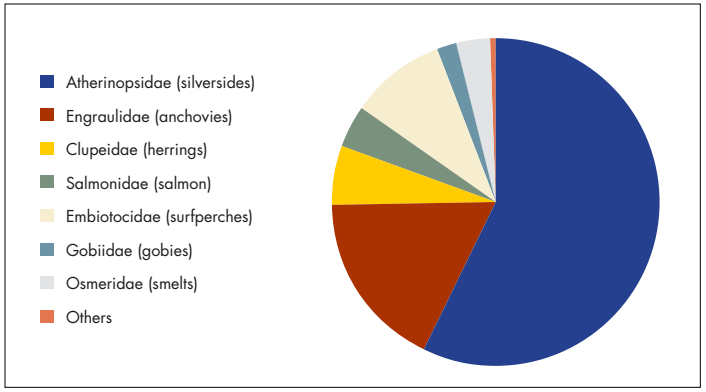
California Least Tern

The largest Least Tern colony in San Francisco Bay is located at Alameda Point on the runway complex of the former Naval Air Station, Alameda. The 3.9–hectare breeding area is surrounded by a chain link fence.

Smaller colonies can be found at Napa–Sonoma Marshes Wildlife Area, Montezuma Wetlands, and Hayward Regional Shoreline.



Breeding pairs of **Least Terns** in the Alameda Point colony. While the colony has grown over the last 26 years, it appears to be stabilizing.



Average percent of each fish in the diet of Least Terns in the Alameda Point colony. Small fishes are the dominant prey item.

San Francisco Bay Status: Stable

Since 1984, the number of **California Least Tern** pairs in the Alameda colony has increased by 9.7% per year, but the colony size appears to have stabilized in the last decade.

Dropped prey items have revealed the diet and foraging habits of Least Terns at the Alameda Point colony from 1981 to present. They show that small estuarine fishes are the dominant prey item. Since the 1990s, northern anchovy and surfperches have declined in the tern's diet, while Clupeids (e.g., herring, sardine) have increased. Understanding prey items is important, because diet is critical to tern reproductive success.

Meredith Elliott (PRBO Conservation Science);
Susan Euing (U.S. Fish and Wildlife Service)

Threats

- **Primary threat: Avian predators** including falcons, hawks, owls, crows, and ravens prey upon young and adult terns. Human activities, such as leaving food for predators and altering native habitat, result in higher than normal predator populations.
- **Development of the Naval Air Station** looms, as the base has been decommissioned.
- **Encroaching vegetation** is reducing the nesting area available to the birds. The California Least Tern needs bare ground for nesting and roosting. Encroachment of vegetation reduces the amount of nesting habitat.
- **Low flying aircraft** over the nesting colony flush adult terns from their nests, leaving young and eggs vulnerable to predators and unfavorable weather conditions.
- **Sea level rise from climate change** threatens to submerge the colony site, as it is built on reclaimed land close to sea level.
- **Loss of common prey species,** such as the region-wide anchovy crash in 2009, can result in fewer feedings to chicks, nutritional deficiencies, and higher rates of chick death.
- **Contaminants** can directly kill birds, but they also kill the prey items that birds depend upon for food. California Least Terns feed on fish and are at risk of accumulating contaminants (e.g., mercury and lead) found in San Francisco Bay. These contaminants, in great enough concentrations, can affect survival and breeding success.

Actions

Planning, Management, and Restoration

- **Continue predator management**, especially of Peregrine Falcons. The increase in local Peregrine Falcon attacks on the terns at Alameda Point is a growing concern. Authorization to permanently remove marauding Peregrine Falcons from Least Tern sites needs to be given to predator management personnel by the appropriate state agency.
- **Control vegetation** by continuing to apply herbicide, remove weeds, and add gravel to the nesting substrate.
- **Reduce air traffic disturbance** by expanding outreach to local airports and pilots regarding impacts to the endangered Least Tern.
- **Secure/identify adequate undeveloped space** beyond the existing colony to allow for colony movement or persistence in the long term, given the uncertain future of the Navy's presence.

