MARINE BIRD RESOURCES

Seabirds are a diverse assortment of bird species that inhabit salt or brackish water environments for at least a part of their annual cycle. This discussion is limited to the pelagic species of birds that breed on offshore islands and make their living by utilizing the food web in the upper layers of the ocean in contrast to the waterfowl (ducks, geese, grebes, loons, wading birds, and shorebirds) that live mostly in the coastal marsh areas or nest in arctic tundra or inland lakes and marshes. Seabirds can be further divided into resident (breeding) and non-resident (not breeding) species. Birds in these ecological categories are very different in how they affect or are affected by the natural environment and human-related events along our coast.

Table 1. Seabirds which breed off the California coast, their distributional status relative to areas north and south of California, the approximate sizes of their breeding populations in the 1980's and their status in the 1990's (X indicates presence, 0 indicates absence).

Common Name (Scientific Name)	Distribution in: Alaska	California[1]	Baja Cfa	Estimated CA Breeding Pop. in the 1980's[2]	CA Status in the 1990's
Forked-tailed storm-petrel (*Oceanodroma furcata*)	X	X	0	300	Unknown
Leach's storm-petrel (*Oceanodroma leucorhoa*)	X	X	X	18,300	Declining
Ashy storm-petrel (*Oceanodroma homochroa*)	0	X	0	5,200	Unknown
Black storm-petrel (*Oceanodroma melania*)	0	X	0	150	Unknown
Brown pelican (*Pelecannus occidentalis*)	0	X	X	2,700	Increasing
Double-crested cormorant (*Phalacrocorax auritus*)	X	X	X	1,900	Stable/Increasing
Brandt's cormorant (*Phalacrocorax penicillatus*)	0	X	X	64,200	Stable/Increasing
Pelagic cormorant (*Phalacrocorax pelagicus*)	X	X	0	15,900	Stable/Increasing
Western gull (*Larus occidentalis*)	0	X	0	51,000	Increasing
Common murre (*Una aalge*)	X	X	0	363,200	Declining
Pigeon guillemot (*Cepphus columba*)	X	X	0	14,700	Stable
Marbled murrelet (*Brachyramphus marmoratus*)	X	X	0	2,000	Declining
Xantus' murrelet (*Synthliboramphus hypoleucus*)	0	X	X	3,600	Stable/Declining
Cassin's auklet (*Ptychoramphus aleuticus*)	X	X	X	131,200	Unknown
Rhinoceros auklet (*Cerorhinca monocerata*)	X	X	0	400	Increasing
Tufted puffin (*Fratercula cirrhata*)	X	X	0	250	Stable
Number species in common		10	-	7	
Total breeding species	28 (30)	16 (23)	14 (22)		

[1]Some species in Alaska or Baja California are not listed because they do not occur off California. The number of breeding species in California can be increased by adding up to five terns (*Sterna sp.*), the black skimmer (*Rynchops niger*), and the California gull (*Larus californicus*); numbers in parentheses indicate additions of this type for each area.
[2] The estimated Alaskan breeding seabird total population is about 40,200,000 compared to about 700,000 for California. These numbers represent approximate mean levels throughout the 1980's, and recent updates will be published in 1993. Ten to forty percent should be added to include non-breeders and immatures, a proportion which varies from year to year and species to species. In California four species (common murre, Brandt's cormorant, Cassin's auklet, and western gull) comprise almost 90 percent of the total number of breeders.

There are 23 species of seabirds that breed along the coast of California. Point Conception is generally considered a major area of transition between characteristically northern seabirds (such as those found in the Gulf of Alaska and Washington) and subtropical seabirds (such as those found in the Gulf of California). North of Point Conception, marine waters are dominated by the California Current System in which cold, nutrient-rich water is upwelled along the coast. South of Point Conception, upwelling mainly occurs only far offshore, and warmer, clearer, nutrient-poor waters extend up from the Subtropics. Ecologically, this makes California's marine birds among the most interesting and taxonomically diverse in the northern hemisphere.

California's breeding seabirds are about evenly divided between southern and northern species. The northern seabird species have a greater biomass, however. One of the reasons for this is that northern waters are generally more productive and, therefore, support greater seabird populations. In California, many of our breeding seabirds, such as common murres, Brandt's cormorants, and Cassin's auklets (all primarily northern species) are concentrated at the Farallon Islands (off San Francisco) and Castle Rock National Wildlife Refuges (near Crescent City). The Farallons are the most important single seabird breeding site in California, and large seabird populations there are associated with abundant availability of suitable and protected nesting habitat, coupled with strong and productive upwelling systems that provide large prey resources in the same area.

