

**CONSERVATION OBJECTIVES FOR THE SAN FRANCISCO BAY
ESTUARY AS OUTLINED IN PLANNING DOCUMENTS OF NORTH
AMERICA'S MAJOR BIRD CONSERVATION INITIATIVES**

**A GUIDING DOCUMENT FOR REVISIONS TO '*RESTORING THE ESTUARY*'
THE IMPLEMENTATION STRATEGY OF THE SAN FRANCISCO BAY JOINT VENTURE**



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**IN COLLABORATION WITH THE RESTORATION STRATEGY AND TECHNICAL
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CHAPTER 1. INTRODUCTION

As stated in *Restoring the Estuary* (Steere and Schaefer 2001), the San Francisco Bay Joint Venture's (SFBJV) Implementation Strategy, the San Francisco Bay Estuary is one of the nation's largest and most biologically significant estuaries on the Pacific Coast. San Francisco Bay holds higher proportions of total wintering and migrating shorebirds than any other coastal wetland along the U.S. Pacific Coast (outside of Alaska). In addition to migratory birds, resident species such as Marsh Wren, Black-necked Stilt, three endemic subspecies of Song Sparrow, and an endangered subspecies of Clapper Rail depend on wetlands of the San Francisco Bay and adjoining watersheds. Notably, approximately 10% of the U.S. Pacific Coast Western Snowy Plover population breeds in the San Francisco Bay salt ponds. This region also provides important breeding habitat to riparian-associated landbird species, such as Swainson's Thrush and Black-headed Grosbeak. The importance of Bay habitats for non-waterfowl bird species emphasizes the need for better integration of their habitat requirements into the SFBJV's Implementation Strategy.

Since the writing of *Restoring the Estuary*, Executive Order 13186 (see Chapter 5) was enacted to provide a mandate for integrating the bird conservation principles from the four migratory bird conservation initiatives. These guiding principles are contained within numerous regional and national bird conservation plans including the 2nd edition of the United States Shorebird Conservation Plan (Brown et al. 2001), the Southern Pacific Shorebird Conservation Plan (Hickey et al. 2003), the North American Waterbird Plan (Kushlan et al. 2002), the California Current System Marine Bird Conservation Plan (in review), the North American Landbird Conservation Plan (Rich et al. 2004), and several California Partners in Flight habitat-based bird conservation plans (CalPIF 2002, CalPIF 2004, RHJV 2004). These plans contain bird conservation goals, priorities, recommendations, and other information directly relevant to the San Francisco Bay region. Although the SFBJV Implementation Strategy outlines habitat goals for all birds using the estuary, it focuses primarily on waterfowl population objectives and goals established under the North American Waterfowl Management Plan. This guiding document summarizes the information within the other bird conservation plans relevant to the San Francisco Bay region, and should inform a comprehensive review and revision of the SFBJV's *Restoring the Estuary*, while helping guide its implementation.

In *Restoring the Estuary*, habitat goals are synthesized by habitat categories from the Goals Project (1999), including tidal flat, tidal marsh, beach, lagoon, salt pond, diked wetland, grassland and associated wetlands, creeks, and riparian zones (see Figure 3-1 in *Restoring the Estuary*). Although other habitats (e.g., oak woodlands, shallow bay, coastal scrub, etc.) that fall under the SFBJV's purview are of importance, this guiding document was written to complement the existing Implementation Strategy and thus we primarily address bird conservation needs in those habitats (listed above) covered by *Restoring the Estuary*. This illustrates the need for a more advanced planning process, truly integrating all bird conservation objectives and incorporating conservation needs of additional species and the habitats upon which they depend.

The San Francisco Bay and other joint ventures are key partnerships in delivering the conservation goals of the migratory bird conservation initiatives throughout North America. This document moves the SFBJV one step closer toward that end. It is important to note that this is not a revised version of the SFBJV Implementation Strategy, but rather a tool to be used in future JV planning which will require the full integration of new decision support tools, new data and information, and eventually the reassessment of the habitat goals as presented in *Restoring the Estuary*. This process should lead to integrated conservation recommendations for each habitat type that will more effectively guide on-the-ground habitat management and restoration as well as future priorities for the JV. With the information herein, the SFBJV will be better able to effectively provide habitat and address the threats for a range of species dependent on the estuary.

Because the various regional and national bird conservation plans were developed through different planning processes and at different scales, this document is structured by bird conservation initiative. Species groups that each initiative addresses are presented in Table 1.

Table 1. Species groups - listed taxonomically and grouped for ease of presentation - covered under the major bird conservation initiatives in North America. Regional bird conservation plans addressing species groups and encompassing the San Francisco Bay are noted.

<i>Species Group</i>	<i>Bird Conservation Initiative</i>				<i>Regional/State Bird Conservation Plan</i>
	North American Waterbird Conservation Plan	U.S. Shorebird Conservation Plan	North American Landbird Conservation Plan	North American Waterfowl Management Plan	
Loons and Grebes	+				CCS Plan ^a
Albatrosses, Petrels, Shearwaters, Storm-Petrels and Pelecaniformes	+				CCS Plan
Wading Birds (e.g., ibises, herons, egrets)	+				None
Swans, Geese, and Ducks				+	SFBJV ^b
Diurnal Raptors			+		RBCP ^c GBCP ^c
Upland Game Birds			+ ^d		CSCBCP ^c covers Mountain Quail
Gruiformes (e.g., coots, cranes, rails)	+			Covers cranes	None
Shorebirds		+			SPSCP ^e / CCS Plan covers phalaropes; RBCP covers Spotted Sandpiper

Jaegers, Skuas, Gulls, Terns, Skimmers, and Alcids	+				CCS Plan ^f
Pigeons and Doves through Cuckoos and their Allies			+		RBCP CSCBCP SNBCP ^c
Owls			+		SNBCP ^c
Goatsuckers through Woodpeckers			+		CSCBCP CFBCP ^c SNBCP OWBCP ^c
Passerines			+		All CalPIF plans ^c

^aCCS Plan = California Current System Marine Bird Conservation Plan

^bSFBJV = San Francisco Bay Joint Venture

^cCalifornia Partners in Flight (CalPIF) Bird Conservation Plans: CSCBCP = Coastal Scrub and Chaparral Bird Conservation Plan; CFBCP = Coniferous Forest Bird Conservation Plan; GBCP = Grassland Bird Conservation Plan; OWBCP = Oak Woodland Bird Conservation Plan; RBCP = Riparian Bird Conservation Plan; SNBCP = Sierra Nevada Bird Conservation Plan

^dSome species also covered by Upland Game Bird Initiative

^eSPSCP = Southern Pacific Shorebird Conservation Plan

^fCCS Plan covers species foraging at sea and breeding colonies on rocky outcroppings or islands – not breeding colonies within baylands

CHAPTER 2. WATERBIRD CONSERVATION

International Context

At least one-third of the 210 species of waterbirds considered in the North America Waterbird Conservation Plan are at risk of serious population loss (Kushlan et al. 2002). Waterbird populations are subject to numerous threats, many of which are habitat-based and affect all aquatic birds and aquatic resources.

Waterbird Conservation for the Americas (the Waterbird Initiative) was established in 1998 as a broad-based, voluntary partnership dedicated to waterbird conservation. This independent and international partnership was created to link the work of individuals and institutions having interest and responsibility for conservation of waterbirds and their habitats in the Americas. In Canada, the U.S., and Mexico, the Waterbird Initiative complements initiatives existing for other bird groups, all of which come together under the North American Bird Conservation Initiative (NABCI). Additionally, the Waterbird Initiative addresses conservation of waterbirds in the Caribbean, Central America, and open waters of the Pacific and Atlantic (Kushlan et al. 2002).

The vision of Waterbird Conservation for the Americas is that the distribution, diversity, and abundance of populations and habitats of breeding, migratory, and nonbreeding waterbirds are sustained or restored throughout the lands and waters of North America, Central America, and the Caribbean. To implement their vision, The North American Waterbird Conservation Plan (NAWCP) was published in 2002 to provide a continental-scale framework for the conservation and management of waterbirds, including seabirds, coastal waterbirds, wading birds, and marshbirds utilizing aquatic habitats in 29 nations throughout North America, Central America, the Caribbean Sea, the western Atlantic and the U.S.-associated Pacific Islands and pelagic waters of the Pacific.

The plan discusses four goals that were developed to support the vision for the conservation of waterbirds:

- *Species and Population Goal:* To ensure sustainable distributions, diversity, and abundance of waterbird species throughout each of their historical or naturally expanding ranges in the lands and waters of North America, Central America, and the Caribbean.
- *Habitat Goal:* To protect, restore, and manage sufficient high quality habitat and key sites for waterbirds throughout the year to meet species and population goals.
- *Education and Information Goal:* To ensure that information on the conservation of waterbirds is widely available to decision makers, land managers, the public, and all whose actions affect waterbird populations and their habitats.

- *Coordination and Integration Goal:* To ensure that coordinated conservation efforts for waterbirds in the Americas continue, are guided by common principles, and result in integrated and mutually supportive waterbird conservation actions.

The North American Waterbird Conservation Plan considers waterbird conservation planning on an international level. Many species considered in the Plan range through a number of countries and the distribution of some species extends across several continents. Maintaining waterbird populations in the Americas at levels necessary for their long-term conservation requires that planning, inventory, monitoring, and management actions be carried out as international activities. Conservation at this largest scale is the principal focus of this Plan. For further information on the species, geographic coverage, conservation status of species, and recommendations visit the Plan online at www.waterbirdconservation.org.

Regional Context

As the vision of Waterbird Conservation for the Americas is broad and international in scope, it is a key recommendation of the initiative that regional partnerships develop complementary plans to target regional conservation issues. Therefore, PRBO Conservation Science has developed the California Current System Marine Bird Conservation Plan (CCS Plan), and the U.S. Fish and Wildlife Service has developed the USFWS Seabird Conservation Plan for Region One. Summaries of both plans are discussed below.

The California Current System (CCS) is a large marine ecosystem, stretching from British Columbia to Baja California, and is home to an abundance and diversity of marine life, supporting over 150 species of breeding and migrating seabirds, at least 29 species of whales and dolphins, and a variety of sea turtles, seals, sea lions, and fish communities. As one of the world's five great Eastern Boundary Current systems, the waters in the CCS are extremely productive and serve as a "feeding trough" of the northern Pacific, supporting many far-ranging migratory species from the Southern Hemisphere in addition to major populations of seabirds and other organisms from the Northern Hemisphere. As such, the CCS is one of the most biologically rich marine systems in the world.

The CCS Plan addresses seabird conservation within the CCS with an ecosystem approach, which takes into account all marine bird species, both breeding and migratory, as well as all positive and negative interactions that affect seabird demography and populations. The CCS Plan is a collaborative effort of various agencies and organizations that are committed to the conservation of seabirds that breed or feed in the California Current marine ecosystem. The overarching mission of the CCS Plan is long-term conservation of marine birds and their prey (Mills and Sydeman, *in review*).

Version 1 of the CCS Plan, to be published in the fall 2004, reflects the start of a long-term process to update scientific information on seabirds and their prey and modify conservation and management recommendations based on the latest information available. Thus, the plan is intended to be a living document to be reviewed, evaluated and adapted at regular intervals every 3-5 years.

The main goals of the CCS Plan include:

- Compile information on California Current marine bird species and ecosystem features.
- Analyze and synthesize information on marine birds of the California Current and their relationships with the environment, natural enemies, and humans.
- Evaluate and identify gaps in information to be filled by research and monitoring.
- Determine conservation needs from an ecosystem perspective and propose a conservation agenda.
- Initiate steps to implement the CCS Plan by developing strategies for partnerships and identifying ‘interest-bridges’ with user groups, agencies, and other organizations.

There are a total of 38 breeders within the CCS (Table 2), and a minimum of 54 species of common migrants, although this number varies from year to year (Table 3). The focal species encompassed in the plan are those that feed primarily in the open ocean, and belong to the families Gaviidae (loons), Podicipedidae (grebes), Diomedidae (albatrosses), Procellariidae (shearwaters and petrels), Hydrobatidae (storm-petrels), Fregatidae (frigatebirds), Phaethontidae (tropicbirds), Pelecanidae (pelicans), Sulidae (boobies), Phalacrocoracidae (cormorants), Anatidae (sea ducks and mergansers), Scolopacidae (phalaropes), Laridae (skuas, jaegers, gulls, and terns), and Alcidae (auks and puffins).

Importance of San Francisco Bay Estuary to Marine Birds: The California Current is adjacent to and abuts the San Francisco Bay Estuary and many of the seabird species addressed in the Plan use the estuary for breeding, feeding and foraging, chick rearing and in cases of migrant species, over-wintering. Of the 38 species of seabirds that breed within the CCS, 14 species utilize the San Francisco Bay to forage and rear chicks (see Table 2). The highly productive central San Francisco Bay provides an abundant resource of alternative prey fish for many seabirds, and this high productivity may explain the success of seabirds breeding in this heavily disturbed environment. For example, despite the heavy human disturbances they encounter, productivity and population growth for Brandt’s Cormorants, Pelagic Cormorants and Western Gulls breeding on Alcatraz Island tend to be much higher than productivity of these species nesting on South East Farallon Island, an undisturbed archipelago 47 km off the coast of San Francisco Bay (Gardner et al. 2004).

Table 2. Breeding seabirds in the California Current System and their basic breeding distribution (CA = California, OR = Oregon, WA = Washington, CN = Canada, MX = Mexico). Seabird species which utilize San Francisco Bay to feed, roost, and breed are highlighted within the table.

COMMON NAME	SCIENTIFIC NAME	BREEDING DISTRIBUTION	UTILIZE SF BAY
Laysan Albatross	<i>Phoebastria immutabilis</i>	MX	
Northern Fulmar	<i>Fulmarus glacialis</i>	CN	
Black-vented Shearwater	<i>Puffinus opisthomelas</i>	MX	
Leach's Storm-Petrel	<i>Oceandroma leucorhoa</i>	CA, OR, WA, CN, MX	
Black Storm-Petrel	<i>Oceanodroma melania</i>	CA, MX	
Ashy Storm-Petrel	<i>Oceanodroma homochroa</i>	CA, MX	
Fork-tailed Storm-Petrel	<i>Oceanodroma furcata</i>	CA, OR, WA, CN	
Least Storm-Petrel	<i>Oceanodroma microsoma</i>	MX	
Magnificent Frigatebird	<i>Fregata magnificens</i>	MX	
Brown Pelican	<i>Pelecanus occidentalis</i>	CA, MX	Feed and roost within Bay
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	CA, OR, WA, CN, MX	Roost on bridges within Bay
Brandt's Cormorant	<i>Phalacrocorax penicillatus</i>	CA, OR, WA, CN, MX	Breeding colony, Alcatraz Is.
Pelagic Cormorant	<i>Phalacrocorax pelagicus</i>	CA, OR, WA, CN, MX	Breeding colony, Alcatraz Is.
Heermann's Gull	<i>Larus heermanni</i>	MX	Feed and roost within Bay
Ring-billed Gull	<i>Larus delawarensis</i>	CA, OR, WA	
Mew Gull	<i>Larus canus</i>	CN	
California Gull	<i>Larus californicus</i>	CA, OR, WA	Feed, roost and breed within Bay
Western Gull	<i>Larus occidentalis</i>	CA, OR, WA, CN, MX	Feed, roost and breed within Bay
Glaucous-winged Gull	<i>Larus glaucescens</i>	OR, WA, CN	
Gull-billed Tern	<i>Sterna nilotica</i>	CA, MX	
Caspian Tern	<i>Sterna caspia</i>	CA, OR, WA, (CN)	Feed, roost and breed within Bay
Royal Tern	<i>Sterna maxima</i>	CA, MX	
Elegant Tern	<i>Sterna elegans</i>	CA, MX	
Arctic Tern	<i>Sterna paradisaea</i>	WA	
Forster's Tern	<i>Sterna forsteri</i>	CA	Feed, roost and breed within Bay

Table 2. continued

COMMON NAME	SCIENTIFIC NAME	BREEDING DISTRIBUTION	UTILIZE SF BAY
Least Tern	<i>Sterna antillarum</i>	CA, MX	Largest colony in California at former Alameda Naval Air Station
Black Skimmer	<i>Rynchops niger</i>	CA, MX	Feed, roost and breed within Bay
Common Murre	<i>Uria aalge</i>	CA, OR, WA, CN	Feed with chicks in Bay from June through October
Thick-billed Murre	<i>Uria lomvia</i>	CN	
Pigeon Guillemot	<i>Cepphus columba</i>	CA, OR, WA, CN	Colony on Alcatraz Island
Marbled Murrelet	<i>Brachyramphus marmoratus</i>	CA, OR, WA, CN	
Xantus's Murrelet	<i>Synthliboramphus hypoleucus</i>	CA, MX	
Craveri's Murrelet	<i>Synthliboramphus craveri</i>	MX	
Ancient Murrelet	<i>Synthliboramphus antiquus</i>	WA, CN	
Cassin's Auklet	<i>Ptychoramphus aleuticus</i>	CA, OR, WA, CN, MX	
Rhinoceros Auklet	<i>Cerorhinca monocerata</i>	CA, OR, WA, CN	
Horned Puffin	<i>Fratercula corniculata</i>	CN	
Tufted Puffin	<i>Fratercula cirrhata</i>	CA, OR, WA, CN	

Table 3. Common migrant seabirds in the CCS, based on observations from the California Cooperative Oceanic Fisheries Investigation (CalCOFI) (1987-2003) and Department of Fisheries and Oceans Canada-Line P (DFO-Line P) programs (1996-2003). CalCOFI and Line P capture the northern and southern extremes of the CCS. * Common migrant birds that utilize San Francisco Bay to over-winter are highlighted below.