Scientists

- **Study the diet and energy requirements** of developing terns and evaluate the nutritional content of common prey species.
- **Monitor contaminant impacts** to terns. Failed-to-hatch eggs should continue to be collected and analyzed for contaminants. Further research on lethal levels of these contaminants in Least Terns is needed.

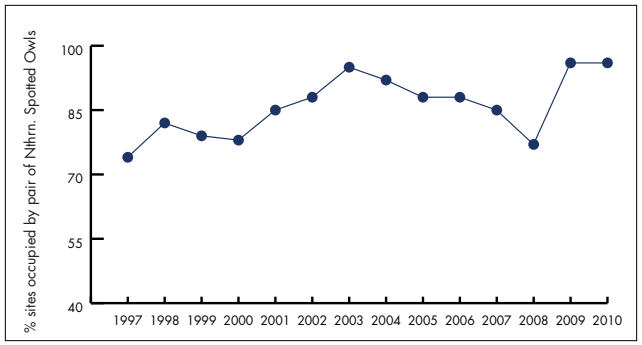
Success Story Monitoring Least Terns at Alameda Point – See page 37

Endangered Species

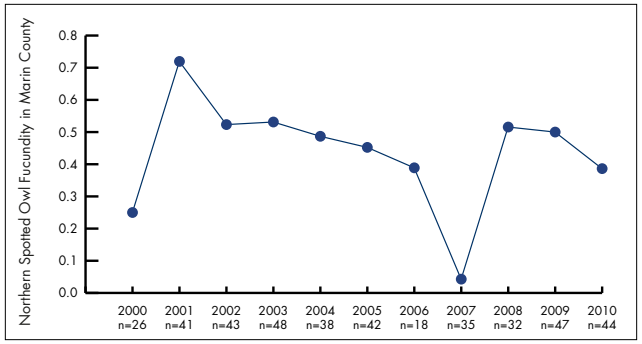
Northern Spotted Owl

In the San Francisco Bay Area (primarily Marin County), Northern Spotted Owls nest in both old-growth and mature second-growth forests of Douglas-fir, coast redwood, bishop pine, mixed conifer–hardwood, and other evergreen hardwood trees. This varies from the rest of the population of Northern Spotted Owls in the Pacific Northwest, where they are commonly associated with mature coniferous forests.

In Marin County, unique forest types are bishop pine and evergreen forests.



Percent of **Northern Spotted Owl** sites surveyed that were occupied by a pair. All sites are not surveyed every year; however, sites surveyed likely reflect the overall population of owls in Marin County. In general, the number of Northern Spotted Owls in Marin County appears stable.



Except for 2007 when almost no young were produced, Spotted owl fecundity (reproductive success) appears stable.

Status: Stable

The Bay Area's population of **Northern Spotted Owls** is thought to be stable; however, thorough population monitoring is not available as all sites are not monitored every year.

While fecundity (reproductive success) is generally high, we lack survival data for owls, which may be more important to the overall number of birds in the population.

Current monitoring occurs on the following public lands: Point Reyes National Seashore, Golden Gate National Recreation Area, Marin Municipal Water District, Marin County Open Space District, and California State Parks (Tomales Bay, Mount Tamalpais, and Samuel P. Taylor).

Renée Cormier (PRBO Conservation Science);
Dave Press (National Park Service).

Threats

- **Primary threat: Barred Owls** pose a threat to Spotted Owls by competing for space and food and through direct aggressive interactions. Currently, the number of Barred Owls in the Bay Area is relatively small but is predicted to increase.
- **Rat poisons.** Spotted Owls feed upon rats; when rats have been poisoned with rodenticides used by residents and businesses, the owls can become sick or die.
- **Sudden Oak Death** changes the forest structure and plant composition, and the loss of tanoaks in particular threaten the owl's preferred food source, the dusky-footed woodrat, which depends on the tanoak for cover and food.
- **Loss of forests** due to urban development along national park and county open space boundaries and the threat of wildfires. Losing forests reduces feeding, roosting, and nesting habitat for Northern Spotted Owls.
- **Human activities,** such as extended presence near Spotted Owl nest trees and noise disturbance from yard maintenance, tree trimming, and construction activities in the communities neighboring owl nesting sites, can disturb nesting owls and may prevent them from feeding their young. Community awareness of regulated protections for Spotted Owls is lacking.
- **Genetic isolation.** The Marin County population of Northern Spotted Owls is isolated from populations to the north because of a break in forested habitat needed for dispersal. Small populations, such as those found in Marin County, are at a higher risk of local extinction.

