



**U.S. Army Corps  
of Engineers**

# Explore 13

The California Coastline  
Newport Beach to the Mexican Border



**The Year of the Coast**

The beauty and physical diversity represented by California's coast, bays, harbors and estuaries are exceptional. Uniquely spectacular scenery features mountains dropping steeply to rocky shores, rolling headlands and bluffs, fertile marshes, wide sandy beaches and dramatic vistas extending some 1,100 miles from Oregon to the Mexican border.

The sea acts as the coast's chief architect, and continual changes take place as waves, rains and winds reshape shoreline contours. Currents and tides continually refresh and nourish coastal lands and waters, where life forms are as diverse as their habitats. Here the mighty whale and the tiniest of organisms, salt marsh plants and towering redwoods, live together with man in an intricately balanced state of interdependence.

The coast means something different to each individual. Some cherish the fresh salt air, the sea breezes and the opportunities for contemplative solitude. Others enjoy the coast as a place to picnic and swim, to fish, sun or sail, while many choose to search for driftwood or study the mysteries of rocky pools. Many choose birdwatching in coastal bays, marshes and lagoons, while others value the potential for commercial and recreational development.

To the U.S. Army Corps of Engineers, California's bay and coastal areas mean a continuing dedication to management and preservation through effective coastal engineering, interdisciplinary investigations, exercise of regulatory authority, water quality and flood control activities, harbor development and protection, and fish and wildlife conservation.

To assist you in developing a greater knowledge and appreciation for California's coastline and its valuable resources, the Corps of Engineers has prepared a series of brochures which highlight both natural and man-made features. The sites included in each brochure were selected for their unique scenic significance, recreational opportunities and accessibility. Related information on various natural phenomena such as tidal action, beach formation and movement of currents has also been included, along with reference to numerous indigenous plants and animals. Such detail provides the visitor with an opportunity to gain an increased understanding of the many fascinating aspects of coastal areas.

Bring your camera and binoculars, your curiosity and sense of adventure and join us in exploring nature's wonderful gifts.



### **Newport Beach to the Mexican Border**

The 85 miles of coast between the rugged beauty of the Laguna Beach headlands and the lush expanse of the Tijuana Slough offer an alluring climate, dramatic physical geography and rich history that combine to make this a

favorite recreation area for Californians and visitors.

The coastline here has a mild climate with one of the lowest seasonal temperature ranges in the continental United States. San Diego, for example, averages 54° F in January and 69° F in August. The temperature at the city's weather station has never dropped below 29°.

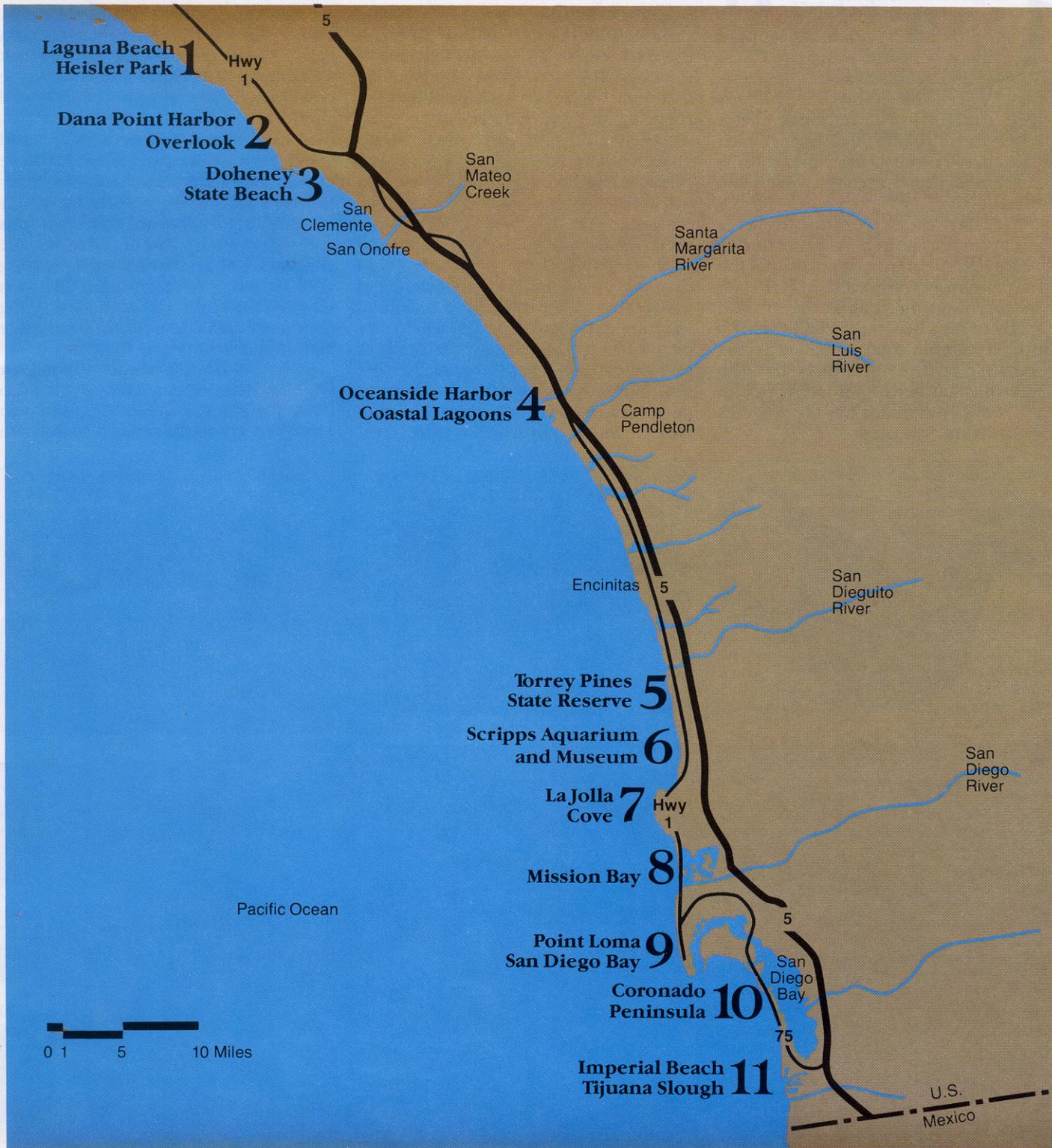
Sea level fluctuations and crustal movement have carved out a series of marine terraces along the Peninsular Range in this area. These terraces have contributed to the creation of a landscape with more visual variety than is commonly associated with coastal plains. Cut deep into the terraces are stream valleys with beautiful lagoons, marshes and beaches.