Red-throated Loon <i>Gavia stellata</i>	Manx Shearwater <i>Puffinus puffinus</i>	Parasitic Jaeger <i>Stercorarius parasiticus</i>
Pacific Loon <i>Gavia pacifica</i>	Short-tailed Shearwater <i>Puffinus tenuirostris</i>	Pomarine Jaeger <i>Stercorarius pomarinus</i>
Arctic Loon <i>Gavia arctica</i>	Sooty Shearwater <i>Puffinus griseus</i>	South Polar Skua <i>Stercorarius maccormicki</i>
Common Loon <i>Gavia immer</i>	Wilson's Storm-Petrel <i>Oceanites oceanicus</i>	Little Gull <i>Larus minutus</i>
Yellow-billed Loon <i>Gavia adamsii</i>	Red-billed Tropicbird <i>Phaethon aethereus</i>	Bonaparte's Gull <i>Larus philadelphia</i>
Red-necked Grebe <i>Podiceps grisegena</i>	Red-tailed Tropicbird <i>Phaethon rubricauda</i>	Black-headed Gull <i>Larus ridibundus</i>
Horned Grebe <i>Podiceps auritus</i>	Red-faced Cormorant <i>Phalacrocorax urile</i>	Franklin's Gull <i>Larus pipixcan</i>
Eared Grebe <i>Podiceps nigricollis</i>	Masked Booby <i>Sula dactylatra</i>	Thayer's Gull <i>Larus thayeri</i>
Western Grebe <i>Aechmophorus occidentalis</i>	Brown Booby <i>Sula leucogaster</i>	Glaucous Gull <i>Larus hyperboreus</i>
Clark's Grebe <i>Aechmophorus clarkii</i>	Blue-footed Booby <i>Sula nebouxii</i>	Slaty-backed Gull <i>Larus schistisagus</i>
Short-tailed Albatross <i>Phoebastria albatrus</i>	Red-footed Booby <i>Sula sula</i>	Sabine's Gull <i>Xema sabini</i>
Black-footed Albatross <i>Phoebastria nigripes</i>	Surf Scoter <i>Melanitta perspicillata</i>	Black-legged Kittiwake <i>Rissa tridactyla</i>
Mottled Petrel <i>Pterodroma inexpectata</i>	Black Scoter <i>Melanitta nigra</i>	Common Tern <i>Sterna hirundo</i>
Cook's Petrel <i>Pterodroma cookii</i>	White-winged Scoter <i>Melanitta fusca</i>	Black Tern <i>Chlidonias niger</i>
Murphy's Petrel <i>Pterodroma ultima</i>	Red-breasted Merganser <i>Mergus serrator</i>	Kittlitz's Murrelet <i>Brachyramphus brevirostris</i>
Buller's Shearwater <i>Puffinus bulleri</i>	Red Phalarope <i>Phalaropus fulicaria</i>	Parakeet Auklet <i>Aethia psittacula</i>
Pink-footed Shearwater <i>Puffinus creatopus</i>	Red-necked Phalarope <i>Phalaropus lobatus</i>	Crested Auklet <i>Aethia cristatella</i>
Flesh-footed Shearwater <i>Puffinus carneipes</i>	Long-tailed Jaeger <i>Stercorarius longicaudus</i>	

The basic conservation problems in the CCS for fish and wildlife (over-exploitation, habitat destruction, by-catch and pollution) are interrelated; indeed, effects from these factors tend to exacerbate one another, becoming magnified through the food chain and affecting all wildlife, either directly or indirectly. Environmental variability, fisheries, and pollutants alter seabird food webs in the CCS and have a major influence on demography (i.e., the vital rates) and population dynamics. Hence, effective management of this vast oceanic domain requires a comprehensive ecosystem-level approach.

Conservation issues and threats to seabirds within the San Francisco Bay boundaries tend to primarily focus on human disturbances, habitat destruction, and pollution. Examples of threats commonly faced by seabirds within San Francisco Bay include:

- **Habitat Alteration** - both terrestrial and marine. Loss of nesting or roosting habitat is a common problem faced by seabirds in the CCS. With the increase in world population, there is a corresponding human encroachment into seabird habitat, displacing roosting or nesting birds. Other reasons for habitat alteration include habitat degradation due to vegetation succession, sea level rise (from global warming), erosion, and periodic inundation. Wetland and estuary habitats, despite providing critical nesting and feeding opportunities to numerous species, both resident and migratory, are the most severely impacted by humans. Most of these impacts have been the result of conversion of these habitats for development and discharges of pollutants through agricultural practices and runoff. It is estimated that there has been a loss of approximately 54% of wetland habitat in the United States impacting certain seabirds such as Caspian Terns, a species which seems to prefer to nest on isolated and sparsely vegetated islands (Mills and Sydeman, *in review*), and Forster's Terns that prefer to nest in tidal marsh habitats (McNicholl et al. 2001).
- **Species Interactions** - There has been a long history of accidental or purposeful introduction of animal and plant species to areas that have seabird colonies. Such introductions have resulted in both direct and indirect impacts on seabirds of the CCS, including decreases in population numbers and extinctions. Non-native animals impact seabirds through predation, habitat alteration, and/or competition for food or habitat. Non-native plants may impact seabird populations by displacing native plants used by seabirds as nesting material or by covering the habitat of burrowing seabird species with a tough root system.
- **Pollutants** –
 - Organochlorines (OCs) encompass a large array of compounds that are highly toxic and remarkably persistent once released into the environment. Some of the more common and serious compounds historically and/or currently found in the CCS include: DDT; DDE - a chemical similar to DDT, enters the environment as a contaminant or breakdown product of DDT; Polychlorinated biphenyls (PCBs) - mixtures of synthetic organic chemicals that were widely used for both industrial and commercial applications; Chlordane - a pesticide that was used in the United States from 1948 to 1978; and Aldrin and Dieldrin (a product of Aldrin) - both insecticides are now banned in the U.S. Current general opinion is

that OCs have been a significant problem in the past but levels have declined to concentrations that no longer pose a great risk to seabirds in the CCS. However, high levels of OC and Hg have been found in the eggs of terns (SFBBO and USFWS unpubl. data).

- Oil pollution is a globally recognized issue; exposure to even small amounts can coat seabird feathers or be ingested, thereby compromising health or killing individuals outright. Oil spills in the CCS have occurred as a result of ship collisions and groundings, accidents while loading or unloading, and accidents at offshore oil-rigs and pipelines. Considerable oil also enters the marine environment through “non-point” sources, including runoff from terrestrial sources. Some oil can also enter the marine environment via natural seeps, most famously in the Southern California Bight. Seeps actually contribute the majority of oil in the marine environment in North America, and non-point sources also exceed the amount of oil from accidental spills (Mills and Sydeman, *in review*).
- Garbage is ubiquitous, occurring throughout the world’s oceans and coastlines. Plastics are especially problematic as they are often mistaken for food and fed to chicks, which in severe cases can cause starvation. Several ways that plastic can affect seabirds and the marine environment in which they live are: through ingestion or entanglement; by absorption and concentration of toxins (including DDT, PCBs and organochlorines from seawater); and through alteration of ecosystem function by reducing the exchange of gases between sediment and seawater, changing the chemical makeup of the benthos. Drifting plastic is also a vector for alien species. Plastics encrusted with marine organisms may travel long distances, introducing alien species and adversely affecting native flora and fauna.
- **Human Disturbances** - include impacts such as the disruption of feeding flocks and injury of seabirds on the water by fishing vessels. Fishing vessels that approach too closely to breeding birds on their nests may cause them to flush, thereby leaving the eggs and/or chicks exposed to predation and desiccation. Human activities can affect seabirds’ ability to feed, rest, and breed; consequently, seabird breeding colonies, roosting sites, and foraging areas are all sensitive to human disturbance. Seabird responses to disturbance can vary depending on species, breeding status, group or community size and structure, environmental conditions, and type, severity, and proximity of the disturbance. Effects may be direct or indirect, clearly observable (e.g., alarm calling, flushing, predation) or difficult to detect (e.g., physiological changes, cumulative effects of disturbance), or may impact an individual or an entire population. Effects of repeated or long-term disturbance are especially difficult to study and quantify. Therefore, in long-lived species such as seabirds, the cumulative effects that disturbance can have on the individual (survival, lifetime reproductive success) or population level remain unknown.

Recommendations to address the above threats and conservation issues include both Research and Monitoring Recommendations and Conservation and Management Recommendations. A sample of these, from each section, that pertain to the above threats which are pertinent within the San Francisco Bay boundaries include:

Research and Monitoring Recommendations

- Investigate long-term effects of oil spills (chronic and catastrophic) on seabird prey, habitat, and population dynamics (reproductive success, survival).
- Model short-term (immediate mortality) and long-term impacts and potential impacts of oil spills on seabird demographics.
- Assess oil pollution threats along the coast and identify the areas that are most at risk (based on frequency of vessel traffic, time of year, and seabird numbers and diversity).
- Implement regular monitoring of contaminant levels (heavy metals, organochlorines, organophosphates/carbonates) in seabird eggs, feathers, and tissues (blood, liver, brain) in adults and juveniles, and of the effects of contaminants on seabird survival and reproductive success. Use seabirds killed as by-catch from fishing boats to monitor contaminant levels.
- Determine whether environmental estrogens are affecting breeding hormone concentrations and reproductive success or resulting in birth defects.
- Identify sources of contaminants.
- Examine levels of ingestion of plastics and other garbage in live and dead seabirds to assess the effect on reproductive success and determine the magnitude of this problem at both individual colony and population levels.
- Identify sources of garbage.
- Identify which seabird species/colonies are most at risk from freshwater inputs, especially from urban and agricultural centers, and determine the thresholds of seabirds to contaminants.
- Create a database that contains the results of seabird contaminant analyses and make this information available to the appropriate agencies.
- Investigate more thoroughly the interactions between terrestrial and marine environments. Further investigate and document the effects of human disturbance on seabirds. Rigorous documentation of disturbance effects on seabirds is sparse; for changes to be effected, documentation is essential.

Conservation and Management Recommendations

- Ensure that all oil transportation vessels have a double hull.
- Enforce current bilge pumping regulations and work with appropriate agencies to increase strictness of regulations.
- Create a database that includes a list of sensitive seabird areas, sensitive times of year, and a list of contact people for each of these areas. This database should be made available in the case of oil spills or other contaminant emergencies.
- Require bilge tank cleaning to occur further offshore than current regulations mandate.
- Work with waste removal and sanitation to decrease exposure of seabirds to garbage.
- Include indirect fisheries effects in management plans. Priority topics to include are: disturbance of seabird colonies or roost sites by fishing vessels; and the introduction of marine pollutants by fishing boats (and other sources) that may harm seabirds and other marine animals.

Opportunities for conservation of oceanic habitats have been increasing in recent years. In response to research findings concerning the utility of no-take marine reserves for biodiversity conservation, the U.S. and Canadian governments have made great strides towards creating a “network” of marine protected areas. In addition to this, there have been policy initiatives such as the Pew Oceans Commission and the U.S. Commission on Ocean Policy, ocean conservation legislation, and an increasing public awareness of ocean conservation issues. Many ongoing marine conservation and fishery management initiatives along the Pacific coast of North America would benefit from a “seabird” perspective of the resource targeted for management.

The primary goal of the CCS Plan is to ensure that information contained within the Plan is included and considered as these various marine conservation initiatives develop. The Plan provides specific recommendations for researchers, managers, educators, policy-makers, and conservationists intended to benefit seabirds of the CCS. These recommendations are aimed to structure research programs, education and outreach, and conservation and management of the seabird species which feed within the CCS.

The overall implementation recommendation for the CCS Plan is to facilitate region-wide coordinated monitoring, partnerships, and regional planning and coordination. The formation of a California Current Joint Venture will be an effective tool for bringing together the various stakeholders for seabird conservation in the CCS region (Mills and Sydeman, *in review*). The CCS Plan is currently in review and expected to be published in the fall of 2004. The CCS Plan has been initiated by PRBO Conservation Science and various individuals from agencies and organizations within the region have helped to prepare and develop the Plan.

US Fish and Wildlife Service

The U.S. Fish and Wildlife Service Pacific Region (Region One) Seabird Plan is currently in review and expected to be published in the fall 2004. The purpose of this Plan is to identify the Service’s priorities for seabird monitoring, management, research, outreach, planning and coordination. It will serve as a guide to coordinate Service activities for seabird conservation at the Pacific Region scale. The Plan includes: a review of seabird resources and habitats, a description of issues and threats, and a summary of current monitoring, management, and outreach efforts. The scope of the plan covers the USFWS Pacific Region (Region One), which for the purposes of conservation planning includes: the coastal and offshore areas of California, Oregon, Washington, Hawaii, and the U.S. Pacific Island commonwealths, territories, and possessions.

Sixty species of seabirds representing three Orders and ten Families, nest in the Region including: three albatross, six petrels, four shearwaters, seven storm-petrels, three cormorants, one pelican, two frigatebirds, three boobies, two tropicbirds, five gulls, twelve terns, three noddies, one skimmer, one murre, one guillemot, three murrelets, two auklets, and one puffin. All species are classified according to regional conservation concern using the ranking system of the North American Waterbird Conservation Plan. Almost half (47%) of the seabird species breeding in the Region fall into the two highest categories of conservation concern: “Highly Imperiled” and “High Concern.”

The Fish and Wildlife Services is the principal federal agency, in the United States, responsible for the protection and management of migratory birds. Within the Service, different divisions have defined, but often overlapping responsibilities concerning the conservation of seabirds: Migratory Bird Management; Ecological Services (including Endangered Species, Environmental Contaminants, and Habitat Conservation branches); Law Enforcement; and the National Wildlife Refuge System.

To date, Service activities have focused primarily on the protection and restoration of seabird nesting habitats, broad scale monitoring and inventory of breeding populations, research and monitoring of contaminant issues, coordination with other agencies and partners to address threats such as fisheries interactions and invasive species, as well as the specific responsibilities associated with endangered species management and oil spill and contaminant issues.