Actions

Planning, Management, and Restoration

Spotted Owl fledgling

- **Follow U.S. Fish and Wildlife Service guidelines** for protecting Spotted Owls. Restrictions for habitat modifications around Spotted Owl territories are in effect year-round, and modifications to potential Spotted Owl habitat may require consultation with USFWS personnel.
- **Limit loud noises,** such as motorized gardening equipment, during the nesting season (February 1st to July 9th) near Spotted Owl habitat.
- **Discontinue the use of rodenticides** as a means to kill pests in areas with Spotted Owl habitat. Residents and business owners should consider rodent prevention and trapping instead of poisons that harm more than the rodent.
- **Communicate to the public** the USFWS guidelines pertaining to activities such as noise disturbance and construction near Spotted Owl habitat during the nesting season (February 1st to July 9th).

Scientists

- **Continue and expand monitoring** of Spotted Owl and Barred Owl populations on public lands. Current research is ongoing in Marin County but should be expanded to include Sonoma and Napa counties, on both public and private lands.

Public

- **Leave owls alone.** Spotted Owls reside near many busy trails in the Bay Area, and it is not uncommon for fledgling owls to perch on the ground. If you see an owl, give it space and keep pets on leash. The parents will continue to care for a fledgling owl on the ground.
- **Discontinue the use of rodenticides** as a means to kill pests. Residents and business owners should consider rodent prevention and trapping instead of poisons that harm more than the rodent.

Success Story Spotted Owl monitoring on public lands – See page 36

Policy

The human population of the San Francisco Bay Area has more than tripled since the 1950s, yet the ponds, open waters, mudflats, and marshes continue to support rich and abundant birdlife. Protection of birds and their habitats has resulted from decades of public involvement, conservation investments, and a strong framework of laws and regulations. However, we cannot assume that all threats to birds and their habitats have been averted and that all protection is permanent. We need an engaged public and informed decision-makers to continue to protect the hundreds of thousands of majestic and ecologically important birds that depend on the San Francisco Bay Estuary region.

The future state of the birds in San Francisco Bay region is at significant risk, resulting from the urban use of the area, the looming threat of climate change and associated sea level rise, and funding limitations during this period of economic uncertainty. It is time to develop and support solutions that benefit our environment, economy, and community. A more resilient San Francisco Bay will be better for birds, people, and the economy: healthy tidal marshes provide flood protection as sea levels rise; healthy streams improve our water quality; diverse and abundant bird populations provide us with recreation, inspiration, and enjoyment; and birds' presence in the Bay Area indicates the sustained quality of those habitats and the services they provide.

Today the most fundamental policy challenges to maintaining and enhancing conservation in the Bay Area, across a broad array of habitat types, can be grouped into four categories: 1) funding; 2) climate change including sea level rise; 3) threats from development; and 4) balancing public use with adequate protections for birds. The State of the Birds Report offers policy recommendations for each.

Funding

Our ability to protect existing habitats and respond to new threats is compromised without adequate funding to: 1) acquire, restore, and manage important habitats in public spaces; 2) continue incentives for the private protection of open spaces; and 3) continue efforts to maintain and enhance the quality of Bay waters upon which birds and people depend.

Caitlin Robinson-Nilsen (left) and Cheryl Strong hold Black-necked Stilt chicks at Hayward Regional Shoreline.

To protect birds in San Francisco Bay region:

- Support the efforts of the San Francisco Bay Restoration Authority (California Government Code §66700 et seq.) to establish a regional funding program in the Bay Area. Doing so would support wetlands restoration, enhancement, and management, and associated public access and flood management.

Dan Taylor (Audubon California);
Beth Huning (San Francisco Bay Joint Venture).