A brood of three California brown pelicans on Anacapa Island off southern California. Improvement in reproductive success is linked to a decline in DDE residues in the offshore environment.

Another major California breeding area south of Point Conception in the Southern California Bight is the Channel Islands. These islands harbor important nesting colonies for some seabirds of northern affinity (such as Cassin's auklets) but also the state's entire nesting population of brown pelicans (presently a recovering endangered species) and the rare Xantus' murrelet. Both species have southern breeding distributions and also nest off Baja California; but the brown pelican is of tropical affinity (origin), whereas the Xantus' murrelet is of subarctic affinity. One of the most unique and interesting breeding seabirds off central and northern California is the marbled murrelet, a small seabird that nests inland in coastal, old-growth coniferous forests, often over a hundred feet high in the tree tops. Unfortunately, this little bird is becoming endangered because of the loss of its nesting habitat due to logging, and because of mortality caused by oil spills and gill-net fishing.

Usually, between the end of summer after the Upwelling Period and before the end of the year, the California Current System experiences an immigration, emigration, and reshuffling of seabirds from the north, south, and within California. The abundance and diversity of seabirds increases immensely at this time. One of the most abundant seabird species in the world, the sooty shearwater, comes through California waters by the millions, mostly from New Zealand. Another exciting sighting involves one of several species of albatrosses which seem to be showing up off California in increasing numbers. Similarly, southern seabirds, such as boobies, red-billed tropicbirds, and magnificent frigatebirds, can provide the highlight of any boat trip. From the Mexican Sea of Cortez around July, come several species of storm-petrels, Heermann's gulls, elegant terns, and many more brown pelicans than nest in California. From the north, especially into the winter, we witness the arrival of northern seabirds like the northern fulmar, tufted and horned puffins and other alcids, the black-legged kittiwake, the brant (one of the few species of wild geese that migrates along the coast to wintering areas in Mexico), and many others. Such diversity and abundance adds to the overall richness and value of California's total marine resources.

Table 2. Scientific names of birds mentioned in text but not included in Table 1.

Albatross	*Diomedia sp.*
Boobies	*Sula sp.*
Black-legged kittiwake	*Rissa tridactyla*
Brant	*Branta bernicla*
California least tern	*Sterna antillarum*
Elegant tern	*Thalasseus elegans*
Heermann's gull	*Larus heermanni*
Horned puffin	*Fratercula corniculata*
Magnificent frigatebird	*Fregata magnificens*
Northern fulmar	*Fulmarus glacialis*
Red-billed tropicbirds	*Phaethon aethereus*
Sooty shearwater	*Puffinus griseus*

History and Utilization

Marine birds or seabirds are the most conspicuous and familiar elements of marine communities, and are a source of pleasure and enjoyment for people at sea or along the coast. They are unique and important biotic elements of marine ecosystems and are good indicators of the general health of coastal offshore environments. Yet, people working or recreating at sea often know little about them. And, although often omitted from marine resource reference works such as this, seabirds require management and protection, just as do other elements of marine ecosystems.

Seabirds are prominent elements in the biodiversity of marine ecosystems. They perform what ecologist Paul Ehrlich calls "ecological services," such as nutrient cycling and scavenging of biological waste materials and debris from waters and

beaches. They often guide fishermen to fish. They are fun to watch, and consequently, contribute to local economies by attracting tourists. Healthy seabird populations give us the justified feeling that all is well at sea, and a "missing," sick, or oiled bird tells us that it might not be.

Like most marine wildlife, marine birds have historically suffered severe and relentless exploitations by man. In California, this was especially true at the Farallon Islands during and after the gold rush in the late-1800's, where common murres were heavily exploited for their eggs. There was no regulation of take, and the murre populations incurred severe declines, so that only a few thousand individuals were left by the late-1920's. The Farallon murre population did not recover for several decades and even now is far below numbers of the 1800's. Exploitation of seabirds or seabird products is neither a local or recent phenomenon. Recall the ancient, managed harvest of guano by the Incas of Peru, or the harvest of guano for manufacturing gunpowder by the imperialistic navies of Europe in the 16th-18th centuries. Empires were won or lost over control of the seabird islands! Early sailors and explorers often utilized seabirds or their eggs, driving some species to the point of extinction. In general, however, there has been little success worldwide in utilizing seabirds for sustainable food or other product sources. The few exceptions include guano harvests in Peru, harvest of eider down from seaducks in Iceland, "muttonbird" harvests (shearwaters) for oil in New Zealand, and the harvest of seabird guano from man-made islands off South Africa. There is no successful, sustainable harvest of seabirds or seabird products in California or the West Coast. Since the early days of exploitation, management has usually involved putting the nesting islands into a protection system. This is the case for most islands off California.