At three places, Laguna Beach, La Jolla and Point Loma, the shoreline features scenic coves and headlands backed by hills prized for their ocean vistas. The only enclosed natural anchorage along this open coastline is at San Diego Bay.

For thousands of years before the Spanish arrived, this temperate land

was occupied by two Indian tribes, the Yumans and the Shoshones. In 1769 California's first permanent European settlement was established at San Diego. This was the first of a long chain of Franciscan missions designed to support Spain's colonization effort. Today, the Hispanic legacy introduced by the Franciscan padres remains evident in the unhurried style and charm of many of the beach towns scattered along the coast.

For all its untamed beauty, this is a fragile place. Increasing urbanization has endangered many plant and animal species that are now at least partially protected in a number of reserves scattered along the coast. From the dramatically gnarled Torrey Pine, making one of its last stands along these shores, to the plucky savannah sparrow, fighting for its future in shrinking marshlands, this is an environment in transition. As you explore and enjoy this part of the coast, we hope you will gain a greater understanding of the delicate balances that must be maintained to preserve the natural environment.



# 1 Laguna Beach and Heisler Park

Approximately ten miles south of Newport Beach along the Coast Highway is Laguna Beach. The area's craggy coves and dramatic headlands lured a migration of painters in the early 1900's, establishing Laguna Beach as an artist colony. That reputation is maintained today through yearly art festivals.

The city's reputation as a beach resort gained momentum in 1928 when the southern portion of the Coast Highway was paved. Before then the surrounding rough terrain had caused Laguna Beach to be bypassed by both El Camino Real, once an oxcart trail linking the missions, and the California Southern Railroad, which in the 1880's connected the Los Angeles Lowlands and San Diego.



## California Ground Squirrel

The California ground squirrel is one of the largest varieties of its species. Resembling its small relative, the chipmunk, the ground squirrel is a burrowing rodent with a rounded head, bushy tail, and short ears and legs. It can reach a length of 20 inches, stand three inches high and weigh as much as two pounds.

Although ground squirrels live in colonies, each animal has its own underground burrow. On sunny days, they

often appear and sit upright on their haunches. The squirrels can remain motionless in this position for long periods, but at the approach of danger, they utter shrill whistles and disappear into their burrows.

Although the ground squirrel is a contributor to cliff erosion along the California coast, it is also a soil builder. As a burrowing animal, it has helped to develop the rich, fertile plains of midwestern North America.

Laguna's Heisler Park provides an excellent vantage point for viewing the area's dramatic coastline. To reach the park, turn right on Cliff Street off the Coast Highway. Immediately ahead is a small gazebo with beaches for relaxing and enjoying the scenery. A walkway along the edge of the steep cliffs leads to additional viewing and picnic areas. Below the gazebo are two pocket beaches and many tide pools. Although these tide pools are protected under state law, some plant and animal inhabitants have been depleted by those unaware of the importance of preserving these delicately balanced habitats. Other tide pools nearby are part of the protected Heisler Park Ecological Reserve. Here marine life flourishes with starfish, sea urchins, hermit crabs, barnacles and sand dollars. Such mollusks as abalones,

chitons, limpets, mussels and cowries are also abundant.

To the right of the gazebo is a type of reef rarely seen from land, but which exists in deeper water along the coastline. An ancient upheaval caused the reef's strata, or layers, to tilt, forming large numbers of ledges and crevices. In underwater reefs, these crevices are habitats for abalone, spiny lobsters, and moray eels. In the bluffs overlooking the ocean, cliff erosion is clearly evident. One cause is the burrowing of ground squirrels. During wet weather, water courses down through the squirrels' tunnels, causing chunks of unstable cliffs to break away and slide down.