- Support full funding for the Federal Land and Water Conservation Act, the North American Wetlands Conservation Act, and other relevant federal authorities to increase and improve wetland habitats and wetland-dependent bird populations.

- Support federal appropriations to the U.S. Army Corps of Engineers for wetland restoration projects authorized in the Water Resources Development Act; appropriations for the San Francisco Bay National Wildlife Refuge Complex; and appropriations for NOAA and USEPA for programs focused on wetlands restoration and water quality improvements in San Francisco Bay.

- Ensure adequate funding for the San Francisco Bay Regional Water Quality Board's effective enforcement of the Federal Clean Water Act and the Porter-Cologne Water Quality Control Act (California Water Code §13000 et seq.), and to local jurisdictions for infrastructure improvements to aid in keeping sewage and animal waste out of the Bay and reducing storm-water pollution, to reduce the threat of catastrophic spills and improve water quality and supply for wildlife and for people.

- Ensure adequate funding for the early detection of non-native invasive plants and aquatic organisms, and continue the systematic removal and control of the species that pose a significant threat to birds' habitats in the Bay region, such as invasive *Spartina* hybrids.

- Restore full funding for the Williamson Act (California Government Code §51200 et seq.), which has historically provided critically important property tax incentives and prevents urban development for over 1.23 million acres of upland bird habitat and open spaces in the nine-county Bay Area region. State funding for this program has been deeply cut and is threatened with elimination.

Alcatraz Island

- Support continued state funding for the San Francisco Bay Area Conservancy Program of the State Coastal Conservancy, which provides grants to multiple organizations for wetland restoration and other projects that benefit birds, and support funding for the California Department of Fish and Game to manage their ecological reserves and wildlife areas in the San Francisco Bay Area.

- Increase local funding for habitat acquisition and management actions by entities such as Open Space Districts, land trusts, and other nongovernmental organizations active in protecting habitats in the Bay Area.

- Support science and monitoring associated with restoration and management projects that answer key uncertainties and help guide priorities for future bird habitat protection and enhancement.

Climate change and sea level rise

To ensure that critically important habitat areas for people and birds are preserved, we encourage:

Policy

(continued from page 31)

- Rapid reduction of greenhouse gases through the full implementation of AB 32, the California Global Warming Solutions Act of 2006 (California Health and Safety Code §38500 et seq.), and support for national climate change legislation to help mitigate the most extreme levels of climate change.

- Full implementation of the California Climate Adaptation Strategy of 2009. On the issues of sea level rise, discourage urban development in areas containing habitat and habitat restoration potential and that are vulnerable to sea level rise.

- The acquisition and restoration of remaining open space areas in proximity to existing wetlands to provide for future habitat refugia for tidal marsh and tidal flats, birds, and other wildlife in the face of rising sea level; and to allow for tidal wetlands to migrate up the shoreline as the Bay rises.

- When practical, encourage the use of natural shoreline protection and buffer lands such as tidal marsh, eelgrass and oysters, and rocky subtidal habitat, in contrast to sea walls and other artificial barriers that are prone to catastrophic failure and provide little habitat value.

- Support dredging policies and regulations that require beneficial re-use of material currently being disposed offshore or in-Bay. Sediment that is in the system will enable marshes to better build and keep pace with sea level rise, protecting not only marsh and mudflat habitats but enabling them to serve their natural functions as buffers against sea level rise and storm events.

- Support science and monitoring to improve our ability to predict the effects of climate change as a means to prioritize future land acquisition, management, and restoration efforts and to mitigate sea level rise impacts.

Threats from development

With the population of the Bay Area estimated to grow to over eight million people by the end of this decade, there will be additional pressures to fill baylands and adjacent restorable uplands for urban development. To ensure that habitat protection and restoration objectives can be met, we encourage that:

- Further development should be prohibited on Bay wetlands or lands adjacent to, and restorable to, wetland conditions.

- Efforts to exempt projects, or to weaken existing development protection provisions of the California Environmental Quality Act (California Public Resources Code §21000 et seq.) or the McAteer-Petris Act (California Government Code §66600 et seq.) establishing the Bay Conservation Development Commission (BCDC), should be opposed.