Recommended Service Priorities

Inventory and Monitoring

- Design and implement a standardized program for inventory and monitoring of seabird populations. Collaboratively develop a standardized system for data collection and analysis that is science based and statistically rigorous. Develop two manuals containing comprehensive designs for monitoring population status and trends for the California Current System and U.S. Pacific Island seabirds.
- Annually review and report the results of seabird monitoring efforts and develop an interactive web interface with GIS mapping capabilities to disseminate the inventory and monitoring information to stakeholders and partners.

Habitat Management

- Maintain, protect and enhance seabird habitats to meet seabird needs. Identify important habitats and through various means provide protection for those areas currently not protected.
- Restore lost or degraded seabird habitats.

Threat Management

- Identify threats and actions to remove or minimize the impacts, investigations to document the effects of threats on seabirds, and research to minimize impacts. Develop monitoring programs, as addressed above, to address threat management.

Research

- The Service will focus on research necessary to make informed conservation and management decisions. Priority will be given to birds of conservation concern and those listed under the Endangered Species Act.
- Develop methods to monitor population trends especially for those species where current methods are inadequate.
- Support research directed at evaluating, ameliorating, or eliminating the effects of threats.

- Work with partners to support studies into the interrelationships of seabirds and their environment.

Planning and Coordination

- Coordinate with other countries, U.S. Territorial and Commonwealth governments, Tribes, federal and state agencies, conservation and industry groups, and the public on the conservation and management of seabirds, at all scales.
- Improve coordination with USGS and support increased involvement by USGS in seabird conservation through research and technical assistance on key issues.
- Improve coordination with NOAA-Fisheries on shared monitoring, management, and seabird conservation issues.

Waterbird Education and Outreach Needs in San Francisco Bay

The San Francisco Bay Area is unique and fortunate to have an abundance of rich marine sanctuaries, wildlife refuges, state reserves, and county parks within miles of its urban centers. As populations continue to grow, however, pressures on the Bay's coastal resources by user-groups (e.g., boaters, commercial and recreational fishers, and hikers) must be effectively managed. Educators and marine managers must work together to reach diverse user-groups with clear, science-based, multi-lingual information on how to reduce threats to waterbirds and their habitats (e.g., human disturbance, overfishing, and pollution effects). Moreover, education and outreach should take an ecosystem approach that teaches across marine taxa – from zooplankton to humans.

The goal for Education and Outreach at the regional level is to provide guidelines, messages, and resources for partners interested in creating or enhancing education programs about waterbird conservation. Key messages specific to San Francisco Bay are presented below. Target audiences and strategies for reaching those audiences can be found in the California Current Marine Bird Conservation Plan (Mills and Sydeman, *in review*). Additionally, a compilation of web links to marine conservation and research organizations and downloadable resources concerning human disturbance to marine birds is available on the PRBO Conservation Science web site (www.prbo.org/seabirdaware).

The following list of Key Concepts for Marine Bird Conservation should be incorporated into education and outreach programs that focus on marine birds and their habitats in the San Francisco Bay region.

Key Conservation Concepts about Marine Birds in the San Francisco Bay Area

- Many colonial waterbirds come ashore to lay eggs and raise young between February and September – when they are particularly vulnerable to disturbances from humans and predators. Ecosystem example: Brandt's and Pelagic cormorants depend on steep, rocky cliffs above the ocean to nest during February to September. Approaching a cormorant colony by foot or watercraft can cause cormorants to fly away from their nests, thus leaving their eggs and young vulnerable to predation and exposure to

inclement weather. Severe or repeated disturbances can even cause seabirds to abandon entire colonies.

- To adequately support waterbirds and other marine life, we must not overexploit or degrade our shared marine resources. Ecosystem example: Common Murres and cormorants (and many other seabirds) depend on available, safe habitat and a reliable supply of fish and zooplankton to feed themselves and their growing young. If the habitat or prey that they have come to depend on disappears or is drastically reduced due to overexploitation or degradation, this may jeopardize adult survival and successful chick rearing.
- To sustain healthy populations, waterbirds must be able to evade predators and find food for several years before they reach breeding maturity. Ecosystem example: Western Gulls, endemic seabirds to the California Current System and common to San Francisco Bay, must be at least 4-years old to breed. To maintain their population, a sufficient number of fledged chicks must survive to replace birds that die or emigrate out of the population. In order to survive the first four years of their life, gulls must find safe, disturbance-free roosting areas; find enough food to eat; avoid disease; evade predators; and, finally, once old enough, find a breeding colony to raise their young.
- Birds possess special adaptations that allow them to thrive in their environment – often in harsh conditions. Ecosystem example: Common Murres spend most of their life at sea; but they depend on remote, rocky cliffs like the Farallon National Wildlife Refuge (29 miles west of the Golden Gate Bridge) to roost and breed. Because murres lay one pear-shaped egg that will not roll away during incubation, they can take advantage of steep and narrow rock ledges for nesting, which few land predators (e.g., coyotes) can negotiate.
- Waterbirds depend on habitats that are diverse in structure and flora. Ecosystem example: Rhinoceros Auklets need islands or mainland coasts with soft soil in which they can dig their nesting burrows. Without adequate plant cover, coastal soils are susceptible to erosion, which severely reduces the quality and availability of nesting habitat for this species.
- Non-native plants and wildlife and an overabundance of native predators can upset the dynamic balance of marine habitats. Ecosystem example: Seabirds have evolved on islands, like the Farallon Islands, and other isolated ecosystems that have been free from many mammal predators. When humans, whether inadvertently or purposefully, introduce non-native species (e.g., rats) to these sensitive ecosystems, the introduced species must find food and habitat to survive - often seabird eggs, young, and nesting burrows.

CHAPTER 3. SHOREBIRD CONSERVATION

National Context

In North America, the majority of shorebird species are thought to be in decline (Morrison 2001). The United States Shorebird Conservation Plan (USSCP; Brown et al. 2001) addresses the conservation needs of the 53 shorebird species that regularly occur in the U.S. It provides a scientific framework to determine species, sites, and habitats that most urgently need conservation action. Species were grouped into conservation priority categories based on their abundance, extent of their distribution, threats, and population trend (see Table 4). The stated national goal is “to stabilize populations of all shorebird species known or suspected of being in decline due to limiting factors occurring in the U.S., while ensuring that stable populations are secure.” Three general regional goals are also presented. The first concerns providing sufficient high quality habitat to ensure that shorebirds in each region are not unduly limited by habitat availability or configuration. The second is to “ensure that efforts to provide habitat for shorebirds are integrated into multiple species habitat management initiatives where appropriate.” The third is to “increase understanding of how local habitat conditions affect shorebird abundance and use of a region and, in turn, how conditions affect hemispheric shorebird populations.”

Multiple technical reports, including population assessment, international monitoring, and research needs, and regional conservation plans were produced during the development of the initiative. The USSCP and all of its associated products can be downloaded from <http://shorebirdplan.fws.gov>. Most international, national, and regional committees formed during development of the plan remain active and are integrating with relevant resource conservation efforts, particularly those of the other bird conservation initiatives. Joint Ventures, established throughout North America, are envisioned as the primary implementation partnerships for bird conservation regionally.

Table 4. National prioritization scores for national conservation variables; regional scores for shorebird population trend, and threats to breeding and non-breeding shorebird populations; USFWS Species of Conservation Concern; relative importance of the region during migration, winter, and breeding; and national conservation category. See Brown et al. (2001) for explanation of variables and scores. Species included are those for which the Southern Pacific Region is important.

Shorebird Planning Region	Southern Pacific											
	PT	RA	TB	TN	BD	ND	PT-R	TB-R	TN-R	USFWS Species of Conservation Concern (BCR 32)	Entire Planning Region	National Conservation Category
Species												
Black-bellied Plover	5	3	2	2	2	1	U	NA	2		M,W	3
American Golden-Plover	5	3	2	4	2	3	U	NA	4		m	4
Pacific Golden-Plover	3	5	2	2	5	4	U	NA	2		m,w	4
Snowy Plover	5	5	4	4	3	4	4	5	4		M,W,B	5
Semipalmated Plover	3	3	2	2	1	1	U	NA	2		M,w	2
Killdeer	5	1	3	3	1	2	U	4	4		M,W,B	3
Mountain Plover	5	5	4	4	5	4	U	NA	5	Y	M,W	5
Black Oystercatcher	3	5	4	3	3	4	U	4	3	Y	W,B	4
Black-necked Stilt	3	3	3	2	1	2	U	3	2		M,W,B	2
American Avocet	3	2	3	4	2	3	U	3	4		M,W,B	3
Greater Yellowlegs	3	4	2	2	2	1	U	NA	2		M,W	3
Lesser Yellowlegs	5	2	2	3	2	1	U	NA	3		m,w	3
Solitary Sandpiper	3	4	4	2	3	2	U	NA	2		m	4
Willet	3	3	3	3	3	3	U	3	3		M,W,b	3
Wandering Tattler	3	5	2	2	3	2	U	NA	2		M,w	3
Spotted Sandpiper	3	3	2	2	1	1	U	2	2		M,W,B	2
Whimbrel	5	4	2	2	3	2	U	NA	2	Y	M,w	4
Long-billed Curlew	5	5	4	4	3	3	U	4	4	Y	M,W,b	5
Marbled Godwit	4	3	4	4	3	3	U	NA	4	Y	M,W	4
Ruddy Turnstone	4	3	2	4	2	2	U	NA	4		m,w	4
Black Turnstone	3	4	4	4	5	3	U	NA	4	Y	M,W	4
Surfbird	4	4	2	4	4	3	U	NA	4		m,w	4
Red Knot	5	2	2	4	3	3	U	NA	4	Y	M,W	4
Sanderling	5	2	2	4	2	1	U	NA	4		M,W	4
Semipalmated Sandpiper	5	1	2	3	3	3	U	NA	3		m	3
Western Sandpiper	5	1	2	4	4	2	U	NA	4		M,W	4
Least Sandpiper	5	2	2	2	2	2	U	NA	2		M,W	3
Baird's Sandpiper	3	2	2	2	3	3	U	NA	2		m	2
Pectoral Sandpiper	3	2	2	3	2	3	U	NA	3		m	2
Rock Sandpiper	3	3	3	4	5	4	U	NA	4		w	3
Dunlin	5	2	2	3	2	3	U	NA	3		M,W	3
Short-billed Dowitcher	5	2	2	4	3	2	U	NA	4	Y	M,W	4
Long-billed Dowitcher	2	2	2	3	4	3	U	NA	3		M,W	2
Common Snipe	5	1	3	2	1	2	U	3	2		W, b	3
Wilson's Phalarope	5	1	3	4	2	5	U	3	4		M,b	4
Red-necked Phalarope	4	1	2	3	2	1	U	NA	3		M	3
Red Phalarope	5	1	2	3	2	1	U	NA	3		M,w	3

Codes: B = breeding, M = migration, and W = wintering. **B,M,W** = high concentrations; region extremely important to the species relative to the majority of other regions. B,M,W = common or locally abundant; region important to the species relative to other regions. b,m,w = uncommon to fairly common; region within species' range but occurs in low abundance relative to other regions.

PT(-R) = Population Trend (Regional); RA = Relative Abundance; TB(-R) = Threats during the Breeding Season (Regional); TN(-R) = Threats during the Non-breeding Season (Regional); BD = Breeding Distribution; ND = Non-breeding distribution.

National Conservation Category: 5 = Highly Imperiled; 4 = Species of High Concern; 3 = Species of Moderate Concern; 2 = Species of Low Concern; 1 = Species not at Risk.

Regional Context

The Southern Pacific Shorebird Conservation Plan (Hickey et al. 2003), from which the majority of the information herein is derived, is one of 11 regional plans associated with the U.S. Shorebird Conservation Plan. It provides relevant information and needs for the conservation of shorebirds on the coast, including San Francisco Bay, and the Central Valley of California. The plan represents the combined expertise of a broad partnership of federal and state agencies, conservation organizations, academics, and private consultants.

The approximately 1,700-km coastline and the 64-km-wide by 644 km-long Central Valley of California are the main areas where shorebirds concentrate in the Southern Pacific Region. Tidal wetlands, salt ponds, sand beaches, and rocky shoreline are the principal shorebird habitats on the coast. About two-thirds of the estimated approximately 381,000 acres of prime tidal wetlands at the turn of the century have been degraded or destroyed by agricultural, industrial, urban, and military development. Simultaneously, sand beaches have been heavily impacted by human recreation and beachfront housing, whereas rocky shoreline has been relatively little altered. As shorebirds today live in an environment quite different from two centuries ago, shorebird conservation in the Southern Pacific Region will require substantial effort to maintain current and recover declining shorebird populations.

Numbers of Shorebirds - Little quantitative information is available on historic shorebird numbers in the region. Currently the Western Sandpiper is the most abundant species with several million passing through the region on migration and over 100,000 present during winter. At least 250,000 Dunlin and likely over 100,000 Long-billed Dowitchers winter in the area (PRBO unpubl. data). Over 100,000 Marbled Godwits, Least Sandpipers, and Short-billed Dowitchers likely pass through the region during migration. Tens of thousands of Black-bellied Plovers, Killdeer, Black-necked Stilts, American Avocets, Willets, Marbled Godwits, Sanderlings, Least Sandpipers, and, probably, Black Turnstones and Wilson's Snipe winter in the region. Additionally, tens of thousands of Whimbrels, Wilson's Phalaropes, and Red-necked Phalaropes pass through during migration. For breeding shorebirds, the region is especially important to Western Snowy Plovers, American Avocets, and Black-necked Stilts.

Importance of Region to Shorebird Species - The Southern Pacific Region is extremely important to 20 shorebird species relative to the majority of other regions (Table 4). Of the 17 temperate breeding shorebirds in the United States, 12 are priority species that are categorized as either Species of High Concern or Highly Imperiled in the U.S. Shorebird Conservation Plan. Of these 12 species, there are five species (Black Oystercatcher, Snowy Plover, Mountain Plover, Long-billed Curlew, and Marbled Godwit) for which the Southern Pacific Region is extremely important to the species relative to the majority of other regions. Non-temperate breeding species categorized as Species of High Concern and Highly

Imperiled for which the Southern Pacific Region is extremely important relative to the majority of other regions, include the Whimbrel, Black Turnstone, Western Sandpiper, and Short-billed Dowitcher. All except two of the above species (Snowy Plover, as it is a federally threatened species, and Western Sandpiper) are also listed as USFWS Species of Conservation Concern in the region (Table 4).

Shorebird Conservation in San Francisco Bay

San Francisco Bay holds higher proportions of total wintering and migrating shorebirds than any other coastal wetland within the U.S. Pacific coast wetland system (Table 5; Page et al. 1999). For eleven species, the San Francisco Bay holds over 50% of the individuals found on surveys of U.S. Pacific Coast wetlands in at least one season (Table 5). About 10% of the U.S. Pacific coast population of the Snowy Plover breeds in South Bay salt ponds. San Francisco Bay is recognized as a Western Hemisphere Shorebird Reserve Network (WHSRN) site of Hemispheric Importance for shorebirds – the highest possible ranking.

Table 5. Percent of coastal shorebird totals found in San Francisco Bay on PRBO surveys of all the major wetlands of the contiguous U.S. Pacific coast (from Page et al. 1999).