Continuing south on the Coast Highway, turn right at the sign for Aliso Beach and Pier. Aliso provides an example of a "bermed" beach. In



One of many tide pool areas at base of Laguna Beach cliffs



Aliso Pier and summer's bermed beach



Laguna's City Beach as seen from Heisler Park



Reef visible from Heisler Park gazebo

summer, gentle wave action lifts grains of sand from the underwater beach face and pushes them toward shore creating a low terrace known as a berm. In winter, larger waves wear away at the berm and carry the sand back to sea. Between fall and spring, a variety of migratory shorebirds rest and feed on the berms at Aliso Beach. One of the best known of these visitors is the long-legged, brown-and-white speckled sandpiper. These graceful birds perform aerial acrobatics in perfectly synchronized motion wheeling, landing and flying away again. The unusual design of Aliso Pier is exemplified in a diamond-shaped viewing and fishing area. Adjacent to the pier is the South Laguna Beach Marine Life Refuge.

Continuing south on the Coast Highway, broad flat land formations known as mesas can be seen through-

out Orange and San Diego Counties. A mesa, which means table in Spanish, is an elevated plateau from coastal cliffs. Mesas are usually sparsely vegetated with brush and chaparral.



Scuba divers prepare to explore underwater coves

## 2 Dana Point Harbor and Overlook

Dana Point can be approached from the north by turning off the Coast Highway on the Street of the Blue Lantern. Drive approximately two short blocks to the end of the street, where a gazebo provides a sweeping view of Dana Point Harbor. Surrounding the gazebo is an attractive park with picnic tables and benches. Dana Point was named for author and adventurer Richard Henry Dana. In search of excitement, Dana left Harvard University in 1834 at the age of 19. He shipped out from Boston on the *Pilgrim*, bound for California. In 1840 *Two Years Before The Mast*, his classic memoirs of that trip was published. It became the first best-selling book about California and did much to influence annexation of the territory.

### Offshore Islands

The Channel Islands are the least visited and most sparsely populated areas of Southern California. The islands consist of two groupings — the Santa Barbara chain to the north and the Santa Catalina chain further south. The coast of Southern California from Point Conception to the

Mexican Border has been strongly influenced by the existence of the Channel Islands. All are actually mountain tops extending as much as 1,500 feet above sea level. The islands act as enormous natural breakwaters that diminish the energy of waves approaching the Southern Califor-

nia shoreline. The result is long, broad sandy beaches with moderate wave energy, in contrast to the high-energy waves typical of the unprotected, rocky coastline further north.

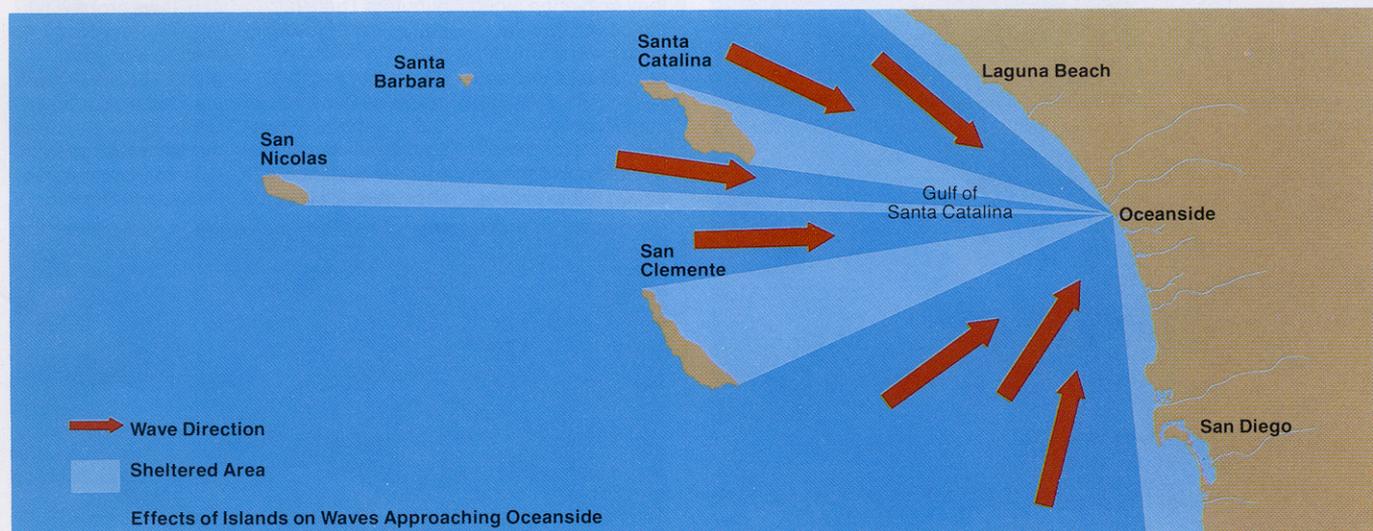
San Clemente Island, the largest of the Santa Catalina group, is one of the south-

ernmost islands. Located almost 75 miles offshore from the City of San Clemente, this island was part of the mainland before deformation of the earth's crust and a rise in sea level separated the island land masses from the continent. San Clemente features a rough, barren terrain and an

arid climate. At one time, the island was used for sheep ranching. Now the sheep are gone, as are thousands of wild goats recently removed by the Navy. Since World War II, San Clemente Island has been set aside as military property closed to the public. The Navy has an air-

field here and naval vessels use the island's southern portion as a target range. An Air Force radar station is also located on the island.

Other islands in the Santa Catalina group are popular Santa Catalina and uninhabited Santa Barbara and San Nicolas.



The hide trade here reached its peak between 1830 and 1840. Cow-hides from the large mission ranches were thrown from nearby cliffs to traders waiting below on the beach. The hides were then loaded on small boats and carried out to anchored ships. The rocky promontory from which the hides were thrown can be seen to the right as one looks out over the harbor.

