Coastal Wetlands: Estuaries and Salt Marshes  By Sherry Schmidt

Bolsa Chica Ecological Reserve is the largest "restored" wetland in Southern California. It is a great place to observe and photograph birds.

Upper Newport Bay is one of the largest natural estuaries remaining in California. Over 90 percent of California's coastal estuaries have been lost to development in the last 100 years.
Coastal Wetlands: Estuaries and Salt Marshes

An estuary is a type of wetland where fresh water and sea water mix. Upper Newport Bay and Bolsa Chica Ecological Reserve are two examples of estuaries that are found in Orange County. The fresh water source for Newport Bay is San Diego Creek. Fresh water enters Bolsa Chica from the Wintersburg Flood Control Channel. Bolsa Chica might be considered a seasonal estuary since flow from the channel varies from season to season. True estuaries are fed by freshwater on a continuous basis.

A salt marsh is the plant community that borders an estuary in temperate latitudes. Mangrove forests border estuaries in tropical latitudes. The plants of the salt marsh are called halophytes which means they are salt tolerant. Different plants are found at different elevations in the salt marsh. Cord grass (*Spartina foliosa*) is found at the lowest elevation in the salt marsh. It can tolerate being covered with sea water at high tide two times per day since it has hollow, air filled stems which allow it to transport oxygen to its roots. It also has salt glands that enable it to tolerate salt water by excreting excess salt on the surface of its leaves. It requires daily flushing of surface salts on its leaves. Cord grass has a rapid growth rate due to a special type of photosynthesis called C₄ photosynthesis. However, few organisms eat it directly due to the salty leaves. Cord grass provides hiding places for juvenile fishes during high tide. Its roots trap detritus (small bits of organic matter) that serve as a food source for micro-organisms, worms, and snails. It is also the zone in the salt marsh that the endangered light-footed clapper rail builds its nest. The light-footed clapper rail builds a floating nest that rises and falls with the tides by weaving dead cord grass stems around growing stems. You can see a model of this nest at the Peter and Mary Muth Interpretive Center.

A zone of succulent plants dominated by pickleweed (*Salicornia sp.*) is found above cord grass in Upper Newport Bay and Bolsa Chica. The roots of pickleweed are only covered by sea water during very high tides. Pickleweed does not have salt glands. It absorbs both water and salt. It concentrates salt in its tips, which turn red and drop off depositing the accumulated salts back into the ecosystem. The endangered Belding's savanna sparrow nests in areas of dense pickleweed and feeds on the seeds of pickleweed during the winter months. It is one of a few species of birds that reside in coastal salt marshes of California year round.

Plants found above the high tide line include salt grass (*Distichlis spicata*), salt tolerant shrubs such as sea blight (*Suaeda taxifolia*), sea lavender (*Limonium californicum*), and the endangered salt marsh bird's beak (*Cordylanthys maritimus*).
Upper Newport Bay at low tide. The mudflats are visible. The mudflats are covered with sea water a majority of the time and lack flowering plants. Algae and cyanobacteria are the only photosynthetic organisms growing here. The green alga *Enteromorpha* can be seen growing on the mudflats in this photograph.

Upper Newport Bay at high tide. The grass that borders the open water of the estuary is cord grass. Cord grass cannot tolerate more than 9 hours of continuous submergence. However it can tolerate being covered with sea water longer than any other flowering plant. It has hollow leaves, stems, and rhizomes. This enables it to get oxygen from the air to its roots and other tissues when they are covered with water.
Cord grass grows at the lowest elevation in the salt marsh.

Pickleweed is a succulent that grows above cord grass.

Salt grass has salt glands. It grows above the high tide line.

California sagebrush or coastal sage is a coastal sage scrub species.
Subtidal channels are important habitats for fish and serve as feeding habitats for diving birds such as brown pelicans and cormorants.

Mudflats are rich in invertebrates such as clams, worms, and snails. These invertebrates are an important food source for birds.

The salt marsh can be divided into the low marsh, the middle marsh, and the high marsh. The low marsh is dominated by cord grass and is good habitat for herons, egrets, and the endangered light-footed clapper rail. The middle marsh is dominated by pickleweed. It provides habitat for the endangered Belding’s savanna sparrow. The high marsh is dominated by salt grass and salt tolerant shrubs such as sea blight.

The freshwater marsh is dominated by cattails (Typha latifolia). Cattails are usually found in dense stands which provide cover for a number of wildlife species including rails, coots, and red-winged blackbirds.

Riparian habitats are found along the margins of freshwater streams. Large winter deciduous trees such as western sycamore and cottonwood are characteristic of riparian environments in southern California. Arroyo willow is a characteristic shrub of riparian habitats.

Coastal sage scrub is an endangered plant community in southern California. Most of the coastal sage scrub around Upper Newport Bay has been developed. Coastal sage scrub is the preferred habitat of an endangered bird species called the California gnatcatcher. There is enough coastal sage scrub habitat in Upper Newport Bay to support a breeding population of this species.
Ecosystem Services Performed by Estuaries and Salt Marshes

Ecosystem services are "the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life". I refer to ecosystem services as the things that an ecosystem does to make the earth livable. Coastal wetlands perform a number of ecosystem services. The freshwater sources that flow into the estuary bring nutrient rich sediments that accumulate in the estuary rather than being washed into the sea. When freshwater runoff flows into a wetland particulate matter is trapped by roots. Dissolved nutrients such as nitrates and phosphates are incorporated into the tissues of plants. The abundant nutrients, coupled with the intensity of the sunlight found in southern California, support high rates of primary production. This supports a huge biomass of organisms that act as a food source for juvenile fishes and migratory birds. The plankton and algae that are found in the open waters of Upper Newport Bay and Bolsa Chica Ecological Reserve serve as a food source for more than 80 species of fish including topsmelt, anchovies, and mullet. Estuaries provide juveniles of many commercially important fish with an abundance of food and places to hide from predators.