Species	Season		
	Fall	Winter	Spring
Black-bellied Plover	62	59	55
Semipalmated Plover	52	40	47
Black-necked Stilt	78	90	58
American Avocet	96	88	86
Greater Yellowlegs	41	41	26
Willet	69	58	57
Long-billed Curlew	66	49	46
Marbled Godwit	62	46	68
Red Knot	76	43	39
Western Sandpiper	59	68	54
Least Sandpiper	67	39	73
Dunlin	-	38	24
dowitcher spp.	72	65	49

Population Goals:

1. Attain a breeding population of 500 Snowy Plovers in San Francisco Bay, consistent with the population objectives of the Snowy Plover Draft Recovery Plan (USFWS 2001).
2. Maintain or increase current breeding populations of Killdeer, Black Oystercatcher, Black-necked Stilt, and American Avocet.
3. Increase numbers of wintering and migrating shorebirds.

Habitat Status, Threats, Management Needs, and Recommended Conservation Actions:

Shorebird habitat use patterns, threats to shorebirds, management issues, and needed conservation actions are provided below for the major habitat types used by shorebirds within the San Francisco Bay estuary. Some of the recommended conservation actions overlap with those presented as necessary for the recovery of the Western Snowy Plover; for a more in-depth treatment of those goals and a Recovery Task Outline, please refer to the Draft Recovery Plan (USFWS 2001).

Tidal flat

There has been a 42% reduction of tidal flat in San Francisco Bay from the historical extent (Goals Project 1999). Today about 90% of the tidal flats occur on the bay's edges and about 10% along marsh channels. Historically, a greater proportion of the tidal flat occurred along marsh channels. Tidal flats are the principal foraging area for most shorebirds in San Francisco Bay at low tide. Species that forage on tidal flats include the Black-bellied Plover, Semipalmated Plover, Willet, Long-billed Curlew, Marbled Godwit, Red Knot, Dunlin, Western Sandpiper, Least Sandpiper, Short-billed Dowitcher, and Long-billed Dowitcher. Tidal flat invertebrates are their primary prey items, the majority of which have been introduced by humans.

Within the past decade, *Spartina alterniflora* has been introduced into San Francisco Bay from stock originating on the Atlantic coast of the U.S. This species grows at both lower and higher elevations in the intertidal zone than the native California cord grass (*Spartina foliosa*) and thereby threatens to reduce the amount of unvegetated tidal flat available to foraging shorebirds. The U.S. Fish and Wildlife Service, East Bay Regional Park District, CDFG, and others have ongoing management programs using physical and chemical methods to control and eliminate *Spartina alterniflora*. A recent study analyzing the potential effects of non-native *Spartina* on shorebird habitat in South San Francisco Bay predicted that between 20% and 41% of the total South Bay mudflat could be encroached upon by *Spartina* and its hybrids (Stralberg et al. 2003b). The study predicted a loss of mudflat habitat value for shorebirds between 10% and 70%, depending on *Spartina* inundation tolerance and invertebrate density scenarios, and predicted that *Spartina* spread would have the largest impact on small shorebirds, dowitchers, and Marbled Godwits.

Other factors impacting, or potentially impacting, tidal flats and the invertebrates living in them include sea level rise, contaminants, oil spills, and proposed new ferry systems. Sea level rise, projected from current levels of global warming, is a phenomenon that could greatly alter the acreage of tidal flat. Galbraith et al. (2002) predicted that sea level rise could affect a conversion of 39% of the intertidal habitat in San Francisco Bay to subtidal habitat. In the San Francisco Bay Area, some communities currently are proposing to construct tidal barriers on tidal flats to prevent future flooding of urban areas from sea level rise.

Contaminants, such as selenium and mercury, are widespread in San Francisco Bay sediments and were identified as possibly detrimental to shorebirds there (N. Warnock pers. comm.). There is a high potential for oil spills, which could have a major impact on shorebirds and their food supply. Proposed new ferry transport systems may involve the use of hovercraft over tidal flats, where their high noise levels and frequent presence has the potential to disturb foraging shorebirds or their benthic invertebrate prey. Dredging to accommodate ferry facilities also could reduce the amount of available intertidal habitat. Additionally, the proposed South San Francisco Bay salt pond restoration plans could alter the distribution and quality of tidal flats in the South Bay.

Priority conservation actions for tidal flats are to:

- Increase the extent of tidal flat by adding 4,000 acres throughout the estuary.
- Improve and revise watershed management actions to reduce sediment accumulation on intertidal habitat.
- Protect existing tidal flat from introduced plants and invertebrates.
- Develop regulations to reduce invasions of non-native benthic invertebrates, including legislation to restrict ballast discharge.
- Eliminate non-native vegetation (e.g., *Spartina alterniflora*) that threatens to reduce the extent of tidal flats.
- Restrict human activities that cause substantial disturbance to large flocks of shorebirds foraging on tidal flats, especially during periods of peak shorebird occurrence.

Salt marsh

There currently are about 40,200 acres of tidal marsh in the San Francisco Bay, a 79% decline from historic levels. Tidal marsh has been lost primarily to the development of salt ponds, agricultural land, and urban areas. There is much evidence that shorebirds use diked managed wetlands including salt ponds in preference to natural tidal marsh in San Francisco Bay (Bollman et al. 1970, Warnock and Takekawa 1996, PRBO unpubl. data), but shorebirds do use this habitat (Stralberg et al. 2003a). Salt marsh vegetation, growing in the upper part of the intertidal zone, may be too tall or dense to provide much foraging habitat for shorebirds, but some species, such as the Willet, Whimbrel, Long-billed Curlew, and Least Sandpiper, forage on marsh plains with sparse or low vegetation (< about 20 cm). The larger non-vegetated channels in salt marsh are used as foraging habitat by the same species that feed on tidal flats. Species such as the Willet, Least Sandpiper, Dunlin, and Long-billed Dowitcher use salt marsh as diurnal and nocturnal roost sites, possibly to provide some protection from predators such as owls. Black-necked Stilts and occasionally American Avocets nest in marshes with shallow ponds (Rintoul et al. 2003).

Priority conservation actions for salt marshes are to:

- Increase the extent of tidal marsh in the Bay.
- Mitigate the effect of introduced *Spartina alterniflora*.
- Incorporate shorebird habitat components in tidal marsh restorations and creations, including broad channels with exposed mudflat during low tides, shallow ponds for foraging and breeding (either through daily tidal exchange or elevated salt panes), and undisturbed roost sites.

- Increase tidal circulation and water quality in marshes to enhance invertebrate productivity and shorebird foraging areas.

Salt ponds

In the San Francisco Bay Estuary, historically, about 1,600 acres of natural salt pannes occurred in the tidal marsh. Salt pannes, open areas amongst the marshes, once served as supra-tidal foraging and roosting sites for many shorebird species, and as nesting areas for plovers, stilts, and avocets. Most of this habitat was located in the South Bay, with the largest pond complex extending over 405 ha. As the demand for salt rose in the mid-1800s, the first artificial salt ponds were developed as extensions and improvements of the natural salt ponds. Currently there are about 34,450 acres of salt ponds in the estuary; the majority of which were constructed on former tidal marsh. Very shallow ponds often contain drier areas that serve as excellent salt panne ‘mimics.’

More than half of the shorebird use of the San Francisco Bay estuary occurs within the diked salt ponds that rim the South Bay. Though the habitat value of the once extensive vegetated marsh was lost when the ponds were formed, the ponds and levees within the salt complex became significant roosting and nesting sites for a wide variety of non marsh-dependent species, and the ponds themselves became important foraging areas for millions of shorebirds and other species of waterfowl, seabirds, and waterbirds (Stenzel and Page 1988, Accurso 1992, Stenzel et al. 2002, Warnock et al. 2002).

Salt ponds are the principal foraging habitat (south of Suisun Bay) of the Black-necked Stilt, Wilson’s Phalarope, and Red-necked Phalarope. The large increase in acreage of salt ponds during the past 200 years likely has augmented numbers of these species in the bay over historical levels. On PRBO shorebird surveys of the North, Central, and South bays, the median proportions of Black-necked Stilts found in the salt ponds, versus other habitats, were 86% and 60% for fall and spring, respectively. For the Red-necked Phalarope, comparable proportions were 99% and 93% (PRBO unpubl. data). The American Avocet and Western Snowy Plover are species that use both salt ponds and tidal flats for foraging and now likely are more abundant in the bay than formerly. Other species that feed principally on tidal flats at low tide, such as the Dunlin, Western Sandpiper, Least Sandpiper, and Willet, also forage in the salt ponds at high tide (Warnock et al. 2002). Most shorebirds use the salt ponds, especially the levees and islands, as high tide roosting areas.

The federally threatened Western Snowy Plover relies heavily on salt pond habitat (Page et al. 2000). Dry margins and levees of salt ponds are their chief nesting habitat in San Francisco Bay and also are important nesting areas for the Black-necked Stilt and American Avocet (Rintoul et al. 2003). The Western Snowy Plover was known to nest in the bay at salt ponds by 1918, whereas the American Avocet and Black-necked Stilts were first known to breed there in 1926 and 1927, respectively (Harvey et al. 1992). Numbers of Black-necked Stilts and American Avocets likely have increased in the estuary due to the existence of salt ponds (Gill 1977, Shuford and Ryan 2000, Rintoul et al. 2003).

In the last two decades, shorebirds nesting in the salt ponds have been impacted by introduced mammalian predators and expanding populations of native predators. Red Foxes have been identified as important predators of plover, avocet, and stilt clutches; feral and

free-roaming cats and dogs, as well as Norway and roof rats also may be a problem. Common Ravens – important predators of the eggs of nesting shorebirds – are expanding their breeding range into the bay, where they nest on power line towers and other artificial structures. Increasing numbers of California Gulls in the South Bay may be impacting shorebird nesting success as well.

Priority conservation actions for salt ponds are to:

- Manage some amount of salt ponds specifically for nesting, feeding, and roosting shorebirds, including some to be managed specifically for nesting Snowy Plovers, as recommended in the Western Snowy Plover Draft Recovery Plan (USFWS 2001).
- Retain many low salinity ponds along with a few high salinity ponds, in which shorebird densities are highest.
- Maintain a number of ponds with shallow water levels, plenty of shoreline habitat, and islands that are safe from terrestrial predators.
- Consider retaining some ponds at the edge of bay, where shorebird densities are highest (consider this with knowledge that shorebird densities are also highest in marshes close to the edge of bay).
- Maintain public closures of Western Snowy Plover nesting areas during the breeding season.
- Continue to manage non-native and native mammalian and avian predators to limit predation of the eggs and chicks of the Western Snowy Plover and other nesting shorebirds in important nesting habitat.
- Use fencing and exclosures to protect Western Snowy Plover nests from egg predators when necessary.
- Prevent the spread of vegetation in dry salt ponds.

Managed diked wetlands

Diked wetlands are a human-created habitat currently totaling about 64,520 acres in the San Francisco Bay. Diked wetlands, whether duck ponds or abandoned salt evaporation ponds, vary considerably in water level, salinity, and amount and type of vegetation. Consequently, shorebird use can be highly variable among ponds. Overall, these wetlands provide important foraging habitat for the Black-necked Stilt, American Avocet, Greater Yellowlegs, Dunlin, and Long-billed Dowitcher and nesting habitat for the Killdeer, Black-necked Stilt, and American Avocet.

Priority conservation actions for managed diked wetlands are to:

- Time water drawdowns in managed marshes to correspond with the peak of spring shorebird migration from mid-April to mid-May.
- Manage vegetation in some ponds to provide broad expanses of open habitat.
- Create 1-6 inch water depths in some managed ponds for wintering shorebirds.
- Increase nesting habitat for the Black-necked Stilt and American Avocet in managed marshes through the strategic placement of islands.

Agricultural lands and seasonal wetlands

Seasonal wetlands that form on agricultural baylands after winter rains are foraging habitat for many shorebirds, such as the Greater Yellowlegs, Western Sandpiper, Least Sandpiper,

Dunlin, and Long-billed Dowitcher. Currently there are about 34,620 acres of agricultural baylands in the San Francisco Bay Estuary of which about 80% are located in the North Bay.

Priority conservation actions for agricultural lands and seasonal wetlands are to:

- Protect from development, including use of conservation easements, seasonal wetlands and pastures with known high shorebird use.
- Limit recreational use of seasonal wetlands with known high shorebird use.
- Restore seasonal wetlands.
- Protect or enhance agricultural lands adjacent to seasonal wetlands with known high shorebird use.
- Reduce reliance on toxic pesticides and herbicides.

Coastal strand

Although sand beaches may be used by a large number of species, they are most important to the Snowy Plover, Willet, Whimbrel, and Sanderling. Snowy Plovers nest on the upper beach and forage on invertebrates on the upper and lower beach. Barren to sparsely vegetated sand dunes, which back some beaches, are also important Snowy Plover nesting and foraging areas (Page et al. 1995b). Migrating and wintering Black-bellied Plovers, Western Sandpipers, Semipalmated Plovers, Willets, Whimbrels, Sanderlings, and other shorebirds forage on beaches and roost on the higher portions of the beach (Colwell and Sundeen 2000) or in barren to sparsely-vegetated dunes backing beaches, particularly at high tides.

Shorebirds foraging and roosting on coastal beaches experience considerable disturbance from humans and other threats to habitat quality. Birds are flushed by pedestrians and joggers particularly those with dogs. Leash laws are seldom enforced and dogs are often permitted to chase roosting and foraging shorebirds. With the growing human population in California this type of disturbance undoubtedly will increase. Oil spills are another problem shorebirds experience on sand beaches. Within the Bay Area, shorebirds were oiled on Point Reyes beaches in November 1997 and January 1998 (PRBO unpubl. data). Nesting Snowy Plovers face numerous threats on sand beaches. These include loss of dune habitat to the introduced European beachgrass, *Ammophila arenaria*, decreased nesting success from human disturbance, and high levels of egg predation by Common Ravens.

Priority conservation actions for sand beaches and dunes are to:

- Identify and rank beaches of importance to migrant and wintering shorebirds, as well as to the Western Snowy Plover, for the purpose of prioritizing conservation actions for this habitat type.
- Remove non-native vegetation in coastal dunes, especially European beachgrass and iceplant, *Mesembryanthemum* sp.
- Where appropriate, restore native plant communities of coastal dune systems.
- Implement recommendations of the draft Western Snowy Plover Recovery Plan (USFWS 2001). These include but are not limited to: In known Snowy Plover nesting and brood-rearing areas, restrict human recreation, use nest exclosures to protect plover nests, implement predator management to protect plover clutches and to increase fledge rate of plover chicks, and implement public education programs.

- Restrict dogs from beaches of highest importance to the Western Snowy Plover and those with highest relative importance to migrant and wintering shorebirds.
- Increase enforcement of dog leash laws on other beaches used by nesting Snowy Plovers and large flocks of migrant and wintering shorebirds.
- Limit human use of beaches with consistent roosts of large numbers of shorebirds, and beaches with feeding and roosting Snowy Plovers to produce conditions conducive to nesting (where they do not currently nest).
- Increase enforcement of county ordinances that already exist to prohibit much of the above activity.
- Restrict building on coastal strand.

Rocky shoreline

Resident Black Oystercatchers use this habitat for nesting, foraging, and roosting. During winter, rocky shoreline is the primary habitat of the Black Turnstone, which also forages on tidal flats. Other rocky coast species, occurring in small numbers in migration and winter, are the Wandering Tattler, Spotted Sandpiper, Ruddy Turnstone, Surfbird, and Rock Sandpiper. Oil spills are the main threat to the species using this habitat.

Priority conservation actions for rocky shorelines are to:

- Develop an inventory of rocky shoreline habitat, as well as jetties that function similarly for shorebirds.
- Identify and rank rocky shoreline of highest importance to breeding Black Oystercatchers and large flocks of migrant and wintering shorebirds.
- Limit human access to Black Oystercatcher breeding sites.
- Control predators of Black Oystercatcher eggs and chicks where they are found to substantially reduce reproductive success.
- Promote regulations reducing the probability of oil spills.