Dana Point Harbor, located within Dana Cove, was completed by the U.S. Army Corps of Engineers in 1970. More than 250 acres of land were formed by the Corps in this harbor project that included the construction of breakwaters, entrance and interior channels, anchorage area, and turning basin. The construction of Dana Point Harbor, which provides an important link in the chain of small craft harbors

along the Pacific Coast, was coordinated with redevelopment and erosion control projects at Doheney State Beach. During excavation of the harbor, Corps engineers moved 3,000 cubic yards of rock to Doheney Beach to create an artificial surfing reef for recreational use and shoreline protection.

Marine life rapidly colonized the harbor because of environmental changes resulting from construction of the breakwaters and internal seawalls. A marine life refuge has been established adjacent to the harbor.

**3 Doheney State Beach**  
Travelling south on the Coast Highway from Dana Point Overlook, watch for a sign indicating Doheney State Beach. This popular beach is named for oil magnate E. L. Doheney, who originally developed the area and terraced the precipitous sea cliffs with ice plant and bougainvillea. The beach area offers camping, swimming, diving, fishing and picnic facilities. Surrounding lush vegetation includes pine, fir and eucalyptus trees.

One of the principal architects of the environment at Doheney State Beach has been San Juan Creek, which meets the ocean here. The creek serves as a major source of sand for beaches scattered along the next 40 miles of coastline. At Doheney, the creek forms a marshy delta at the beach's down-coast end. The marsh can be observed



*Palm tree typical of Southern California landscape*



*View of harbor from Dana Point Overlook*



*Breakwater constructed by Corps of Engineers*

#### **Spiny Lobster**

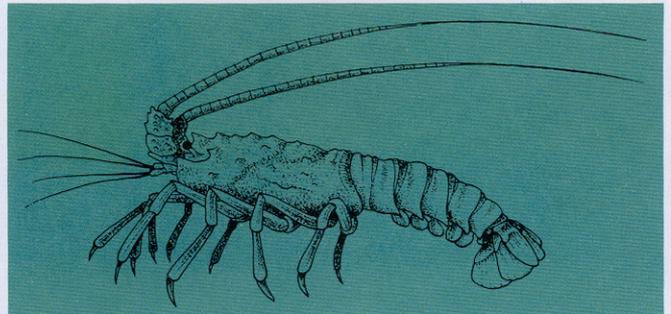
The spiny lobster is a native of the rocky habitats of Southern California. Called "the bug" by local fishermen, its long, slender front legs are unlike those of the large-clawed Maine lobster. Lobsters are opportunistic omnivores that eat both plants and animals. Most active at night they scavenge along the ocean floor for such invertebrates as mollusks and sea worms, small fish and occasional plants. Like most crustaceans, lobsters have a hard exoskeleton

that functions as protective armor. This exoskeleton molts or sheds, at various stages of growth.

When molting, the lobster's body exudes a substance that softens the shell. Then, by expanding its muscles, the lobster splits the shell and steps out — a process that takes about 15 minutes. The lobster's new covering is soft for a period of time. Until the shell hardens, the animal is an easy victim for its natural enemies, which include the sheephead fish and

the octopus. Injured appendages are regenerated and develop to almost normal size during subsequent molts.

California's spiny lobsters are in danger of extinction as a result of over-fishing. They are now protected by laws designed to conserve the species. In addition, laws prohibit taking females of less than 10.5 or more than 16 inches long. A maricultural, or sea-farming, industry for the spiny lobster is currently being established in California.



from a paved walkway and from the beach running along the shoreline.

Doheney Beach is formed from sediments carried by San Juan Creek during its annual rainy-season flooding period. During flooding, sediment is deposited in a delta-like fan at the creek's mouth. Following the flood season, waves push sediments back into the creek's mouth to form a closed lagoon. Since the amount of water trapped in the lagoon at Doheney is small, there is no exchange with the ocean during high tides. The lagoon usually opens to the ocean only during periods of extreme flooding when the sandy barrier is breached or swept away. The marsh is then completely inundated.

Doheney Marsh provides an excellent example of a dynamic ecological setting that ranges from a

flood plain to a relatively dry environment. During droughts, the marsh changes from a lushly vegetated wetland to an arid coastal environment. The dominant plant in this ever-changing environment is pickleweed, an herb with jointed stems and scale-like leaves. The marsh supports an estuarine population when sufficient water is available.

As a result of man's development activities, only about 125,000 acres of wetlands remain in California—a reduction of more than 50 percent since the turn of the century. More than 75 percent of Southern California's marshy expanses have been filled to provide additional space for homes and businesses. This trend, however, has been slowed in recent years through various regulatory and conservation measures.

Returning to the Coast Highway, continue south through San Clemente and follow the signs to Interstate 5. On the ocean side of the highway, at the San Diego County Line, a stand of tall palm trees marks the location of what was the Western White House during the Nixon administration. To the South, the highway crosses over San Mateo Creek, which flows into San Clemente State Beach at San Mateo Point. This creek is another source of sand which feeds downcoast beaches. At San Clemente Beach, a campground is nestled in tree-shaded grasslands overlooking the ocean. Footpaths lead down the bluffs from the camping area to the beaches.