- Implement the Climate Change amendments to BCDC's Bay Plan.

- The recommendations in the Subtidal Habitat Goals report should be implemented in order to maintain and improve fish and wildlife habitat in the Bay.

- Utilize decision-support tools, such as that developed by the Bay Area Open Space Council's Upland Habitat Goals project, and the San Francisco Bay Sea Level Rise decision support tool developed by PRBO Conservation Science and its partners, as resources for determining priority parcels for future protection and restoration.

- The San Francisco Bay Regional Water Quality Control Board should complete and adopt its

Tidal marshland is likely to be inundated by sea level rise. Here, winter rainwater and an extreme high tide flood the Bay shore.

Clapper Rail, dependent on tidal marsh habitat in the Bay

Wetlands and Riparian Area Protection Program recommendations in order to provide protection for many bird species.

Public use and bird protection

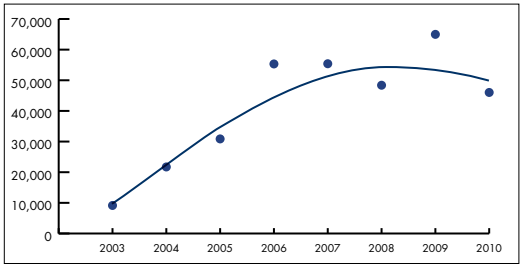
A balancing act exists in wildlife conservation: the needs of sensitive wildlife populations versus the need to connect the public with the outdoors and provide opportunities to observe wildlife. We recommend the following policy considerations to accommodate habitat protection and outdoor recreation:

- Protect and enhance values of tidal marsh, managed pond, open Bay, and other sensitive habitats, particularly those utilized by listed and sensitive wildlife species. Where wildlife would be negatively impacted by public use, public access should be limited. As much as possible, access should be designed in ways and locations that both provide public enjoyment and reduce impacts to sensitive habitats and species.
- Regulations regarding dogs and cats should be implemented to protect key shoreline areas used by endangered bird species.
- New boat launching and access points should be developed away from sensitive habitats. Boating activities should avoid those areas that provide important foraging and resting for diving ducks, grebes, and waterbirds during the migratory and wintering seasons when those species are present.
- Study impacts of public access on wildlife as a means to improve future planning for beneficial public access.
- Support educational programs and facilities to help the public to appreciate, understand, and value birds and the ecology of San Francisco Bay.

Success Stories

Managed Ponds South San Francisco Bay Salt Pond Restoration

With the transfer of over 15,000 acres to public ownership in 2003, the South Bay Salt Pond Restoration Project is the largest wetland restoration on the West Coast. An early goal in the long-term restoration plan was to reduce salinity in open ponds from their inherited toxic production concentrations to those of ambient Bay waters. The U.S. Geological Survey began monitoring birds and water quality from the start of the project and has documented increases in shorebirds and ducks as the restoration has proceeded. Examples include the 480-acre Island Ponds that were opened to tidal action in 2006. As salinity declined from 160 to less than 20 ppt, average numbers of dabbling ducks increased from zero in 2003 to over 4,000 birds at high tide on a given winter day in 2009. In the larger Alviso system and across the South Bay's managed ponds, dabbling ducks such as Northern Shoveler increased substantially through winter 2010. The restoration project occurs within a designated area of Hemispheric Importance for migratory and wintering shorebirds such as



Dabbling ducks have increased in South Bay ponds.

Western Sandpipers. Further north, in the Eden Landing pond complex, small shorebirds during spring have increased from 10,000 to over 50,000 birds observed in monthly surveys, as water depths declined in former commercial salt ponds now maintained as seasonal wetlands. Numerous ponds are planned for enhancements or restoration to tidal marsh within a 50-year time horizon, and continued monitoring is critical to learn from successes or unexpected changes that can feed back into adaptive management in this extremely important area for birds within San Francisco Bay.