After World War II, California's abundant seabird populations began to suffer from new problems. For example, birds and marine mammals experienced population depletions as a result of offshore chemical pollutant discharges from industries in Southern California. In a different kind of example, bird populations in central and southern California declined from excessive sardine fishing. Many species of seabirds feed almost exclusively on surface-feeding fishes which are also sought in commercial fisheries. The depletion of sardines off Monterey is thought to have had deleterious effects on some species of seabirds. It is not well known, however, how long it takes to bring about a population decline of seabirds and how effectively various kinds of marine birds can switch to other prey. Since the 1950's, large oil spills and chronic waste oil discharges have become increasingly frequent, and large numbers of seabirds have been killed. Although acute oiling of seabirds (oil spills and the associated publicity they get) receives more attention, it might be that chronic oiling of the offshore environment causes the greatest damage to seabirds and other marine wildlife. Rehabilitation of oiled birds and mammals has not been very successful. Most birds die before rehabilitation can be attempted and many birds that receive care die anyway. Prevention of oil spills and chronic oiling is still the best solution.

Since seabirds are visibly affected when people misuse marine resources, the well-being of our seabird populations helps tell us about the health of our oceans. Potential effects on seabirds are often examined to help evaluate the overall projected effects on the marine environment of future development activities. Such activities include increased levels of offshore oil extraction and transport; mining of other ocean resources; development of alternate forms of energy; use of new fishing techniques; fish farming and fish ranching at sea; and new marine product development and exploitation. Increasing levels of marine debris, including fishing gear and seemingly edible items made of plastic and other materials present other hazards. Additionally, "eco-tourism," a rapidly growing industry, can lead to unregulated intrusion onto nesting islands that are important to seabird populations. There is already a history of disappearance of seabird colonies on islands visited too frequently by unsupervised tourists. Global warming, if it occurs, may have detrimental effects on seabirds.

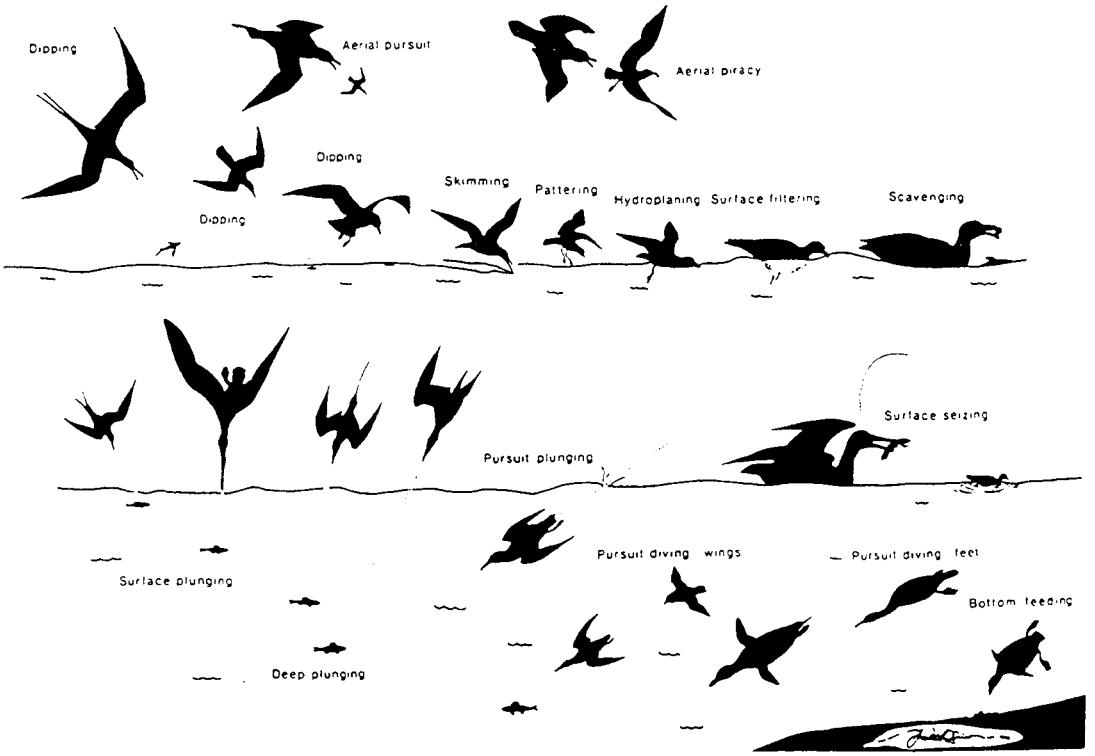
Recognition of the importance of seabirds as indicators and of the effects that human activities can have on them has led to a surge of activity and interest in seabird conservation and management. In addition to many governmental agencies, there are five "seabird groups" around the world composed of interested professionals which have been organized to study and help conserve these important elements of marine wildlife. The Pacific Seabird Group focuses on our West Coast from California to Washington, plus Alaska, Hawaii, British Columbia, and Mexico. In California, state and federal governmental agencies, anglers and commercial fishermen, and marine bird conservationists are beginning to work together to help conserve and manage marine wildlife.

