Connecting the webs of life in the California Current

For decades, ocean fisheries off the West Coast have been managed a single species at at time, as though they exist in isolation. Of course, they don't. Now, as ocean climate undergoes a massive sea change, the entire ecosystem is at a heightened state of risk. Yet new ideas that take into account the needs of the entire California Current Large Marine Ecosystem are still highly controversial.

Long Seabird Migrations

More than 100 species of seabirds have been recorded migrating to the California Current, according to the 2005 California Current Marine Bird Conservation Plan, by the Point Reyes Bird Observatory.

Sooty shearwaters migrate between September and May from breeding colonies in New Zealand and the southern tip of South America, and are the most abundant seabird predator. Within Monterey Bay, sooties consume substantial amounts of forage fish.

The density of migrants at sea is highest during the spring and fall and is also higher in the summer than in the winter. The other two shearwater species that can be found here are the **pink-footed shearwater** and the **Buller's shearwater.**

Sooty shearwater (P*hoto by Greg Gillson, The Bird Guide, Inc., http://thebirdguide.com*)

Long-range seabird migrants include:

Phalarope
Northern Fulmar
Pink-footed Shearwater
Black-legged Kittiwake
Herring Gull
Pacific Loon
Black-footed Albatross
Bonaparte's Gull
Buller's Shearwater
Common/Arctic Tern
Pomarine Jaeger
Murphy's Petrel
Cook's Petrel
Mottled Petrel
Short-tailed Albatross

Currents and Upwellings

The Point Reyes Bird Observatory has performed one of the most thorough reviews of ecological conditions in the California Current, at least as it pertains to seabirds. Its 2005 report, California Current Marine Bird Conservation Plan, breaks down the main components of the California Current: the southward-flowing California Current, the northward-flowing (in the fall and winter) California Undercurrent, the northward-flowing Southern California Undercurrent, and the Southern California Countercurrent.

Strong northwest winds during late spring and early summer lead to wind-driven upwelling, particularly near headlands. Along the coast, surface waters are pushed by seasonal winds and deflected offshore by the Earth's spin on its axis. Relatively warm surface waters, displaced westward, are replaced by deep, cold, nutrient-enhanced waters. Where this happens, the marine ecosystem is exceptionally productive.

Where upwelling fronts occur, plankton and fish are trapped, and seabird predators concentrate. This process creates favorable conditions for phytoplankton growth and increases retention of zooplankton, larval fish, crabs, and jellyfish.

North of Cape Blanco, Ore., extensive coastal down-welling in winter is associated with intense winter storms that pass through this region. From Point Conception, Calif., to Cape Blanco, coastal upwelling occurs all year. The Southern California Bight separates the subarctic waters from warmer subtropical waters to the south.

Leatherback Conservation Zone

Leatherback turtles are regularly seen in the California Current, especially between Point Reyes and Monterey Bay, where upwelling zones create favorable habitat for their favorite prey, jellyfish. Off Oregon, jellyfish become denser and larger in size during summer, when the movement of surface and near-surface waters concentrates food in near-shore areas. Independent telemetry studies show that from mid-summer through the fall, leatherbacks travel thousands of miles from the Western Pacific to feed.

The only remaining major nesting areas for the Western Pacific leatherback population are on the Bird's Head Peninsula beaches of in the Indonesian province of Papua. Recent studies estimate 300-900 female leatherbacks nest at one of the beaches. at Jamursba-Medi, down from 1,000-3,000 prior to 1985.29 The leatherback population there has continued to decline since 1993, when scientists first began to consistently record data.

The Pacific Leatherback conservation Area (in dark blue).

This critically endangered species in the Pacific Ocean has declined by more than 90 percent over the past three decades, primarily as a result of drowning in industrial longline and gillnet fisheries. leatherbacks are easily entangled in abandoned fishing gear, lines, ropes, and nets.

The National Marine Fisheries Service, in a biological opinion issued in 2001, concluded that leatherback foraging areas off California and Oregon need special protection. In August 2001, it closed an area (see maps above and to the right) to drift gillnet fishing.

In September 2007, three conservation groups - the Center for Biological Diversity, Oceana and the Turtle Island Restoration Network, petitioned NMFS to designate the 200,000 square mile area as "critical habitat" for the highly endangered sea turtle.

Important bird areas

The California Current shelf provides relatively shallow habitat for many coastal species such as **terns, cormorants,** and **murres.** Many of these habitats hvee been designated by the National Audubon Society as Important Bird Areas, or IBAs, that provide essential habitat for several seabird species. The Important Bird Areas Program) is a global effort to identify and conserve areas that are vital to birds and other biodiversity.