Further downcoast is San Onofre State Beach, which can be reached by exiting at San Onofre and Basilone Road. San Onofre is an excel-



Mission San Juan Capistrano



Mission San Luis Rey

### The Missions

One of the West's greatest cultural heritages is California's Franciscan missions. Founded between 1769 and 1823, most of the state's 21 missions are located within a few miles of the ocean. Each is a day's journey apart on the El Camino Real.

The early missions were great socio-economic units that included *ranchos*, Indian villages, work-

shops, gardens and orchards. They often served as headquarters for a commodities trade between the padres and Yankee shippers. During the 1830's, the missions were secularized by a new sovereign, Mexico, and much of the land was distributed to settlers. As a result, the buildings were left to ruin. Deterioration continued until the end of the nineteenth century, when local residents began res-

toration and rebuilding.

Three missions are located along this section of the coast. Mission San Juan Capistrano can be reached by driving inland on Camino Capistrano just south of Dana Point Harbor. Partially destroyed by an earthquake in 1812, the mission is widely known for the swallows that have built their homes in the ruins. The birds fly away on St. John's

Day, October 23, and return to the mission each spring, on St. Joseph's Day, March 19. Only once have they been late.

Mission San Luis Rey de Francia is located five miles east of Oceanside on State Highway 76, inland

from Interstate 5. The mission's white bell-tower is a pleasing part of the landscape of this hilly valley. Founded in 1798, San Luis Rey was considered the most successful of the missions, with bountiful crops and great herds of livestock.

Mission San Diego de Alcala is located five miles east of Interstate 5 in Mission Valley, off Highway 8. The first European settlement in California, it was dedicated in 1769 by Father Junipero Serra, *padre-presidente* of the missions.



lent surfing beach that also offers surf fishing. A frequent catch is the California corbina, a common ocean-bottom habitant found near sandy beaches and shallow bays from Point Conception to Baja, California.

Continue south on Interstate 5. Military vehicles involved in training operations at the U.S. Marine Corps' Camp Pendleton can often be seen in this area. This large military base borders 18 miles of ocean front between the San Diego County line and the City of Oceanside. Camp Pendleton occupies the former site of *Rancho Santa Margarita y Las Flores*, once controlled by Mission San Luis Rey. In 1942, the Federal government purchased much of the *rancho* in order to establish today's military base.

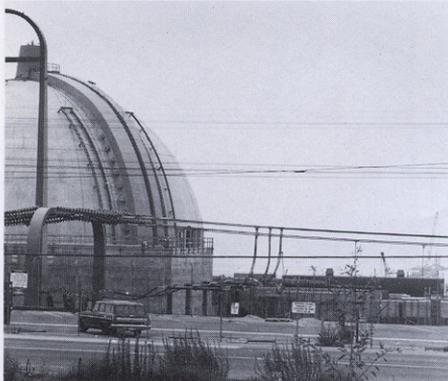
Just north of Oceanside near Camp Pendleton's southern boundary,

the Santa Margarita River empties into the ocean forming a beach and salt marsh during the rainy season. The marsh is a refuge for the endangered least tern, and harbors one of the bird's largest nesting sites. The short-legged least tern, closely related to the gull, is a graceful flier often seen diving dramatically into nearby waters.

San Diego County is marked geologically by a series of coastal hills that are visible as one proceeds south on the Coast Highway. A much larger range of coastal mountains lies inland.



*San Clemente State Beach as seen from Coast Highway*



*San Onofre Power Plant located at end of Basilone Road*



*Amphibious vehicle seen along drive through Camp Pendleton*



*Mouth of San Juan Creek*

## 4 Oceanside Harbor and Coastal Lagoons

To reach Oceanside Harbor, continue south through Camp Pendleton on Interstate 5 to Oceanside Harbor Drive. Picnic facilities, walkways, benches and fishing piers are available in the harbor area. Oceanside Harbor, which is used by small craft, was completed in 1963. It is immediately adjacent to the southern coastal boundary of Camp Pendleton and shares entrance jetties with the camp's Del Mar Boat Basin. This basin was built in World War II for emergency use and is now used exclusively as Camp Pendleton's harbor for amphibious exercises.

Sands from the Santa Margarita River, San Mateo Creek and other sources north of Oceanside are moved downcoast by waves coming from the



### Caution

In spite of the wondrous beauty and typically non-threatening appearance of the California Coast, exploration of cliffs, rocks and tide pools can be dangerous.

Remember to stay well back from cliff edges where softened soils, particularly during rainy periods, often slide eas-

ily. Rocks moistened by rain or surf can be slippery. Powerful, unexpected waves can quickly throw one off balance. Always watch for incoming tides and wear non-slip, protective footwear for rock climbing and tide pool exploration. Be aware of the dangers of wave backwash and rip currents.

north. As the sand moves into the harbor area, it enters what is called a "wave shadow," an area of low waves caused by the protection of the harbor's breakwater. These low waves do not have sufficient energy to carry sands away, making it necessary for the Corps of Engineers to dredge the harbor and bypass sand materials to depleted beaches downcoast.