Seabird Ecology

Almost all important adaptations in body form and behavior of seabirds reflect specialization for either breeding or feeding. Methods of marine bird feeding depend on types of foods and where these foods are found in the water column. Seabirds are, therefore, influenced by the environmental factors which influence the marine environment. During the breeding season, seabirds are confined to feeding within a reasonable distance from their nesting islands. In addition to providing suitable nesting habit, nesting islands must be free of predators and disturbances. Outside the breeding season, when not constrained to tending offspring, many seabird species are highly mobile and can move long distances to find food. Other species may remain in areas of abundant and predictable food supplies, just like fishermen. Distribution at sea is heavily influenced by the physical oceanography of the area. For example, plankton feeders will be found where ocean currents favor growth and accumulation of planktonic species. Such areas, in turn, provide food for shoals of pelagic species such as northern anchovy, Pacific sardine, herring, mackerel, or juvenile demersal fishes such as rockfishes. These midwater fish in turn are preyed upon by fish-feeding seabirds. The species of fish is usually not as important as is the fact that the fish are available and abundant.

Some seabirds feed at the surface and others fly or paddle underwater to extend their reach lower into the water column. Some California species can dive to a depth of 330 feet. Water

clarity influences which type of feeding method will be most successful. For example, clear, tropical waters typically best support species that catch fish by plunge-diving (boobies and pelicans). In contrast, northern waters are usually too turbid for aerial plungers to see prey, but are better suited to underwater swimmers or flyers (like the murres, auklets, and cormorants).



Seabird feeding methods in relation to depth of water column penetration and morphological variation of different species (described by N.P. Ashmole and drawn by J. Ahlquist, reprinted with permission from Academic Press).

While nesting, seabirds are more or less bound to a nest that requires protection from predators and parental care. The breeding season is the period of time it takes from courtship, nest-building, and egg-laying to the point of fledging, when young leave the nest or become independent. During breeding, seabirds are strongly influenced by local food supplies and, thus, the oceanographic and meteorological conditions. Reproductive success is influenced by the biomass, availability, and consistency of local food supplies. For instance, when El Niño weather patterns occur, seabirds reproduce poorly or not at all because prey resources are less abundant and available.

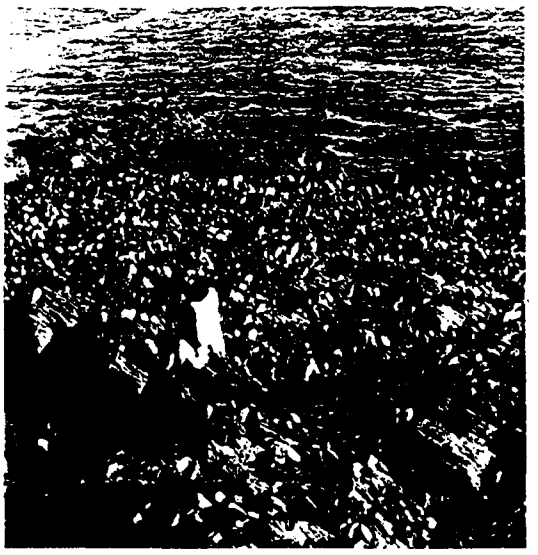
Since offshore islands with nearby, stable food supplies are in short supply for nesting seabirds in California, such birds are almost always found concentrated into tightly-packed nesting colonies, with different species usually segregated onto different kinds of micro-habitat. As a consequence, nesting colonies are vulnerable to destruction by mammalian predators such as foxes and raccoons. Therefore, nesting islands must be free from terrestrial predators and human disturbance to provide seabirds with successful nesting opportunities. Evolutionary development on islands lacking terrestrial predators has left many seabirds with no defenses against predators, except to abandon their colonies. Undisturbed roosting and loafing sites are also critical to seabirds. Tourism and introductions of rats, cats, dogs, pigs, goats, and other feral animals has repeatedly led to extermination of seabirds from islands that were formerly predator-free.