Offshore waters

Offshore waters are important for migrating Red-necked and, particularly, Red phalaropes (Briggs et al. 1987, Tyler et al. 1993). Available food supplies in these waters are undoubtedly affected by ocean temperatures and large-scale oceanic events such as El Niño conditions (Warnock et al. 2001). The Red Phalarope may be affected by winter storms, which sometimes cause large numbers to come ashore in a weakened condition that leaves them susceptible to predators. Oil spills are the main human-induced problem for phalaropes in offshore waters.

Priority conservation actions for offshore waters are to:

- Promote regulations reducing the probability of oil spills.
- Promote creation of a California Current Joint Venture.

All habitats

In order to aid in the management and creation of salt pond and tidal marsh habitat in the South Bay, PRBO Conservation Science has been developing a predictive modeling approach called the Habitat Conversion Model (HCM) to determine what the impact might be on bird populations when salt ponds are restored to a mix of other habitats (see Stralberg

et al. 2003a). Some recommendations from this report are included for specific habitat types above. The model hopes to inform restoration decisions about how the condition, amount, and configuration of resulting habitat maximally benefits and supports a diverse bird community.

Priority conservation actions for all habitats are to:

- Protect existing habitat from loss to development or from further fragmentation by human-created infrastructures. For example, additional power lines can artificially increase predation pressure on shorebirds and be direct sources of mortality through collision of birds with wires.
- Develop site-specific management plans for habitat under public ownership, where they are currently lacking.
- Implement management practices favorable to breeding, wintering, and migrating shorebirds.
- Improve management capacity for existing protected habitats.
- Enhance existing shorebird nesting habitat.
- Reduce level of disturbance and other degrading impacts of human recreational activities on nesting, foraging, and roosting areas of the Snowy Plover and other shorebirds.
- Reduce erosion of sediment from watersheds into lagoon and estuarine habitats.
- Encourage cleanup of areas containing hazardous levels of environmental contaminants in invertebrates or substrates and reduce shorebird use of areas until hazardous materials are removed.

Monitoring Needs

For the San Francisco Bay Joint Venture, it will be important to contribute to and participate in national/international programs being developed to estimate shorebird population sizes, detect population trends, and monitor shorebird numbers at stopover locations. Monitoring needs specific to the Southern Pacific Region include the establishment of an active network of organizations and individuals to undertake monitoring activities, establishment of monitoring methods for the region that feed into national monitoring efforts, and establishment of a data central for monitoring results for the region.

Monitoring of breeding shorebird populations is a priority and includes monitoring annual numbers, reproductive success, and survival of Snowy Plover, Black Oystercatcher, and other species, particularly those dependent on habitat types that face the most imminent threats. For non-breeding shorebird populations, it will be important to establish long-term monitoring schemes for species of conservation concern and other species for which the Southern Pacific Region is particularly important relative to other regions of North America.

Additionally, in light of proposed conversion of thousands of acres of salt ponds to tidally influenced wetlands in the estuary, monitoring wintering and migrating shorebird use of the estuary is needed to assess impacts of the restoration activities on shorebird populations and to inform restoration and conservation activities. In addition to population monitoring, priorities include monitoring of habitat availability, quality, and condition over the long-term and quantifying the success of restoration and enhancement projects in supporting shorebird populations.

Shorebird Education and Outreach Needs in San Francisco Bay

Successful shorebird conservation requires strategic implementation of education and outreach programs to engender acceptance of conservation recommendations. The needs and priorities at the national level are summarized in the US Shorebird Conservation Plan (USSCP; Brown et al. 2001), and outlined in more detail in the technical report of the Education and Outreach Working Group of the USSCP, the National Shorebird Education and Outreach Plan (Johnson-Schultz et al. 2000).

The goal for Education and Outreach at the regional level is to provide guidelines, messages, and resources for partners interested in creating or enhancing education programs about shorebird conservation. Key messages specific to San Francisco Bay are presented below. Target audiences and strategies for reaching those audiences can be found in the Southern Pacific Shorebird Conservation Plan (Hickey et al. 2003). Additionally, a compilation of resources available concerning shorebird ecology and conservation for each of the audiences identified is available for download from the PRBO Conservation Science web site (www.prbo.org/shorebirdconservation).

Key Conservation Concepts about Shorebirds in the San Francisco Bay Area

- San Francisco Bay Estuary is one of the largest and most important shorebird migration stopover sites on the Pacific Flyway south of Alaska.
- San Francisco Bay Estuary holds more wintering and migrating shorebirds than any other coastal wetland on the US Pacific coast; it has been designated as a WHSRN site of Hemispheric Importance (highest possible ranking for a wetland ecosystem).
- Migrating birds rely on the estuary for predictable food and resting areas.
- Salt marsh channels are important habitat for foraging Willet and Least Sandpiper.
- South San Francisco Bay salt ponds provide critical habitat for:
 - > 70 species of shorebirds and waterfowl;
 - a half-million (single day count) migrating shorebirds seeking supra-tidal (high tide) foraging and roosting habitat;
 - 10% of breeding threatened Western Snowy Plover; and
 - thousands of breeding Black-necked Stilts and the American Avocets.
- Salt pond restoration efforts will be directed towards replacing much of the pond habitat with vegetated marsh; retaining a mix of habitats will be critical to maintain current wildlife values.
- The San Francisco Bay ecosystem is negatively affected by:
 - invasive plants that replace beneficial habitat;
 - introduced non-native predators and human-aided expansion of native predators that prey on breeding and migrating shorebirds, their nests, and chicks; and
 - contaminants, oil spills, dumping, development, and dredging that can reduce and degrade habitat.
- Almost half (42%) of tidal flat habitat in the San Francisco Bay Estuary has been filled for urban or agricultural development.
- To reduce human disturbance of breeding, migrating, and roosting shorebirds in the San Francisco Bay Estuary, it is necessary to:

- focus outreach and signage on reducing human disturbance of shorebird nesting and roosting sites around the Bay;
- target outreach efforts to engender support for seasonal restrictions and habitat protection measures for breeding Western Snowy Plovers;
- promote volunteerism at local parks, wetland, and refuge visitor centers;
- educate the public against keeping open compost or trash bins, which support predators of shorebirds and young, including crows, ravens, cats, rats, and foxes; and
- educate the public to take unwanted cats, dogs, or other pets to the local SPCA and to never abandon them on roadsides, in local parks, or in wild lands.

CHAPTER 4. LANDBIRD CONSERVATION

International Context

Following the lead of the North American Waterfowl Management Plan, Partners in Flight (PIF) began in 1990 with the collective commitment to conserve the resident, short distance, and Neotropical migrant landbirds that occupy every major biome and habitat on the continent. PIF is a voluntary, nonadvocacy, international coalition of federal, state, provincial, and territorial government agencies, First Nations, tribes, nongovernmental organizations, numerous universities, concerned individuals, and private industry in Canada, the U.S., Mexico, the Caribbean, and Central America. PIF expects to expand into South America in the near future. This international approach is essential because most species breed, migrate, and winter in more than one country, such that Canada, the U.S., and Mexico share many of the same birds at different times of year. Migratory birds are an international resource that requires conservation planning at a continental scale and beyond - a different approach than what may be suitable for more sedentary wildlife.

The Partners in Flight mission is expressed through three related concepts:

- *Helping species at risk.* Species exhibiting warning signs today must be conserved before they become imperiled. Allowing species to become threatened or endangered results in long-term and costly recovery efforts in which recovery often is not guaranteed. Species that have attained endangered or threatened status must not only be protected from extinction, but also must be recovered.
- *Keeping common birds common.* Native birds, both resident and migratory, must be retained in healthy numbers throughout their natural ranges. Humans have a responsibility to be good stewards of species that are fundamental to the integrity of North America's diverse and unique ecosystems.
- *Voluntary partnerships for birds, habitats, and people.* A central premise of PIF is that the resources of public and private organizations throughout the Americas must be combined, coordinated, and increased in order to achieve success in conserving bird populations in this hemisphere. The power of PIF lies in the synergy that builds when diverse, committed partners who care about birds work together for a common goal.

The North American Landbird Conservation Plan

The PIF North American Landbird Conservation Plan (Rich et al. 2004) provides a continental perspective on North American landbird conservation, presenting geographic, species, and habitat priorities. The current version, published in 2004, is limited to 448 native landbirds that breed in the U.S. and Canada. The full participation by the Mexican partners will add another 450 breeding species to the next iteration of this plan. The first estimates for total population size for all 448 landbird species and population objectives for specially designated species are given in this plan. These objectives are based on the extent of declines since the late 1960s and call for the reversal of those declines over the next 30 years.

The plan considers two types of landbirds to be of high conservation importance – those that show some combination of population declines, small ranges, or distinct threats to habitat, and those that are restricted to distinct geographical areas, but otherwise not currently at risk. This rationale forms the basis for grouping species into the PIF Watch List (those warranting attention due to concern) and the Stewardship Species (those that are recognized as responsibilities due to restricted range). Collectively, the Watch List and Stewardship Species are referred to as Species of Continental Importance.

The PIF Watch List for Landbirds includes 100 species (22% of the 448 species assessed), which have the greatest range-wide concerns, and which are most in need of conservation attention. The intent is for Watch List Species to receive focused management attention that may or may not consider the needs of an entire faunal suite. The Watch List designation will improve the chances that species at risk are given appropriate attention, whether that is immediate intervention, long-term planning and management to maintain populations, or only a close watch in existing conditions.

Of the 100 Watch List Species, 66 also are Stewardship Species. There are an additional 92 continentally important Stewardship Species beyond those included in the Watch List. With Stewardship Species, the intent is to develop a pool of species that represents all major biomes across the continent and that will bring attention to habitats and birds characteristic of each of these biomes. For Stewardship Species, the implied conservation need is almost always to be taken in the much broader context of a species suite and related to habitat.

In selecting the Species of Continental Importance, PIF developed a process that evaluated several components of species vulnerability and provided an overall assessment of the species. This assessment process is based entirely on biological criteria. Each species was given scores for six factors that assess distinct aspects of vulnerability: 1) population size; 2) breeding distribution; 3) non-breeding distribution; 4) threats to breeding; 5) threats to non-breeding; and 6) population trend. Species were selected for the Watch List according to the Combined Score, which reflects the level of concern across multiple vulnerability factors.

Pacific Avifaunal Biome

Partners in Flight recognizes that there are important differences in habitats, conservation issues, and appropriate strategies for action among the various regions of the continent. Therefore, PIF placed Watch List species into Avifaunal Biomes which helps to highlight the roles that each portion of the continent has to play in bird conservation. The boundaries of the San Francisco Bay Joint Venture are situated within the Pacific Avifaunal Biome. This region encompasses the Pacific coastline of Canada and the U.S. This biome has a distinct group of species that is concentrated along the coast, both in the breeding and wintering seasons. Overall, the species in this region have relatively high breeding season threats, and a high proportion of Watch List Species occur here. The Species of Continental Importance for this biome, abridged based on occurrence within SFBJV boundaries, are presented in Table 6.

Table 6. Landbird Species of Continental Importance within the Pacific Avifaunal Biome

Species ¹	% Breeding Population	% Winter Population	Primary Habitat	Continental Population Objective	Monitoring Need ²
Tricolored Blackbird	91%	65%	Wetland	Increase 100%	Mo1
Spotted Owl	40%	40%	Coniferous forest	Recovery Plans	**
Oak Titmouse	99%	99%	Woodland	Increase 50%	**
Wrentit	97%	97%	Western shrublands	Increase 50%	**
Nuttall's Woodpecker	96%	96%	Woodland	Maintain/ Increase	**
California Thrasher	95%	95%	Western shrublands	Increase 50%	Mo2
Rufous Hummingbird	61%	0%	Western shrublands	Increase 50%	Mo2
Black Swift	29%	0%	Various	Increase 50%	Mo2
Band-tailed Pigeon	22%	18%	Mixed forest	Increase 100%	Mo2
Olive-sided Flycatcher	15%	0%	Coniferous forest	Increase 100%	Mo3
White-throated Swift	10%	4%	Various	Increase 100%	Mo2
Allen's Hummingbird	98%	4%	Western shrublands	Maintain/ Increase	Mo2
Mountain Quail	96%	96%	Western shrublands	Maintain/ Increase	**
Pacific-slope Flycatcher	91%	0%	Mixed forest	Maintain	**
Chestnut-backed Chickadee	90%	90%	Coniferous forest	Maintain	**
Golden-crowned Sparrow	12%	85%	Western shrublands	Maintain	Mo3
Lawrence's Goldfinch	84%	29%	Woodland	Maintain/ Increase	Mo2
Red-breasted Sapsucker	78%	77%	Mixed forest	Maintain	Mo3
Varied Thrush	33%	72%	Coniferous forest	Maintain	**
Black-throated Gray Warbler	69%	0%	Mixed forest	Maintain	**
Bald Eagle	60%	39%	Wetland	Maintain	Mo3
California Towhee	55%	55%	Western shrublands	Maintain	**
Steller's Jay	54%	54%	Coniferous forest	Maintain	**
Western Scrub-Jay	53%	53%	Western shrublands	Maintain	**
Fox Sparrow	8%	52%	Western shrublands	Maintain	Mo3
Winter Wren	26%	50%	Coniferous forest	Maintain	Mo3

¹Highlighted species are found commonly within the San Francisco Bay Joint Venture boundaries.

²Monitoring Need (this assessment addresses only the adequacy of long-term population trend monitoring at the continental scale): Mo1=no trend data, Mo2=imprecise trends, Mo3=inadequate northern coverage, **=long-term monitoring population trend is generally considered adequate, but some issues, such as bias, may not have been accounted for.

Regional Context

The California chapter of Partners in Flight was formed in 1992 and shares the same vision of the international PIF initiative. The mission of California Partners in Flight (CalPIF) is to promote the conservation of resident and migratory landbirds in California through research, monitoring, education, and collaboration among public and private landowners and managers, government agencies, non-government organizations, and individuals and other bird conservation efforts. This mission translates into identification of habitat conservation and management priorities for bird species in California. CalPIF seeks to promote conservation and restoration of California's diverse ecosystems to support long-term viability and recovery of both native bird populations and other native wildlife species.

Landbird Conservation in San Francisco Bay

San Francisco Bay harbors several endemic subspecies of landbirds. The Salt Marsh Common Yellowthroat (*Geothlypis trichas sinuosa*) breeds only in San Francisco Bay wetlands and adjacent riparian areas. Three endemic subspecies of Song Sparrow (*Melospiza melodia samuelis*, *M. m. pusillula*, *M. m. maxillaris*) reside within the tidal marshlands of the San Francisco Bay. Both of these species have declined substantially over the last century due to habitat loss and alteration (Guzy and Ritchison 1999, Arcese et al. 2002) and are currently considered California Species of Special Concern (CDFG and PRBO 2001). Additionally, riparian areas and other habitats within the San Francisco Bay region provide important habitat to species such as Warbling Vireo, Pacific-slope Flycatcher, and Chestnut-backed Chickadee (Tables 6 and 7).

Habitat-based Bird Conservation Plans

CalPIF has completed habitat-based bird conservation plans for riparian, oak woodland, grassland, coastal scrub and chaparral, coniferous forest, and shrubsteppe habitats, and the Sierra Nevada bioregion. The bird conservation plans are dynamic “living” documents that are regularly revised to incorporate new information and data analyses into the recommendations and conservation targets. The goals of CalPIF's Habitat-based Bird Conservation Plans are:

- To emphasize what is needed to conserve both populations of species, and species assemblages, which are defined here as groups of naturally co-occurring bird species.
- To synthesize and summarize current scientific knowledge of the requirements of birds in California's habitats.
- To provide recommendations for habitat protection, restoration, management, monitoring, and policy to ensure the long-term persistence of birds and other wildlife dependent on California's ecosystems.
- To support and inform efforts to increase the overall acreage and effectiveness of California habitat conservation efforts in California by funding and promoting on-the-ground conservation projects.