The southern edge of Oceanside Harbor, where the San Luis Rey River enters the Pacific, marks the beginning of a cobbled beach that extends several miles to the south. Because of reduced river flows over many years, sand losses have exceeded sand accretion causing the beach to become increasingly narrow. The Oceanside area is relatively unprotected from storm waves because of the distance and wide spacing of off-

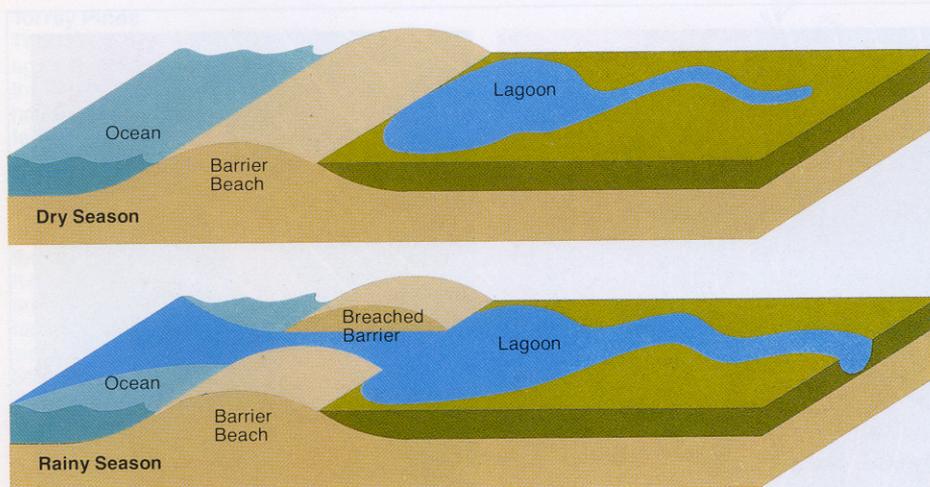
shore islands. The resulting high wave energy has contributed to the disappearance of what were once wide, sandy beaches.

To reach the San Luis Rey River mouth's cobbled beach, return to the Coast Highway, follow the Hill Street exit, turn right on Sixth Street and continue oceanward. Sixth Street leads to the beach, where palm trees, picnic facilities and a long fishing pier provide recreational opportunities. Occasionally, dolphins, taking advantage of excellent surfing waves, can be sighted.

Following the coastline south through Oceanside, turn right on Pacific from Sixth Street. Turn left on Eaton, then right on Hill. Along the shoreline portion of this route, high-energy waves crash against a "rip-rap" revetment made of rocks from inland

quarries to protect the shore from further erosion.

Buena Vista Lagoon, a valuable wildlife habitat, can be seen on both sides of Hill Street. The first of the major accessible coastal lagoons in San Diego County, Buena Vista covers approximately 140 acres and is a sanctuary for over 200 species of waterfowl. Agua Hedionda Lagoon, another coastal wetland, lies downcoast from the community of Carlsbad. About 90 acres of marshland at the inner end of the lagoon provide a habitat for such endangered species as the least tern, the California pelican and Belding's savannah sparrow. The remainder of the marsh has been dredged to provide a cooling water intake pond for a nearby power generating plant.



### Coastal Lagoons and Estuaries

Coastal lagoons are formed by barrier beaches which separate them from low-lying inland areas. Lagoons can be associated with both rivers and streams. Technically, a coastal lagoon is a body of water with a restricted connection to the ocean. An estuary is the lower course of a river, where fresh and salt water mix during

tidal ebbs and floods.

Lagoon waters can be fresh during rainy periods and exhibit varying degrees of salinity during times of high tide and minimal or nonexistent rainfall. Because lagoons are shallow, waters approximate air temperatures. For this reason, waters are typically colder than the ocean during winter and somewhat warmer in summer.

Coastal lagoons are transient geological features. Because they serve as sediment traps, they eventually become marshes. In some areas this filling process is accelerated by poor land management including land clearing, overgrazing, and fire damage. The disappearance of these valuable resources is a matter of significant concern because

many of the area's picturesque lagoons provide significant, virtually irreplaceable, wildlife habitats.

Estuaries typically involve a larger connection to the ocean and a greater amount of fresh water inflow. Estuaries can be renewed by high river flows which scour the old channels.



Cobbled beach south of Oceanside Pier



Gulls resting on river mouth sand spit

Travelling south from Agua Hedionda, steep cliffs and crashing waves can be observed downcoast. The area includes a number of campgrounds and beaches. Surf fishing is a popular sport. Common catches include perch, corbina, croaker and calico bass. The next major lagoon is Batequitos, the most lake-like of the lagoons along this part of the coast. Several species of shorebirds rest here, including the snowy plover, killdeer, American avocet and black-necked stilt. The lagoon also serves as a prime nesting site for the least tern.