Management

Many agencies are involved in the management and conservation of marine birds, and many statutory and executive provisions contribute to their protection. In addition, California has one of the finest systems of sanctuaries and refuges for seabirds in the world. However, our coastal wetlands now comprise only a small percentage of their former extent, and these habitats are critical to many species of seabirds. Offshore waters are becoming increasingly occupied and utilized by people, yet many offshore islands and rocks are as close to their natural states as one might reasonably expect in our modern world.

Nonetheless, some of California's seabirds are threatened or endangered, and others may warrant such designation. Examples are the California least tern, the California brown

pelican, the marbled murrelet, the Xantus' murrelet, and the ashy storm-petrel. The brown pelican may soon be downlisted because its populations are recovering; one of the few success stories in recent times.



Common murres and Brandt's cormorants on Flatiron Rock off Trinidad, north of Eureka.

Seabird populations have a number of characteristics in common which make them susceptible to harm from environmental changes:

1) Resident seabirds concentrate their nesting efforts over several months at small areas, and they traditionally use the same nesting areas year after year.

2) Some seabirds (pelicans, cormorants, gulls) concentrate in roosts or resting sites. Night roosts provide protection from predators and disturbances and may have beneficial thermal characteristics. Day roosts are located closer to food supplies and may have good plumage drying properties.

3) Many seabirds depend on concentrated food supplies, often commercially valuable fisheries resources. Marine fisheries biologists are working with marine wildlife biologists to balance recreational and commercial fisheries with other wildlife needs.

4) Many seabirds tend to be long-lived with low annual reproductive rates. Thus, seabirds cannot usually recover very rapidly from large impacts on their populations.

5) Seabirds are often components of assemblages with interdependent elements, which means that they are closely allied to other species in their system. Disruption of one or more interacting elements may affect the entire assemblage in some way.

Seabird and Fisheries Interactions

Seabird-fisheries interactions have been categorized as follows: 1) direct competition, with negative population implications either for fish or seabird populations; 2) mutualism, where the interaction is beneficial, or commensalism, where there is neither benefit nor detriment to the interaction; and 3) physical injury, where birds are killed or damaged by fishing activities, or bird activities damage operations or gear. Categories 1) and 3) describe conflicts in resource use that should be minimized. Multi-species or ecosystem management instead of management that is single-species oriented may be the key to minimizing such conflicts. The management plan of the Pacific Fishery Management Council (PFMC) for anchovies was one of the first in the nation to consider the multiple uses of the anchovy resource, including seabirds, marine mammals, and bait fisheries for sport fishermen. With the rapidly recovering Pacific sardine resource, the PFMC is revising its anchovy plan to include multi-species management of small pelagic fishes. Fishery management plans are beginning to include concepts such as reserves, multiple-needs, ecosystem balance, and thresholds of minimum resource abundance.

Pileup of brown pelicans, Heermann's gulls, and Brandt's cormorants feeding on anchovies at Shell Beach. Other individuals are roosting on nearby rocks.

The future of fishing gear/seabird interactions is also improving. Gill netting has been banned in many areas, and some fishermen have switched to other fishing methods that do not harm seabirds. Situations are more difficult to control when the commercial fishing occurs outside areas of state or federal jurisdiction. Interactions between recreational fisheries and marine wildlife also occur. While each individual interaction may involve only one angler and one bird, together they can have a significant effect on some seabird populations, especially threatened or endangered species. In many instances the best management approach is education.

Daniel W. Anderson
University of California, Davis

David G. Ainley
Point Reyes Bird Observatory

Harry R Carter
U.S. Fish and Wildlife Service

Kenneth T. Briggs
University of California, Davis

Alec D. MacCall
National Marine Fisheries Service

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