CalPIF does not use the same species ranking criteria as the international Partners in Flight initiative. Instead, CalPIF relies on focal species whose requirements define different spatial attributes, habitat characteristics, and management regimes representative of a healthy system (Chase and Geupel, *in press*). For example, the bird that requires the largest area to survive in a certain habitat is used to determine the minimum suitable area for that habitat type. Likewise, the requirements of non-migratory birds that disperse short distances to establish new territories will define the attributes of connecting vegetation. Therefore, the assumption is that any landscape designed and managed to meet the needs of focal species will encompass the requirements of other species (Lambeck 1997). Future planning efforts of the SFBJV should attempt to expand the focal species list (and associated species account) by habitat for those species representing the important attributes of the SFBJV region.

Riparian Bird Conservation Plan

The Riparian Bird Conservation Plan (RHJV 2004) synthesizes and summarizes current scientific knowledge of the requirements of birds in riparian habitats. It provides recommendations for habitat protection, restoration, management, research, monitoring, and policy to ensure the long-term persistence of birds and other wildlife dependent on riparian ecosystems. This plan emphasizes a suite of 17 bird species chosen because of their conservation interest and as focal species representative of riparian habitats in the state. Table 7 presents the riparian focal species and their selection criteria.

Table 7. Criteria for selecting the Riparian Bird Conservation Plan focal species.

Focal Species	Riparian Breeder	Special status	Reduction in breeding range	Abundant breeder in CA	Nest Site Location
Swainson's Hawk	X	X	X		Canopy
Spotted Sandpiper	X			X	Gravel Bar
Yellow-billed Cuckoo	X	X	X		Midstory to Canopy
Willow Flycatcher	X	X	X		Understory
Warbling Vireo	X		X	X	Canopy
Bell's Vireo	X	X	X		Understory
Bank Swallow	X	X	X		Sandy banks
Tree Swallow	X			X	2° Cavity
Swainson's Thrush	X		X	X	Understory
Yellow Warbler	X	X	X	X	Midstory
Common Yellowthroat	X	X	X	X	Understory
Wilson's Warbler	X			X	Understory
Yellow-breasted Chat	X	X	X		Understory
Song Sparrow	X		X	X	Understory
Black-headed Grosbeak	X			X	Midstory
Blue Grosbeak	X	X	X		Understory
Tricolored Blackbird	X	X	X		Understory

In preparation for this conservation plan, California Partners in Flight developed a series of species accounts for the riparian focal species. These detailed accounts describe historical and current ranges, life history traits, habitat needs, and management concerns for each species. The accounts are available as electronic appendices to the Riparian Bird Conservation Plan at <http://www.prbo.org/calpif/htmldocs/riparian.html>.

Population Targets

California Partners in Flight seeks to develop avian population targets that will guide conservation efforts and provide land managers with a gauge of success for their restoration and management activities. Although subject to interpretation and based on assumptions difficult to test, numerical population targets provide a compelling means of communicating with the public and policy makers.

Furthermore they provide: 1) monitoring objectives and an evaluation procedure of project success (“accountability”); 2) ranking criteria for project proposals that allow reviewers to determine which sites or projects will be more advantageous for a particular species or suite of species; 3) current data for scientifically sound biological objectives; and 4) integration and comparison with population objectives of larger regional, national, and international schemes. In some cases, targets may simply require maintenance of populations at existing levels. However, targets for rare or declining species will encourage actions that increase existing populations to sustainable levels.

Bioregionally-based population targets for many of the riparian focal species have been developed using currently available data for the Bay-Delta (Table 8) and all bioregions of California (RHJV 2004). These targets are the highest densities (derived either from habitat specific point counts or spot mapping surveys) observed for that species within a given bioregion. Numbers provided from point counts are the average number of detections within 50 meters of the observer during five minute counts. Numbers from spot mapping are pairs per 40 hectares during the breeding season. Such reference density estimates are useful as population density targets that can translate into habitat acreage protection for some species, or be considered in restoration goals. These data are currently lacking for many species in many bioregions. The boundaries of the San Francisco Bay Joint Venture are situated within the Bay-Delta bioregion. Therefore, Bay-Delta population targets are presented (Table 8).

Table 8. Population parameter targets for riparian focal species that commonly breed in the San Francisco Bay area.

Species	Bay-Delta	
	Point Count	Spot Map
Warbling Vireo	1.30	18.0
Tree Swallow	0.16	-
Swainson's Thrush	1.90	322.2
Common Yellowthroat	0.42	-
Wilson's Warbler	1.69	288.6
Black-headed Grosbeak	0.91	117.6
Song Sparrow	3.10	509.6

Conservation Recommendations

Habitat loss and degradation are probably the most important factors causing the decline of riparian bird populations. Alteration of riparian landscapes narrows or destroys important population dispersal corridors. Disruption of natural hydrological conditions by dams, levees, and diversions, clearing associated with farming and development, overgrazing, and invasion by exotic species have all contributed to degradation of riparian zones. Nest predation and parasitism by the Brown-headed Cowbird may reduce the reproductive success of many riparian birds in California (Gardali et al. 1998, USFWS 1998).

The Riparian Bird Conservation Plan provides specific recommendations for riparian habitat activities throughout the state that seek to reverse the current declines of many riparian-associated bird populations. Habitat protection and restoration, land management, research and monitoring, and policy action recommendations are presented. The restoration of healthy, stable populations will help avoid the expensive and intrusive last resort of listing more species as threatened and endangered.

Habitat Protection Recommendations

- Prioritize potential riparian protection sites according to current indicators of avian population health.
- Prioritize restoration sites according to their proximity to existing high-quality sites.
- Protect and restore riparian areas with intact adjacent upland habitats.
- Prioritize sites with an intact natural hydrology or the potential to restore the natural processes of the system.
- Prioritize sites according to surrounding land use.
- Ensure that the patch size, configuration, and connectivity of restored riparian habitats adequately support the desired populations of riparian dependent species.

Restoration Recommendations

- Restore and manage riparian forests to promote structural diversity and volume of the understory.
- Restore the width of the riparian corridor.

Cultivated Restoration Recommendations

- Plant a minimum of two or more species of native shrubs or trees (i.e., avoid monotypic plantings).
- Increase shrub richness, shrub density, and the rate of natural reestablishment by including plantings of understory species in restoration design.
- Plant native forb and sedge species.
- Cultivate tree species where natural hydrological processes are compromised and natural tree regeneration is limited or absent.

- Plant vegetation in a mosaic design with dense shrub patches interspersed with trees to achieve a semi-open canopy.
- Retain at least some existing trees on restoration sites, planting around them, to promote occupancy of the plot by birds requiring mature trees (e.g., cavity nesters, orioles, etc.). Projects that plan to remove orchards should consider leaving a few trees in small clumps (with the exception of fig or other species with invasive root stocks).
- Connect patches of existing riparian habitat with strips of dense, continuous vegetation that are at least 3-10 meters wide.

Management Recommendations

- Manage riparian and adjacent habitats to maintain a diverse and vigorous understory and herbaceous layer, particularly during the breeding season.
- Manage or create “soft” edges (through establishment of hedgerows at field margins) appropriate to historical vegetation patterns.
- Avoid the construction or use of facilities and pastures that attract and provide foraging habitat for Brown-headed Cowbirds.
- Brown-headed Cowbird trapping should only be used as an interim/emergency measure. Trapping can save or maintain a threatened population of host species while sustainable, habitat based solutions are developed, but should not be considered a long-term solution.
- Manage or influence management at the landscape level (i.e., land surrounding riparian corridors or, preferably, the whole watershed).
- Limit restoration activities and disturbance events such as grazing, disking, herbicide application, and highwater events to the nonbreeding season. When such actions are absolutely necessary during the breeding season, time disturbance to minimize its impacts on nesting birds.
- Coordinate with management and restoration projects targeted at non-avian taxa to maximize the benefits of conservation of riparian habitats.
- Control and eradicate non-native plant species. Such control is best planned and implemented on a watershed scale.
- Control and eradicate non-native animal species.

Monitoring and Research Recommendations

- Consider reproductive success and survival rates when monitoring populations, assessing habitat value, and developing conservation plans.
- Conduct intensive, long-term monitoring at selected sites. In order to analyze trends, long-term monitoring should continue for more than five years.
- Investigate the relationship between herbaceous vegetation height and avian productivity and recruitment, especially in wet meadows.
- Conduct selective monitoring at critical sites to determine the effects of cowbird parasitism on the Warbling Vireo, Common Yellowthroat, Wilson’s Warbler, and Yellow Warbler.

- Conduct selective monitoring at key sites to determine the factors influencing nest success of the Song Sparrow, Lazuli Bunting, Yellow Warbler, and Warbling Vireo.
- Increase communication and coordination between land managers and specialists hired to implement specific projects or conduct monitoring.
- Use standardized monitoring protocols.
- The CALFED Bay-Delta Authority should continue to incorporate bird monitoring into all riparian and wetland habitat restoration projects as a way to assess avian response, evaluate projects, and most importantly, adaptively manage.
- Maximize the cost effectiveness and value of existing specialized monitoring programs for listed species (e.g., those oriented toward Western Yellow-billed Cuckoo and Willow Flycatcher) by collecting standardized data on multiple species (such as point counts) in addition to any specialized protocols aimed at one species.
- Determine what habitat and population characteristics are necessary to successfully wean a songbird population from cowbird trapping.
- Coordinate with monitoring and research projects targeted at non-avian taxa to maximize the benefits of the protection, management, and restoration of riparian habitats.
- Identify and implement research relevant to management of Tricolored Blackbirds, which continue to decline in California.
- Work cooperatively with agricultural researchers, particularly grape growers, to assess the potential for agriculture adjacent to existing riparian areas to be more “bird friendly.”
- Devise an urgently needed method for controlling giant reed.

Policy Recommendations

- Land managers should consider avian population parameters, such as reproductive success, as important criteria when designating priority or special-status sites, such as USFWS refuges, regional parks, open space districts, and other publicly owned areas specially managed for conservation values.
- Incorporate the costs of limited-term (two–five years) or long-term bird monitoring into management endowments prescribed for conservation projects, including mitigation banks, habitat conservation plans, and natural community conservation reserves.
- Local governments should establish locally relevant riparian buffer zones to protect riparian habitat and associated surrounding uplands from development and disturbance, through zoning ordinances and/or general plan provisions.
- Develop GIS layers representing the extent of riparian zone habitats throughout the state at a resolution fine enough for the analysis of territory-level bird data in association with the occurrence of various habitat types. Resulting maps should be field-verified and may be used to identify suitable habitat for riparian birds and habitats for other declining or sensitive species.

Grassland Bird Conservation Plan

The geographic scope of this plan is the distribution of annual and native perennial grasslands in the state, which are found primarily along the coast and in California's Great Central Valley. The Grassland Bird Conservation Plan (CalPIF 2000) synthesizes and summarizes current scientific knowledge of the requirements of birds in grassland habitats. It provides recommendations for habitat protection, restoration, management, and monitoring and research to ensure the long-term persistence of birds and other wildlife dependent on grassland ecosystems. Population targets have not been developed for grassland focal species primarily due to the paucity of data for grassland bird species in California.

Seven species dependent on grassland habitats were selected as focal species for this plan. The focal species are: 1) Ferruginous Hawk; 2) Grasshopper Sparrow; 3) Mountain Plover; 4) Northern Harrier; 5) White-tailed Kite; 6) Western Meadowlark; and 7) Savannah Sparrow. A majority of these species with the exception of Mountain Plovers and Ferruginous Hawks have notable breeding populations within the SFBJV boundaries. Detailed species accounts describe historical and current ranges, life history traits, habitat needs, and management concerns for each species. These accounts are available as electronic appendices to the Grassland Bird Conservation Plan at <http://www.prbo.org/calpif/htmldocs/grassland.html>.

Conservation Recommendations

The widespread replacement of native and perennial annual grasses and forbs with exotics is a serious problem afflicting grassland habitats. Loss of habitat and habitat fragmentation may be especially acute in grasslands. With loss of habitat, the patch size of remaining grasslands has decreased and continues to do so. This has unknown but potentially highly significant ramifications for native grassland bird species.

The Grassland Bird Conservation Plan provides specific recommendations for grassland habitat activities that seek to reverse the current declines of many grassland-associated bird populations. However, a primary finding of this plan, and therefore the most important recommendation, is the paucity of data concerning grassland bird species and the need to collect basic information on species distribution, productivity, and survival before extensive conservation recommendations can be made.

Habitat Protection Recommendations

- Identify remaining grassland areas of large patch size that have high species abundance and productivity for grassland birds.
- Target unprotected areas that have been identified for protection as priority areas for 1) land purchases when possible, 2) conservation easements, and 3) the forging of partnerships with private landowners to create win-win situations.
- Target areas with quality grassland habitat for protection status before targeting at-risk or degraded habitat.

Habitat Management Recommendations

- Avoid mowing and disking during the breeding season.
- Avoid burning during the breeding season.

Monitoring and Research Recommendations

- Initiate a statewide point count project.
- Develop methods to monitor productivity and survivorship for grassland birds.
- Determine the sensitivity of California's grassland birds to grassland patch size.
- Determine grassland bird response to various grazing, burning, mowing, and disking regimes that occur in California.
- Determine the benefits and drawbacks of various agricultural regimes.

Landbird Education and Outreach Needs in San Francisco Bay

Scientific efforts for conservation have little impact without the support of local communities, including private landowners, government land managers, and the public of all ages. To gain crucial support, research, management, and conservation programs must share their findings and involve community groups and partners in conservation through education and outreach. The following list of *Key Concepts for Landbird Conservation* should be incorporated into education and outreach programs in the San Francisco Bay Area. These concepts are important to include in any program concerning conservation, and are indispensable in programs focusing on birds and their habitats. More detailed information about education and outreach for a variety of different habitats are available at www.prbo.org/calpif.

Key Concepts for Landbird Conservation in the San Francisco Bay Area

- **Reproductive success (the ability to produce healthy young) may be the most important factor influencing bird population health.** It contributes directly to a population's size and viability in an area. A number of factors influence reproductive success, including predation, nest parasitism (ex. Brown-headed Cowbird), availability of habitat for nest sites, and food availability.
- **Nesting habitat requirements vary among species.** Different landbird species place their nests in different locations - from directly on the ground to the tops of trees. Most landbirds nest within five meters of the ground. Managers must consider that habitat needs for different species vary and manage for this diversity accordingly. This can be accomplished by managing grass and forbs to a height greater than 6 inches for ground nesters, retaining a structurally diverse shrub and tree layer for low to mid-height nesters, and leaving dead trees and snags for cavity nesters. Additionally, older tall trees should be retained for landbirds that build their nests in the canopy.

- **The breeding season is a vital period in birds' lives, during which they are highly sensitive to disturbances.** In the San Francisco Bay Area, most landbirds nest during the spring and early summer of each year (generally mid-March-August). Nestlings are particularly sensitive to changes in the environment and are indicators of ecosystem health. Disturbances during the breeding season, such as vegetation clearing, habitat restoration, and recreation, may result in nest abandonment, remove potential nest sites, directly destroy nests, expose nests to predators, and decrease food sources such as insects. Predators, such as domestic cats, skunks, and jays, can decimate breeding populations, thus land managers should avoid subsidizing their populations through human food and garbage.
- **Understory - the weedy, shrubby growth underneath trees - is crucial to landbirds.** A healthy and diverse understory with lots of ground cover offers well-concealed nest and foraging sites. Manicured parks and mowed lawns provide poor nesting conditions for all but a few bird species.
- **Native plants are important to birds.** Native bird populations evolved with the regional vegetation, learning to forage and nest in certain species. Introduced plant species may not provide the same nutrition, host sites for insects, or nest site quality. Introduced plants can also quickly dominate an area, reducing the diversity of vegetation. Less diverse vegetation can lower the productivity and viability of a bird population.
- **Natural predator-prey relationships are balanced, but human disturbance creates an imbalanced system.** Interactions with predators are a natural and essential part of an ecosystem. However, a preponderance of non-native predators or a sustained surplus of natural predators severely affects the health and persistence of bird populations. Feeding wildlife, especially foxes, raccoons, and skunks, should be discouraged. Feeders that are frequented by jays, crows and cowbirds should not be maintained during the breeding season (most songbirds feed their young insects). Domestic and feral cats are responsible for killing hundreds of millions of birds each year. It is not true that a well-fed cat will not hunt! In fact, a healthy cat is a more effective predator.
- **Natural processes, such as flood and fire, are integral to a healthy ecosystem.** They provide the natural disturbance needed in an area to keep the vegetative diversity high, an important factor for birds.