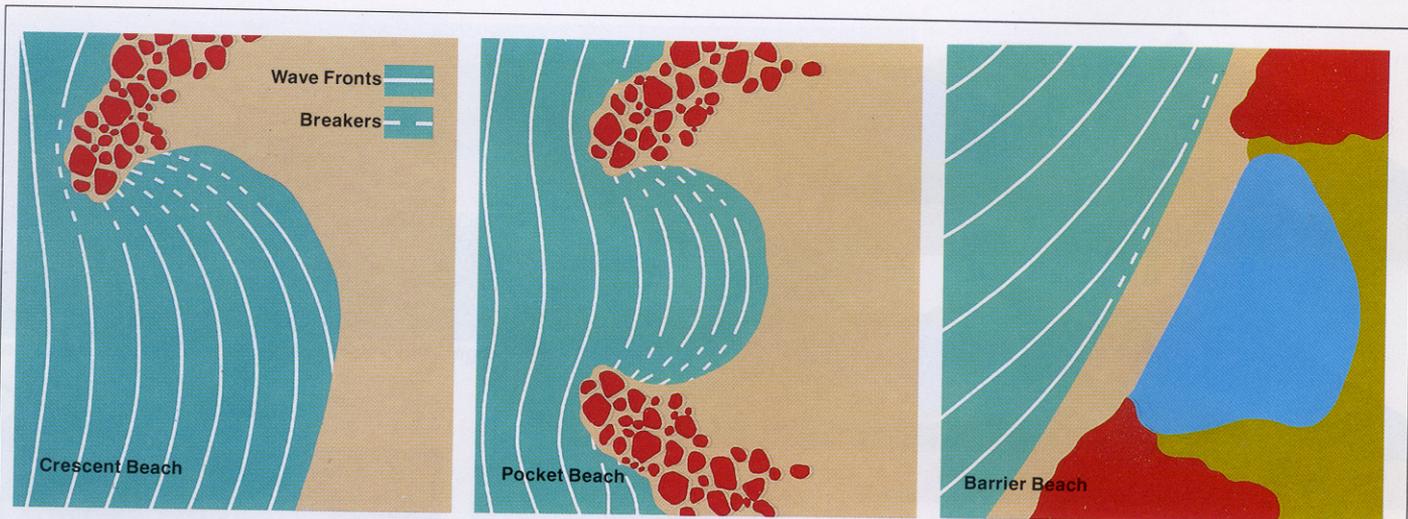
Flower and winter vegetable crops are grown in the area between Carlsbad and Encinitas. In Encinitas, a sign indicates Moonlight State Beach. The road winds to the beach through a broad valley carved through the cliffs

in a series of heavy storms that occurred in 1862. At that time, a temporary river cut through coastal cliffs and formed a large delta.

Immediately south of Cardiff-by-the-Sea is another coastal lagoon known as San Elijo. This undeveloped 500-acre marsh is located at the south end of Cardiff Beach State Park. San Elijo is a major refuge for wintering and migratory waterfowl. The popular Solano Beach surfing area is situated adjacent to Cardiff State Beach.

**5 Torrey Pines State Reserve**  
The San Dieguito River, which enters the sea at Del Mar, forms a natural coastal lagoon, similar to those immediately upcoast. This lagoon features a population of Pacific pond turtles, as well as sizable numbers of beautiful wading birds such as the great blue and black-crowned night herons, and great and snowy egrets. During summer months, thoroughbred horses gallop through the surf at the beach near the river's mouth warming up for the Del Mar races. At the southern end of the City of Del Mar is Torrey Pines State Beach, a barrier beach for the 312-acre Los Pensaquitos Lagoon. Los Pensaquitos hosts some 68 species of water-associated birds, including the endangered light-footed clapper rail.

Torrey Pines State Reserve, the location of one of the world's only two



### Beaches

Beaches serve as an area of dynamic interface between land and ocean. They are recognized as temporary features of the landscape. Beaches may increase in size, disappear, change in shape or change in composition — depending on sources of material and the dynamics of wave action, storms, winds

and currents. In winter, waves along the California coast are predominantly from the north. Thus, sand moves toward the south. In summer, along the south coast beaches, swells originating from the southwest reverse this trend, moving sands toward the north.

Three types of beaches are of particular significance. *Crescent* beach shapes result from the refraction and diffraction of waves downcoast on erosion-resistant rocky headlands. *Pocket* beaches usually exhibit a steep face and are small and roughly semicircular in formation. Protected by rocky headlands at

each end, such beaches are relatively stable and feature minor loss and gain of sand. West Coast *barrier* beaches are high energy wave-fronting beaches situated parallel to the coastline. This type of beach is generally associated with well established offshore bars and rip current patterns.

Southern California beaches serve not only as prime recreational sites, but also as protectors of the coast itself. They act as vital buffers against eroding wave action by absorbing wave energy on both offshore bars and the beach face. Conversely, solid rock shores without protective beaches are more easily de-

stroyed by the sea. The Corps of Engineers and its research arm, the Coastal Engineering Research Center, are actively involved in monitoring beach changes, in the interest of maintaining one of our most vital natural resources.

remaining stands of Torrey Pine, is a particularly fascinating and popular site. The intriguing gnarled Torrey Pine also grows on Santa Rosa Island, one of the northern Channel Islands.

Near the topmost mesa portion of the park, a sign marks North Drive/Guy Fleming Trail. This self-guided nature trail offers excellent vistas of the golden-hued rock outcroppings typical of the reserve. The smell of sage, pine and wildflowers permeates the air. Some 200 species of birds live here, including quail, scrub jays, brown towhees and the great horned owl. Brush rabbits and other small rodents are common sights, and a number of gray foxes, coyotes, mule deer and reptiles also make their homes here. At the top of the road is a visitor center where exhibits, films and slide shows are enjoyed by the public. Views

from a nearby 300-foot cliff are breathtaking, with lush vegetation spilling down the wind-slashed canyons.

People have inhabited this area for thousands of years. Within the last 1,500 years, the San Diegueno Indians arrived. They occupied not only the coastal area but also the mountains and deserts to the east. These hunter-gatherers and pottery makers were the first people to greet the early Spanish explorers.

After visiting Torrey Pines State Reserve, follow the Coast Highway southward along the top of the Torrey Pines cliffs. Approximately one-half mile south of the Torrey Pines Golf Course, follow Torrey Pines Road along the coast to a popular hang glider port. Here one can often observe glider pilots soar from the 200-foot bluff

riding the upwelling drafts of the westerly-blowing coastal winds.