—L. Arriana Brand and Cheryl Strong

Tidal Marsh Carl's Marsh

Song Sparrow

Carl's Marsh is a great example of successful tidal marsh restoration. After this 42-acre dry fallow field was breached in 1994, sediment began accumulating with each tidal cycle, and the site is now a lush tidal marsh supporting a diversity of birds including several endangered California Clapper Rails. This collaborative project between California Department of Fish and Game (CDFG) and Sonoma Land Trust was more successful than expected. The transition from fallow agricultural land, to productive mudflat habitat for shorebirds, to a fully vegetated marsh was rapid, occurring within the first five years. Carl's Marsh now supports over 60 pairs of breeding Samuel's Song Sparrows. This subspecies of Song Sparrow is found only in the tidal marshes of San Pablo Bay and is recognized by CDFG as a Bird Species of Special Concern.

—Julian Wood and Nadav Nur

Tidal Marsh Herons and Egrets

West Marin Island

Snowy Egret with nest material

The West Marin Island National Wildlife Refuge is a protected home to one of the largest nesting colonies of herons and egrets in San Francisco Bay, and is a true bird conservation success story. During the 1980s the Marin Islands were slated for development. Over the next 12 years, local citizens, the Friends of the Marin Islands, the California Coastal Conservancy, the Trust for Public Land, and at least 14 other agencies and organizations participated in the establishment of the Marin Islands National Wildlife Refuge and State Ecological Reserve. Senator Barbara Boxer designated September 19th as Marin Islands National Wildlife Refuge Day in 1992.

The establishment of West Marin Island Wildlife Refuge was largely due to data provided by ongoing monitoring, which began in 1979 and documented the importance of the island to nesting herons and egrets. Region-wide monitoring of heronries throughout the San Francisco Bay Area by Audubon Canyon Ranch substantiated the importance of this nesting colony and now guides the management of the Marin Islands National Wildlife Refuge. Today the Refuge is home to over 500 nesting pairs of herons and egrets each year.

—John Kelly

Human-created Habitats

Seabirds on Alcatraz Island

Brandt's Cormorant

Prior to human settlement, Alcatraz Island was home to thousands of nesting seabirds, as indicated by the guano-covered sandstone. As early human settlement took place, birds left the island and did not return throughout the military and prison history. Over a century later, Alcatraz became part of the Golden Gate National Recreation Area (GGNRA), a unit of the National Park Service (NPS), and birds slowly began to return to reclaim the island. The Brandt's Cormorant colony on Alcatraz is one of the few known estuarine breeding sites for this species. Pigeon Guillemots are not known to breed elsewhere in San Francisco Bay. The Western Gull and Black-crowned Night Heron colonies are the largest in the Bay. Currently, this diversity of species exists in a delicate balance with the considerable human presence both on and around Alcatraz Island. Over the last 10 years, PRBO Conservation Science and the NPS have been monitoring the return of the nesting birds and especially the growth of the cormorant colony.

Pigeon Guillemots

With cooperative efforts between biologists and NPS staff, improved public outreach (signage, bird interpretive displays, tours), and island management (altered tourism, maintenance, and construction activities to protect nesting birds) human-caused disturbance to the cormorants has been reduced and the colony has grown.

—Sara Acosta

Success Stories

Upland Habitats — Chileno Creek, Marin County

Sally and Mike Gale live and work on a 600-acre ranch first purchased by Sally's great-grandfather in 1856. The Gale Ranch is located in Marin County's picturesque Chileno Valley, where agriculture has been a way of life for 150 years. Mike and Sally took over operation of the ranch in 1993 and currently tend a humanely raised grass-fed beef herd of about 100 cows as well as other farm enterprises such as u-pick apples.

Mike and Sally are stewards of the land and quickly noticed that the creek running through their property, Chileno Creek, was completely lacking vegetation and drying out in the summer. The Gales recognized the need to revive Chileno Creek in order to retain soil and prevent creek sedimentation, keep evaporation in check, retain water, replenish groundwater, and provide better wildlife habitat. Working with the Marin Resource Conservation District, the Natural Resource Conservation Service, and the Students and Teachers Restoring a Watershed Program (STRAW), the Gales undertook a seven-acre riparian restoration project.

Riparian habitat on the Gale Ranch, before and after restoration began

The restoration has successfully increased native vegetation (see photo), especially to benefit birds. The number of bird species found on the Gale Ranch has increased significantly since the restoration project began. The growing populations of the 33 bird species inhabiting the ranch tell us the restoration is really paying off.