CHAPTER 5. OTHER BIRD CONSERVATION PROGRAMS

In addition to the aforementioned bird initiatives, there are a number of other important bird conservation programs and resources to be considered.

California Bird Species of Special Concern

To meet California's pressing environmental challenges, and provide a means for allocating financial and staff resources, the California Department of Fish and Game (CDFG) has initiated a process to determine and set conservation priorities for native birds by revising the initial California Bird Species of Special Concern (BSSC) document, which subjectively described declining or vulnerable species. Revision was needed to evaluate over twenty years of research and monitoring data to enable identification of currently declining or vulnerable taxa that may warrant listing as state threatened or endangered if present trends continue. The revision process, coupled with other recent efforts to develop and implement conservation strategies, led to expansion of the Bird Species of Special Concern concept to include ranking of special concern taxa for conservation priority using objective criteria. Also, the original BSSC list included only full species but the current draft list includes full species, subspecies, and identified populations. The current BSSC effort also aims to integrate with other multi-species conservation planning efforts, such as Partners in Flight, and the U.S. Shorebird Conservation Plan.

Bird Species of Special Concern in California are those species, subspecies, or identified populations that currently satisfy one or more of the following criteria: 1) may meet the state definition of threatened or endangered but have not formally been listed; 2) are extirpated from the state totally or in their primary seasonal or breeding role and were never listed as state threatened or endangered; 3) are listed as federally, but not state, threatened or endangered; 4) are experiencing, or formerly experienced, serious population declines or range retractions that if continued, or resumed, could qualify them for state threatened or endangered status; and 5) have naturally small populations exhibiting high susceptibility to risk from any factor(s) that if realized could lead to declines that would qualify them for state threatened or endangered status. The draft BSSC document can be viewed at www.prbo.org.

Important Bird Areas (IBA) Program

The IBA program is a global effort to identify areas that are most important for maintaining bird populations, and focus conservation efforts at protecting these sites. By working through partnerships, Audubon is working to identify sites that are critical to birds during some part of their life cycle (breeding, wintering, feeding, migrating). California's Important Bird Area Program began as a volunteer-driven effort in the mid-1990s. It was greatly expanded by Audubon California into a fully funded research project in 2000. A team of technical advisors contributed hundreds of hours granting interviews, providing data and reviewing sites. Approximately 150 IBAs in 58 California counties have been identified by Audubon California. The fifteen IBAs occurring within the San Francisco Bay area are: 1) Alameda Naval Air Station, 2) Benicia State Recreation Area, 3) Bodega Harbor, 4) Bolinas

Lagoon, 5) Brooks Island Regional Preserve, 6) Concord Marshes, 7) Corte Madera Marsh, 8) Eastshore Wetlands, 9) Jepson Prairie Preserve, 10) North Richmond Wetlands, 11) Point Reyes – Outer, 12) Richardson Bay, 13) San Francisco Bay – South, 14) Suisun Marsh, and 15) Tomales Bay (Cooper 2004).

IBAs in California are defined as 1) less than 100,000 acres in extent; 2) possessing a bird community distinct from the surrounding region; and 3) satisfying one of the “IBA Criteria.” The following four criteria were used in identifying California’s IBAs:

- >10% of California /1% Global population (breeding and/or wintering) of one or more sensitive taxa;
- > 10% listed/sensitive species (incl. federally and state threatened and endangered) regularly occurring;
- >10,000 possible on a 1-day count; and
- > 5000 waterfowl possible on a 1-day count.

Several of the IBAs were identified as having “critical” or “high” threat levels, meaning that a significant portion of their habitat was under immediate threat of modification due to human activity. Major identified threats include urban sprawl and associated habitat destruction (e.g., road building, streambed alteration), agricultural expansion (esp. vineyards), and exotic species. Interim conservation recommendations will be developed for these sites and Audubon California will develop relationships with appropriate partners through an IBA Stewardship Program. Audubon California will then work cooperatively with these stewards to reduce the threat levels of each of these sites. More information on Important Bird Areas can be found at: <http://www.audubon.org>.

North American Bird Conservation Initiative

The intent of the North American Bird Conservation Initiative (NABCI) is to facilitate the conservation of native North American birds by increasing the effectiveness of existing initiatives, enhancing coordination, and fostering greater cooperation among the nations and peoples of the continent. The vision of NABCI is to see populations and habitats of North America’s birds protected, restored, and enhanced through coordinated efforts at international, national, regional, state, and local levels, guided by sound science and effective management. NABCI seeks to accomplish this vision by 1) broadening bird conservation partnerships; 2) working to increase the financial resources available for conserving birds in the United States and wherever else they may occur throughout their life cycle; and 3) enhancing the effectiveness of those resources and partnerships by facilitating integrated bird conservation. NABCI will promote the focus and independence of existing programs, while providing a forum to address deficiencies in coverage (of species, habitats, monitoring, etc.), the integration of objectives within ecosystems, the evaluation of range-wide needs of species, and international consistency and cooperation. More information on NABCI can be viewed at: <http://www.nabci-us.org/>.

International Association of Fish and Wildlife Agencies

The International Association of Fish and Wildlife Agencies (IAFWA) was founded in 1902 as a quasi-governmental organization of public agencies, including state wildlife agencies charged with the protection and management of North America's fish and wildlife resources. IAFWA develops, supports, and defends legislation and regulations that safeguard and improve the well-being of North America's fish and wildlife. The objectives of IAFWA are: 1) to promote the sustainable use of natural resources; 2) encourage cooperation and coordination of fish and wildlife management at all levels of government; 3) develop coalitions of conservation organizations to promote fish and wildlife interests; 4) encourage the professional management of fish and wildlife; and 5) foster public understanding of the need for conservation.

IAFWA administers an All-Bird Conservation project that supports state fish and wildlife agencies in the development and implementation of state-level bird conservation programs. Through workshops, meetings, and technical assistance visits, IAFWA staff provide consulting services to the state agencies as they carry out priority bird conservation activities identified in the Partners in Flight Landbird Conservation Plans, the U.S. Shorebird Conservation Plan, the North American Waterbird Conservation Plan, and emerging resident game bird initiatives. State and provincial agencies advocate an "all-bird" approach to conservation. Although all-bird conservation has many facets, it involves four basic steps:

- assessing the biological needs of each species in the region and determining how they relate to the needs of other species,
- developing population and habitat objectives based on those assessments,
- conducting bird conservation programs that meet the biological needs of all species of concern on a landscape scale, and
- monitoring the results of these programs and modify management practices as needed.

All-bird conservation demands an unprecedented level of communication and coordination among state and national wildlife agencies, nongovernmental organizations, joint venture partnerships, bird conservation initiatives, and others working to protect and restore bird populations. Nevertheless, results have shown that collaboration among these diverse groups yield conservation benefits exceeding what any one group can achieve by working alone. To promote all-bird conservation, IAFWA is sponsoring workshops across the country to provide state wildlife biologists, resource managers, and their bird conservation partners with the knowledge and tools they need. The California workshop was held in November 2004. More information on IAFWA can be viewed at: www.iafwa.org.

Congress

The U.S. Congress strongly supports a public-private partnering approach to protecting and restoring wetlands and other important migratory bird habitats across North America. They have signaled their support by increasing the federal funds available for migratory bird initiatives. In FY 2002, Congress re-authorized appropriations for the North American Wetlands Conservation Act (NAWCA) through FY 2007, reflecting its support for the Act's

goals. Congress increased the appropriations authorization to \$55 million in 2003, with \$5 million increases to occur annually until FY 2007, when the appropriation cap will be \$75 million. In FY 2004, Congress appropriated \$37.5 million to fund the grants program. Additional funding comes from moneys received from fines, penalties, and forfeitures under the Migratory Bird Treaty Act of 1918 and from interest accrued on the fund established under the Federal Aid in Wildlife Restoration Act of 1937.

Executive Order 13186 – Protection of Migratory Birds

The Executive Order directs each Federal agency taking action having or likely to have a negative impact on migratory bird populations to work with the U.S. Fish and Wildlife Service to develop an agreement to conserve those birds. The protocols developed from this consultation are intended to guide future agency regulatory actions and policy decisions; renewal of contracts, permits, or other agreements; and the creation of or revision to land management plans. In addition to avoiding or minimizing impacts to migratory bird populations, agencies will be expected to take reasonable steps that include restoring and enhancing habitat, preventing or abating pollution affecting birds, and incorporating migratory bird conservation into agency planning processes whenever possible.

Neotropical Migratory Bird Conservation Act

The act provides funds to countries in Latin America and the Caribbean, and the United States for the conservation of neotropical migratory birds that winter south of the border and summer in North America. The law creates a competitive grants program to be administered by the Secretary of the Interior, through the Director of the U.S. Fish and Wildlife Service. Funds must: 1) enhance the conservation of neotropical bird species in the U.S., Latin America, or the Caribbean; 2) ensure adequate local public participation in project development and implementation; 3) be implemented in consultation with relevant wildlife management authorities and other appropriate government officials with jurisdiction of the resources addressed by the project; 4) be sensitive to local historic and cultural resources and comply with applicable laws; and 5) promote sustainable, effective, long-term programs to conserve neotropical migratory birds and other requirements that the Secretary considers to be necessary.

CHAPTER 6. FUTURE DIRECTION FOR ADAPTIVE CONSERVATION PLANNING BY THE SFBJV

Executive Order 13186 provides a mandate for Joint Ventures to integrate the conservation principles from the four migratory bird conservation initiatives. With the information sources identified herein, the SFBJV will be better able to fulfill that mandate and to effectively provide habitat and address the threats for a broad range of species dependent on the estuary. This guiding document should be viewed as a planning tool that can be used in the eventual comprehensive review and revision of the JV's restoration strategy. The planning process also will require the full integration of new decision support tools, recent research and monitoring results, necessary restructuring of the JV's committees, new partnerships, and reassessment of the JV's habitat goals. For aid in envisioning the context for this process, Figure 1, describing an "Adaptive Conservation Strategy," is included below (Figure from Elliott et al. 2002). Joint Venture partners are essential to each step in this strategy and the SFBJV itself plays an especially critical role in the Adaptive Conservation Planning stages of the process. To advance in this process, there are some particularly important next steps for the SFBJV.

Current SFBJV Programs

The San Francisco Bay Joint Venture is currently taking several steps toward integrating recommendations from the major bird conservation initiatives, while maintaining a wetland focus. Actions currently in place include:

1. Riparian Bird Conservation Plan - The SFBJV Creeks Sub-committee is adopting this plan for implementation with creek/riparian restoration projects. The plan will help guide restoration to benefit riparian-dependent species.
2. SFBJV Project Support Program - The SFBJV provides limited financial support for partner projects. Project support is available for projects that address conservation of any bird species that utilize SFBJV habitats for all or part of the year. Project support will, on occasion, be provided for projects outside the SFBJV geographic region if the project directly benefits sensitive species for which habitats within the SFBJV boundaries are utilized.
3. SFBJV Project Tracking Data System - Data fields will enable JV partners to track all bird species that will benefit from a specific project. The information will assist with project planning to benefit a wide array of species.
4. Upland Habitat Goals Project - The Upland Habitat Goals Project is designed to be the counterpart to the wetland Goals Project (1999). SFBJV is promoting the integration of all the bird conservation plans into this project of the Bay Area Open Space Council (BAOSC). Using the Goals Project, BAOSC members as well as JV partners who manage upland habitats, will integrate the bird conservation plans with new acquisitions and as part of adopted management practices.

Next Steps in Planning

SFBJV boundaries have been adjusted subsequent to the development and publication of *Restoring the Estuary*. Goals need to be developed for wetlands and other habitats for regions within the adjusted JV boundaries that do not currently have established goals. Goals identified in the JV Implementation Strategy are currently based upon habitat acreage. In addition to acres, species goals should be developed.

Habitat - Wetland and riparian habitats are the primary focus of *Restoring the Estuary*. However, certain “wetland” habitat types, including shallow bay, which contains eelgrass beds and deep bay, need to be more thoroughly addressed and incorporated into implementation strategies by the JV. Additionally, wetland habitat goals need to be set for areas not considered under *Restoring the Estuary*, specifically, wetlands along the Sonoma, Marin, and San Mateo county coastlines. For Sonoma and Marin Cos. wetland goals established by the Pacific Coast Joint Venture should be adopted and incorporated in the short term.

Conservation goals for additional habitats, within the geographic area addressed by *Restoring the Estuary*, were mentioned under the Goals Project (1999) but were not synthesized for the JV Implementation Strategy, as the focus of the Implementation Strategy was wetland habitats. Some of these habitats (e.g. oak woodlands) have existing bird conservation plans that lay out clear conservation goals and recommendations. These should be incorporated into future JV acquisition, restoration, and enhancement objectives. Habitats, not addressed by the Goals Project or *Restoring the Estuary*, within the expanded JV boundaries (e.g. coastal scrub, coniferous forest) will need to be treated in future planning documents completed by the Joint Venture. Additionally, regional projects working to enhance and restore upland habitats, such as the San Francisco Bay Area Upland Habitat Goals Project, currently under development, should address these habitats and should be consulted in future JV planning efforts. Indeed, the JV should be actively involved in the development of those goals and any other habitat goals processes within the JV boundary.

Important Bird Areas – Public lands that have been identified as Important Bird Areas (IBAs) should be managed for IBA and focal species identified in the Partners In Flight (PIF) plans. When wetland habitats with an upland component are being restored, IBAs and the PIF plans should be consulted.

Bird species - Except for the California Current System Marine Bird Conservation Plan, currently no regional plan addressing waterbird conservation needs in the San Francisco Bay area has been developed under the North American Waterbird Plan. Waterbird species not currently addressed by a regional bird conservation plan include marsh dependent species such as the endangered California Clapper Rail, Black Rail, and wetland dependent colonial waterbirds such as gulls, terns, herons, and egrets. There is a wealth of data regarding regional waterbird status, distribution, and habitat needs to inform future planning efforts. There is also a wealth of data on marsh-dependent landbird species, such as Common Yellowthroat and endemic races of Song Sparrow, of high conservation concern in San Francisco Bay wetlands. Future planning efforts of the SFBJV should attempt to expand the

focal species list (and associated species accounts) to include species representing important attributes of the SFBJV region.

Monitoring and Evaluation Recommendations

In this document, the importance of monitoring at different scales has been addressed, including site-specific restoration success, bay-wide, and population level – including how site specific and bay-wide activities contribute to population level response. The SFBJV should set a clear monitoring and evaluation agenda that addresses JV success at each of these scales and one that helps guide future JV priorities. An important first step would be to compile and incorporate existing data sources that have been completed since the development of the Goals Report (1999). Data are available from monitoring of almost all bird groups dependent on the estuary.

For the purpose of evaluating the effectiveness of the JV, the JV should consider supporting site-specific monitoring of bird response to JV supported projects as well as bay-wide population monitoring. These data can be used for continued decision-making about the configuration and amount of different habitats necessary to support the full range of bird species dependent on the estuary. As restoration proceeds, tools are becoming available to predict the impact of habitat changes on bird populations; on-going monitoring can test predictions and guide future restoration decisions.