Estuaries and salt marshes also function as resting areas for migratory birds. They serve as the critical habitat for endangered species such as the light-footed clapper rail, Belding's savanna sparrow, and a plant called salt marsh bird's beak. The mudflats have enormous numbers of filter-feeding bivalves. These organisms filter the water reducing the impact of urban runoff. These areas also protect coastal communities from floods and rising sea water by absorbing water from rainstorms and high tides. Coastal wetlands areas also provide open space for recreation.

Endangered Species

The Belding’s savanna sparrow is a nonmigratory subspecies of savannah sparrow. It is a state endangered bird and is a candidate species for federal protection. The light-footed clapper rail is a federally listed endangered species that is endemic to California. It is well adapted to living in the salt marsh. It has a narrow body to help it move through dense vegetation. It also has long toes keep it from sinking it the mud.
Shorebirds

Estuaries are important resting and feeding areas for migratory birds. Nearly 75% of the shorebird species that breed in North America fly from their nesting grounds in the arctic to winter in Central and South America. They return to the Arctic the following spring due to food availability associated with the long day length of the arctic summer. Both Bolsa Chica and Upper Newport Bay are located along a migration pathway called the Pacific Flyway. Huge concentrations of birds can be seen in these areas during migration. These birds avoid competition between one another due to anatomical differences that enable resource partitioning. Different species of birds have bills of different lengths and feed in different ways. They also feed at different depths of the mud.

Black-necked Stilt  American Avocet

The black-necked stilt and the American avocet are two shorebirds that can be seen at Upper Newport Bay and at Bolsa Chica. Note the difference in the shape of their bills. These birds feed at different depths below the surface of the mud. The black-necked stilt stalks its prey in water that is at least 6 inches deep. The American avocet uses its upcurved bill as a scythe, swinging it back and forth in the water. It stirs up the bottom and feeds on small crustaceans.

Shorebirds have a variety of bill lengths. This determines the depth they feed below the surface of the mud. This reduces competition between species. (Drawing is from Marine Biology, 9th Edition by Peter Castro and Michael E. Huber, 2013).
The long-billed curlew and the western sandpiper differ significantly in both size and bill length. The long-billed curlew has a large body and uses its long down curved bill to probe deeply in the mud for crustaceans, bivalves, and worms. The small bodied western sandpiper belongs to a group of small sandpipers called "peeps". They feed on organisms found just below the surface of the mud. When the tide covers their shallow feeding grounds western sandpipers move to higher ground and wait for the next low tide when they can resume feeding.

The marbled godwit is commonly seen in flocks with whimbrels and long-billed curlews. It probes the mud with its sensitive up curved bill and often inserts its entire bill in the mud with its head totally submerged. The willet uses a wide range of foraging methods including probing into the mud with its beak and stalking prey in the water.
Birds of the Subtidal Channels

The subtidal channels are the feeding grounds of a number of diving birds. Diving birds typically feed on fish. Brown pelicans dive into the water to scoop fish into their pouches. This feeding strategy is called plunge diving. Cormorants, grebes, loons, and diving ducks chase their prey under the water's surface. This feeding strategy, which is also used by penguins, is called pursuit diving.

Brown Pelican Plunge Diving

Brown Pelican with a fish in its pouch

The Double Crested Cormorant is a pursuit diver

The Pied-billed Grebe is a pursuit diver

There is also a group of ducks that feed in the shallow areas of the subtidal channels. These are called dabbling ducks. Dabblers such as the mallard, American wigeon, and northern pintail, feed by tipping, tail up, to reach aquatic plants under the water's surface.

The Northern Pintail is a dabbling duck

Northern Pintails feeding
Herons and Egrets

Herons and egrets are wading birds with long legs, a long neck, and a sturdy long bill. They stalk prey such as fish and crustaceans in shallow water. Their eyes face forward which allows both eyes to focus on an object at the same time. This is called binocular vision and it is associated with good depth perception which is necessary for them to accurately strike living prey. The great blue heron is the largest heron in North America. It is primarily a "sit and wait" style predator which stands immobile and strikes its prey with its large sharp beak. The great egret typically stalks prey in shallow waters, walking slowly until suitable prey are spotted. The snowy egret is a more active predator using its bright yellow feet to stir up the bottom to drive small fish to the surface.

Great Blue Heron

Great Egret

Snowy Egret - Note the black bill, yellow feet, and the forward pointing eyes.
Coastal Sage Scrub
Coastal sage scrub is an endangered plant community that consists of small perennial shrubs 1-5 ft. in height with an understory of winter annuals. This is a drought-deciduous plant community that dominates the hillsides on the coastal sides of mountain ranges in southern California up to 2500 ft. Although drought-deciduous shrubs are the characteristic element of this plant community, evergreen shrubs and succulents may also be present and locally abundant. Common plants of this community include California sagebrush, coastal brittlebush, and California buckwheat. Animals characteristic of this habitat include the western fence lizard, gopher snake, California ground squirrel, bobcat, and coyote. The coastal remnants of this habitat are no longer large enough to support what was once the top carnivore, the mountain lion.

Coastal Brittlebush
Bobcat

Western Fence Lizard
Coyote

The coyote is a keystone species in coastal wetlands. A keystone species is a species that other organisms in the ecosystem depend on. Endangered species of birds that nest in wetlands such as the least tern, Belding's savannah sparrow, and clapper rail are vulnerable to predation by foxes since foxes have a hunting strategy similar to cats. The coyote preys on foxes which reduces predation on birds.