Over the years, neighboring ranches joined in and the cumulative effect in Marin and southern Sonoma counties has greatly increased the number and diversity of birds.

—Tom Gardali

Endangered Species — Spotted Owls

For over 10 years, the National Park Service, Marin Municipal Water District, and Marin County Open Space have been conducting surveys on their lands to ensure that Northern Spotted Owls are not disturbed by management activities. Their commitment to the protection of Spotted Owls has resulted in better timing of management activities (e.g., trail work) to avoid disturbance to nesting owls and increased knowledge about the status of Northern Spotted Owls in Marin County.

Adult Spotted Owl

—Renée Cormier and Dave Press

Endangered Species—Least Tern Watch

Monitoring and Protecting a California Least Tern Breeding Colony

Tern Watch is a volunteer predator observation program at Alameda Point. The intention of Tern Watch is to give a broader picture of predator presence during the least tern breeding season, allowing USFWS to conduct proactive predator management. Annually, volunteers are recruited and trained to observe the tern colony from a vehicle outside the colony fence line, for three hours at a time. Volunteers record predator and Least Tern activities during daytime hours, seven days a week.

Not only are the Tern Watch data useful for understanding the local predators at the Least Tern colony, but the volunteers themselves act as predator deterrents. The physical presence of a human in their vehicle close to the Least Tern colony appears to deter many avian predators from entering the nesting area, thus giving more protection to the terns. The Tern Watch volunteers also record least tern activities and their responses to predator presence. While conducting a tern watch, each volunteer is able to enjoy the behaviors and nature of the Least Terns in their breeding habitat, a rare sight to see.

In 2010, the presence and vigilance of volunteers at the Least Tern colony helped thwart several hunting attempts made by juvenile Peregrine Falcons. The quick response time by volunteers alerting the biologists of predators enabled them to chase off marauding predators in time.

—Meredith Elliot and Mark Rauzon

Least Tern incubating eggs

Marshland on Reclaimed Shoreline

Sonoma Baylands

Much of the historic marshland in the North Bay was diked from the Bay and drained in the late 19th century for farming oat hay and other crops. From 1991 to 1996, the State Coastal Conservancy and the Sonoma Land Trust conceived and developed the Sonoma Baylands Project to restore tidal marsh on 320 acres. This pioneering project of wetland creation used dredged materials from navigation channels to jump-start the restoration.

While it took many years to establish, the site now boasts large numbers of shorebirds (sometimes as many as 18,000 individuals), with at least 23 species amassing on the mud before and after high tides. As rising water pushes the birds off these restored bay mudflats, they pause at the Baylands for a last frantic forage before moving to upland habitats where they rest and preen until the tide begins to drop again. During high tide in the winter, 18 species of ducks and geese have been recorded in the aquatic habitats within the Sonoma Baylands. With its ability to attract large populations of wading birds, the site is also attractive to diurnal raptors including Merlin, Prairie and Peregrine Falcons. Surveys for endangered California Clapper Rails by PRBO biologists since 2008 have documented their presence, along with Black Rails, in the restored Sonoma Baylands.

The restoration of Sonoma Baylands has enhanced opportunities for San Pablo and San Francisco Bays' wildlife, especially birds, in ways only dreamed of 30 years ago.

—Caroline Warner and Rich Stallcup

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Diana Howard—treatment of all graphs

South San Francisco Bay tidal marsh

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Funders

The 2011 State of the Birds Report, San Francisco Bay was funded by the following:

The Joseph and Vera Long Foundation (formerly the J.M. Long Foundation)

Pacific Gas and Electric Foundation

PRBO Conservation Science

San Francisco Bay Joint Venture

San Francisco Estuary Partnership

U.S. Fish and Wildlife Service

American Avocets

Aerial view of shorebird flock over saltworks

The State of the Birds San Francisco Bay 2011 is a collaborative project of PRBO Conservation Science and the San Francisco Bay Joint Venture, with contributions from numerous partners.

Found online at **www.prbo.org/sfbaystate of the birds**