Common murres (photo by Gulf of the Farallones National Marine Sanctuary)

IBAs in the California Current include numerous islands, several of which contain seabird colonies

= Important bird areas

exceeding 100,000 breeding birds. Puget Sound, the Columbia River estuary and San Francisco Bay provide critical habitat for many seabird species, as reported by the Point Reyes Bird Observatory, which published these findings in its California Current Marine Bird Conservation Plan:

In Oregon, 1,400 offshore islands, rocks, and reefs provide habitat for more than a million seabirds, including common murres, tufted puffins, cormorants, and storm-petrels, nest there.

The most important seabird breeding areas in California are Castle Rock, the Farallon Islands, and the northern Channel Islands. The Farallones are home to the largest and most diverse assemblage of breeding seabirds in California.

In Washington, there are five national wildlife refuges, all within the Olympic Coast National Marine Sanctuary .Washington is home to approximately 300,000 seabirds belonging to 16 species.

Forage Fish

Forage fish in the California Current are targets of some of the largest commercial fisheries, and play a key role in marine food webs. A wide variety of predators eat them.

These fish live in the water column as opposed to living near the sea floor. They can generally be found anywhere from the surface to 1,000 meters. The Pacific Fishery Management Council manages harvests of:

Northern anchovy, a small, short-lived fish typically found in schools near the surface. It is an important part of the diet for other fish, birds, and marine mammals.

Pacific sardine are also a small schooling fish. No other fish was more abundant than the sardine in the California Current. Sardines may live as long as 13 years, but they are usually younger than five years old.

Pacific mackerel school with other pelagic species such as jack mackerel and sardines.

Jack mackerel are a schooling fish that grow to about 60 cm and can live 35 years or longer.

Market squid are most abundant between Punta Eugenio, Baja California and Monterey Bay,

Northern anchovies are important prey for marine mammals and fish (photo by OAR/National Undersea Research Program

California. Fishermen find them near the surface, but they can appear to depths of 800 meters or more. They live up to ten months, and are important as forage foods to many fish, birds, and mammals, such as salmon, coho salmon, lingcod, rockfish, seals and sea lions, sea otters, porpoises, cormorants, and murres.

Fishing for **krill**, a shrimp-like species that whales and other predators eat, has been banned by the Pacific council.

Rockfish nestle in the branches of a gorgonian soft coral(photo by Ed Bowlby, NOAA/Olympic Coast NMS; NOAA/OAR/Office of Ocean Exploration)

Deep Sea Habitats

Destructive trawls and dredges used for commercial fishing have destroyed and continue to destroy entire seafloor environments necessary to conserve, protect and restore healthy oceans and healthy fish populations.

The conservation group Oceana, working with fishermen, other groups and fishery management councils, successfully protected more than 500,000 square miles of ocean habitat from destructive trawling off the North Pacific and the Pacific coasts. The protected areas are off the Aleutian Islands, in the Gulf of Alaska, the Bering Sea and off the coasts of Washington, Oregon and California in the California Current. Destructive trawling and dredging is prohibited in areas where deep sea coral and sponge habitat are known to exist and areas where scientists have not yet studied. Bottom trawl areas are set in each region.

Deep sea corals literally form the cradle of life for the oceans. These marine animals form the foundation of stunningly beautiful seafloor communities and are important habitats for fish to forage, find protection and lay their eggs. Some coral gardens contain more than one hundred species of corals and sponges and provide habitat for countless other animals.

Rockfish, Atka mackerel, walleye pollock, Pacific cod, sablefish, flatfish, crabs and other economically important fish inhabit coral and sponge areas.

A diversity of riches

Countless species live in the California Current, including those below. These species are just part of the ecosystem's rich diversity, and are shown approximately where one might find some of them.

National Marine Sanctuaries

Washington
- Olympic Coast

Oregon
- None

California
- Cordell Banks
- Gulf of the Farallones
- Monterey Bay
- Channel Islands

These sanctuaries are not true marine reserves. Commercial fisheries are allowed, under the management of the Pacific Fishery Management Council.

Wave Energy

A gold rush in wave energy projects is hitting the California Current, and at least 23 projects have been proposed, including seven in Oregon. There is concern that wave energy development could interfere with ocean fisheries and possibly slow down progress toward the creation of marine reserves. Unlike its neighbors to the north and south, the state of Oregon still has not created its first marine reserve.

California's new Marine Reserves

California's Central Coast Marine Protected Areas took effect Sept. 21. From Pigeon Point (San Mateo County) south to Point Conception (Santa Barbara County), the series of 29 marine protected areas represent approximately 204 square miles (or approximately 18 percent) of state waters in the Central Coast Study Region.

- 15 State Marine Conservation Areas which limit all fishing.
- 13 "no-take" State Marine Reserves
- One State Marine Recreational Managed Area: Morro Bay State Marine Recreational Management Area, where recreational fishing is limited or restricted.