Additionally, the JV will need to evaluate the constraints on management and restoration and implications of the different techniques on bird populations. One clear and pressing need is to assess how mosquito abatement techniques may impact the habitat value of wetlands for wildlife species and how restoration design and wetland management can reduce the necessity of using abatement techniques with detrimental impacts to bird populations.

Planning and Implementing Partnerships Within and Outside JV

The JV may need to assess its committee structure to ensure that the necessary partnerships and technical representation are in place to guide implementation of the now broadened objectives. The relevant JV committee should assess the JV's current conservation strategies as outlined in *Restoring the Estuary* for their effectiveness at reaching these objectives and, where necessary, devise new strategies and create new committees toward that end.

The JV also should diagram existing science, planning, and implementation partnerships and their respective roles within JV boundaries. This will help determine areas to coordinate and collaborate on projects and will help ensure that the JV continues to have a clear leadership role that complements the work of others, but also drives the objectives and helps ensure that the broader conservation community is addressing the needs of all bird species.

Implementation

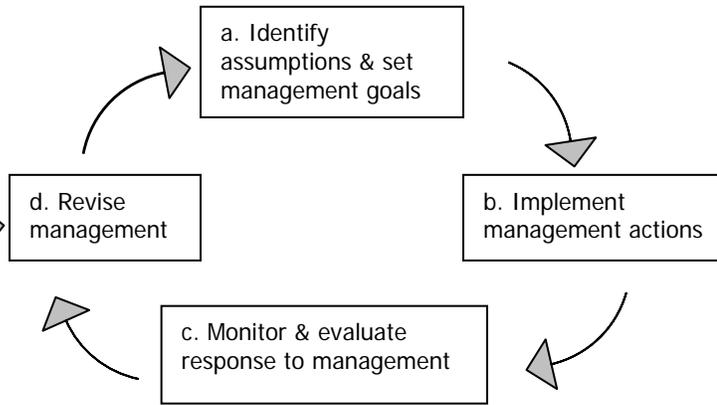
Given the now broadened conservation goals of the JV, an assessment of available resources for implementation is warranted, including whether those resources are being utilized fully. The JV should take full advantage of the strengths of its partnership, including technical and

grant writing expertise, to maximize the conservation resources brought to the Bay and thus the benefit to all bird species dependent on the estuary.

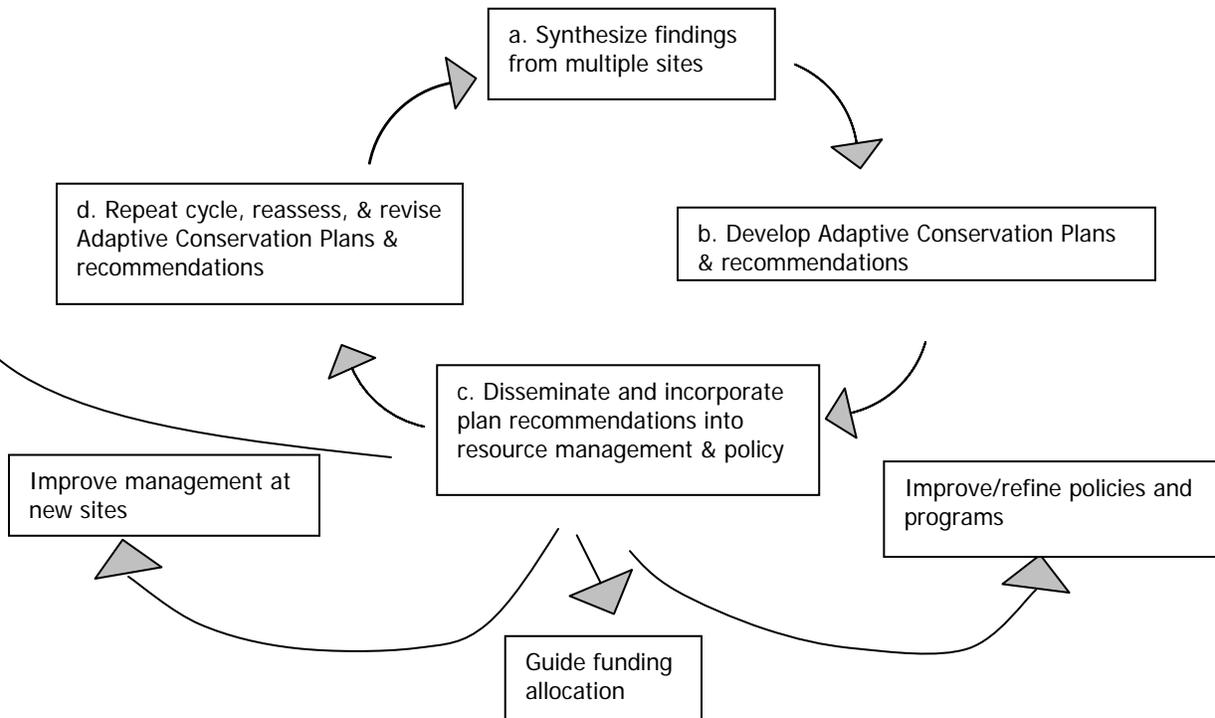
Again, this guiding document provides recommendations that can be implemented immediately in restoration and enhancement projects, and provides essential information to the JV in its priority-setting process and for a future comprehensive review and revision of the JV Implementation Strategy, *Restoring the Estuary*.

Figure 1. Components and Process of an Adaptive Conservation Strategy (from Elliott et al. 2002).

I. Site-Specific Adaptive Management



2. Adaptive Conservation Plans for Sharing Learning across Sites



CHAPTER 7. LITERATURE CITED

- Accurso, L.M. 1992. Distribution and abundance of wintering waterfowl on San Francisco Bay 1988-1990. Msc. thesis. Humboldt State University, Arcata, California.
- Arcese, P., M.K. Sogge, A.B. Marr, and M.A. Patten. 2002. Song Sparrow (*Melospiza melodia*). In *The Birds of North America*, No. 704 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Bollman, F.H., Thelin, P.K., and R.T. Forrester. 1970. Bimonthly bird counts at selected observation points around San Francisco Bay, February 1964 to January 1966. *California Department of Fish and Game* 56:224-239.
- Briggs, K.I., W.M.B. Tyler, D.B. Lewis, and D.R. Carlson. 1987. Bird communities at sea off California: 1975 to 1983. *Studies in Avian Biology* 11.
- Brown, S., C. Hickey, B. Harrington, R. Gill, eds. 2001. *The U.S. Shorebird Conservation Plan*, 2nd ed. Manomet Center for Conservation Sciences, Manomet, MA.
- CalPIF (California Partners in Flight). 2000. Version 1.0. The draft grassland bird conservation plan: a strategy for protecting and managing grassland habitats and associated birds in California (B. Allen, lead author). PRBO Conservation Science, Stinson Beach, CA. <http://www.prbo.org/calpif/pdfs/grassland.v-1.pdf>.
- CalPIF (California Partners in Flight). 2002. Version 2.0. The oak woodland bird conservation plan: a strategy for protecting and managing oak woodland habitats and associated birds in California (S. Zack, lead author). Point Reyes Bird Observatory, Stinson Beach, CA. <http://www.prbo.org/calpif/plans.html>.
- CalPIF (California Partners in Flight). 2004. Version 2.0. The coastal scrub and chaparral bird conservation plan: a strategy for protecting and managing coastal scrub and chaparral habitats and associated birds in California (J. Lovio, lead author). PRBO Conservation Science, Stinson Beach, CA. <http://www.prbo.org/calpif/plans.html>.
- CDFG and PRBO. 2001. *California Bird Species of Special Concern: Draft List and Solicitation of Input*.
- Chase, M K. and G. R. Geupel. In press. The use of avian focal species for conservation planning in California. In *Proceedings of the Third International Partners in Flight conference*, C.J. Ralph and T.D. Rich eds. USDA Forest Service Gen. Tech. Report PSW-GTR-191.
- Colwell, M.A., and K.R. Sundeen. 2000. Shorebird distributions on ocean beaches of northern California. *Journal of Field Ornithology* 71:1-15.
- Cooper, D. S. 2004. *Important Bird Areas of California*. Audubon California. 286pp.

- Elliott, G., M. Chase, G. Geupel, and E. Cohen. 2002. Developing and implementing an adaptive conservation strategy: a guide for improving adaptive management and sharing learning among conservation practitioners. PRBO Conservation Science, Stinson Beach, CA.
- Galbraith, H., R. Jones, R. Park, J. Clough, S. Herrod-Julius, B. Harrington, and G. Page. 2002. Global climate change and sea level rise: potential losses of intertidal habitat for shorebirds. *Waterbirds* 25:173-183.
- Gardali, T., A. King, and G. Geupel. 1998. Cowbird parasitism and nest success of the Lazuli Bunting in the Sacramento Valley. *Western Birds* 29:174-179.
- Gardner, D.A., J.A. Thayer, W.W. Merkle, D.A. Hatch, 2004. Population Studies of Seabirds on Alcatraz Island, 2003. Unpublished Final Report to the National Park Service, Golden Gate National Recreation Area, PRBO Conservation Science, Stinson Beach, CA.
- Gill, R.E., Jr. 1977. Breeding avifauna of the South San Francisco Bay estuary. *Western Birds* 8:1-12.
- Goals Project. 1999. Baylands ecosystem habitat goals. A report of habitat recommendations prepared by the San Francisco Bay Area Ecosystem Goals Project. U. S. Environmental Protection Agency, San Francisco, and San Francisco Bay Region Water Quality Control Board, Oakland.
- Guzy, M., and G. Ritchison. 1999. Common Yellowthroat (*Geothlypis trichas*). In *The Birds of North America*, No. 448 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Harvey, T.E., K.J. Miller, R.L. Hothem, M.J. Rauzon, G. W. Page, and R.A. Keck. 1992. Status and trends report on wildlife of the San Francisco Estuary. Report of U.S. Fish and Wildl. Serv., Sacramento, CA 95825.
- Hickey, C., W.D. Shuford, G.W. Page, and S. Warnock. 2003. Version 1.0. The Southern Pacific Shorebird Conservation Plan: A strategy for supporting California's Central Valley and coastal shorebird populations. PRBO Conservation Science, Stinson Beach, CA.
- Johnson-Schultz, H., J. Burton, N. Cirillo, and S. Brown, eds. 2000. National Shorebird Education and Outreach Plan. Manomet Center for Conservation Sciences, Manomet, MA.
- Kushlan, J. et al. 2002. North American Waterbird Conservation Plan, Version 1. U.S. Fish and Wildlife Service National Publications Clearinghouse National Conservation Training Center. Shepherdstown, WV.

- Lambeck, R. J. 1997. Focal species: a multi-species umbrella for nature conservation. *Conservation Biology* 11:849-856.
- Mills, K. and W.J. Sydeman. In Review. The California Current Marine Bird Conservation Plan, Version 1.0. PRBO Conservation Science, Marine Ecology Division, Stinson Beach, CA.
- McNicholl, M. K., P. E. Lowther, and J. A. Hall. 2001. Forster's Tern (*Sterna forsteri*). In *The Birds of North America*, No. 595 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Morrison, R.I.G. 2001. Trends in shorebird populations in North America using Breeding Bird Survey data. *Bird Trends* 8:12-15. Canadian Wildlife Service, Ottawa.
- Page, G.W., C.M. Hickey, and L.E. Stenzel. 2000. Western Snowy Plover *Charadrius alexandrinus*. Pages 277-280 in P. Olofson, editor. Goals project 2000. Baylands ecosystem species and community profiles: life histories and environmental requirements of key plants, fish and wildlife. Prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. San Francisco Bay Regional Water Quality Control Board, Oakland, California.
- Page, G.W., L.E. Stenzel, and J.E. Kjelson. 1999. Overview of shorebird abundance and distribution in wetlands of the Pacific coast of the contiguous United States. *Condor* 101:461-471.
- Page, G.W., J.S. Warriner, J.C. Warriner, and P.W.C. Paton. 1995b. Snowy Plover (*Charadrius alexandrinus*). In *The Birds of North America*, No. 154 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia.
- RHJV (Riparian Habitat Joint Venture). 2004. Version 2.0. The riparian bird conservation plan: a strategy for reversing the decline of riparian associated birds in California. California Partners in Flight. <http://www.prbo.org/calpif/pdfs/riparian.v-2.pdf>.
- Rich, T.D., C.J. Beardmore, H. Berlanga, P.J. Blancher, M.S.W. Bradstreet, G.S. Butcher, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Inigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.N. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt, T.C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY.
- Rintoul, C., N. Warnock, G.W. Page, and J.T. Hanson. 2003. Breeding status and habitat use of Black-necked Stilts and American Avocets in South San Francisco Bay. *Western Birds* 34:2-14.

- Shuford, W.D., and T.P. Ryan. 2000. Nesting populations of California and ring-billed gulls in California: recent surveys and historical status. *Western Birds* 31:133-164.
- Steere, J.T. and N. Schaefer. 2001. Restoring the Estuary: Implementation Strategy of the San Francisco Bay Joint Venture. San Francisco Bay Joint Venture, Oakland, CA. 124 pp.
- Stenzel, L. E., C. M. Hickey, J. E. Kjelson, and G. W. Page. 2002. Abundance and distribution of shorebirds in the San Francisco Bay area. *Western Birds* 33:69-98.
- Stenzel, L. E., and G.W. Page. 1988. Results of the first comprehensive shorebird census of San Francisco and San Pablo bays. *Wader Study Group Bulletin* 54:43-48.
- Stralberg, D., N. Warnock, N. Nur, H. Spautz, and G.W. Page. 2003a. Predicting the effects of habitat change on South San Francisco Bay bird communities: An analysis of bird-habitat relationships and evaluation of potential restoration scenarios. Report to California Coastal Conservancy by PRBO Conservation Science, Stinson Beach, CA.
- Stralberg, D. V. Toniolo, G.W. Page, and L.E. Stenzel. 2003b. Potential impacts of non-native *Spartina* spread on shorebird populations in South San Francisco Bay. Report to Coastal Conservancy Invasive Spartina Project by PRBO Conservation Science, Stinson Beach, CA.
- Tyler, W.B., K.T. Briggs, D.B. Lewis, and G. Ford. 1993. Seabird distribution and abundance in relation to oceanographic processes in the California Current System. Pages 48-60 in *The status, ecology and conservation of marine birds of the North Pacific* (K. Vermeer, K.T. Briggs, K.H. Morgan, and D. Siegal-Causey, Eds.). Canadian Wildlife Service Special Publication, Ottawa.
- USFWS (U.S. Fish and Wildlife Service). 1998. Draft recovery plan for the Least Bell's Vireo. U.S. Fish and Wildlife Service, Portland, OR. 139 pp.
- U.S. Fish and Wildlife Service. 2001. Western Snowy Plover (*Charadrius alexandrinus nivosus*) Pacific Coast Population Draft Recovery Plan. Portland, Oregon. Xix + 630 pp.
- Warnock, N., C. Elphick, and M. Rubega. 2001. Shorebirds in the marine environment. Pages 581-615 in (J. Burger and B. A. Schreiber, Eds.). *Biology of Marine Birds*. CRC Press, Boca Raton, FL.
- Warnock, N., G. W. Page, M. Ruhlen, N. Nur, J.Y. Takekawa, and J.T. Hanson. 2002. Management and conservation of San Francisco Bay salt ponds: effects of pond salinity, area, tide, and season on Pacific Flyway waterbirds. *Waterbirds* 25 (Special Publication 2):79-92.

Warnock, S.E. and J.Y. Takekawa. 1996. Wintering site fidelity and movement patterns of Western Sandpipers *Calidris mauri* in the San Francisco Bay estuary. *Ibis* 138:160-167.