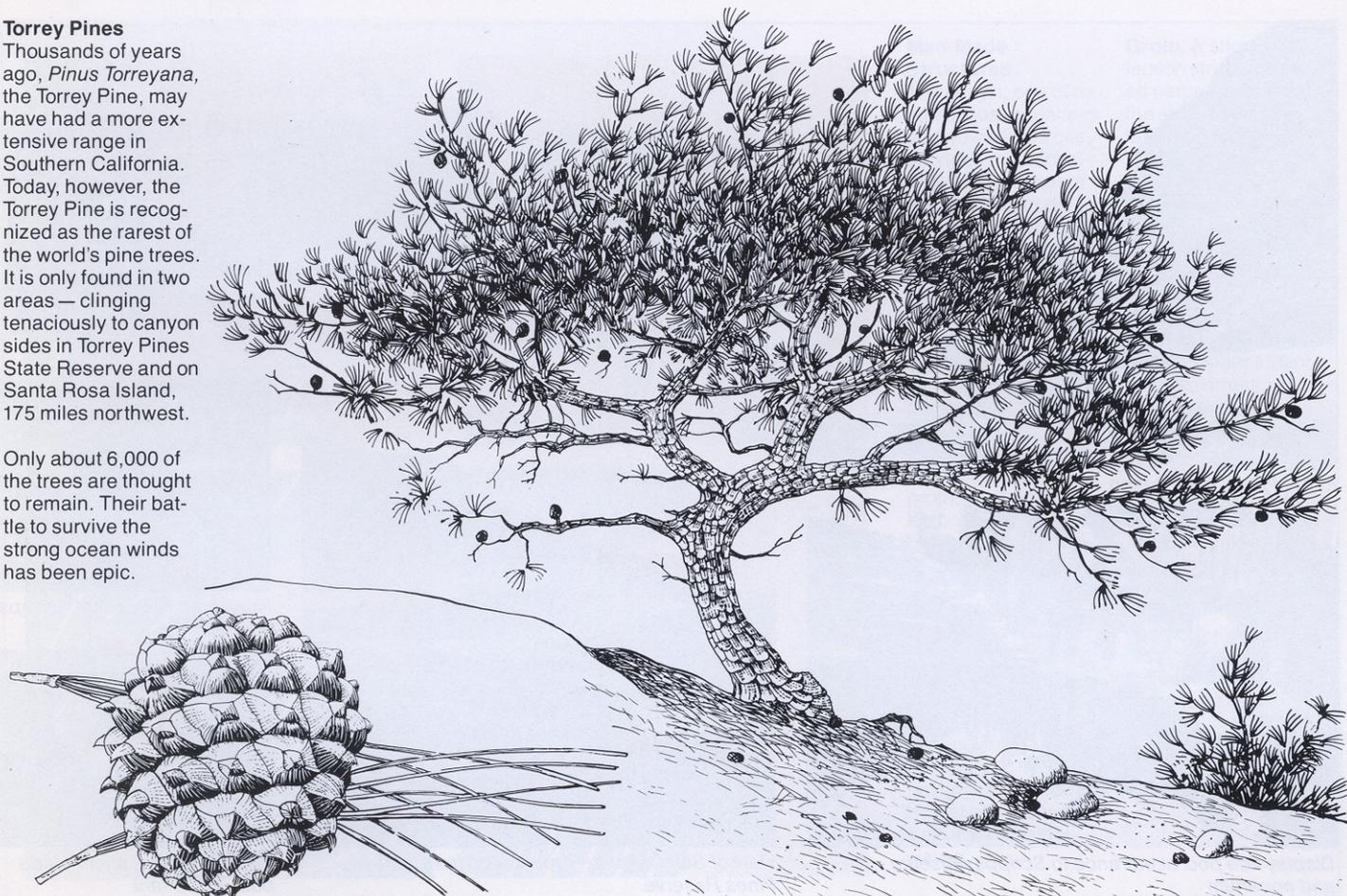


Rocky outcropping typical of Torrey Pines State Reserve

### Torrey Pines

Thousands of years ago, *Pinus Torreyana*, the Torrey Pine, may have had a more extensive range in Southern California. Today, however, the Torrey Pine is recognized as the rarest of the world's pine trees. It is only found in two areas — clinging tenaciously to canyon sides in Torrey Pines State Reserve and on Santa Rosa Island, 175 miles northwest.

Only about 6,000 of the trees are thought to remain. Their battle to survive the strong ocean winds has been epic.



## 6 Scripps Aquarium and Museum

The campus of the University of California at San Diego, the location of Scripps Institution of Oceanography, begins just past the hang glider port on Torrey Pines Road. A right turn at La Jolla Shores Drive, just opposite the entrance to the campus, leads to the Scripps facility, founded in 1892 by philanthropist E. W. Scripps and his sister, Ellen Browning Scripps. The Institution's world-famous aquarium, open to the public, is a particularly worthwhile point of interest. To reach the aquarium follow La Jolla Shores Drive along coastal bluffs and enjoy outstanding ocean views. A right turn at the bottom of the hill leads to the aquarium and an adjacent museum.

Near the aquarium's entrance is an artificial tide pool well-stocked

with plants, animals and fish. The pool's inhabitants include starfish, lobsters, barnacles, abalone, sea hare and octopi. The pool reproduces tidal action. Aquarium tanks approximate varying environments. One tank, for example, is unheated with circulating water approximating the temperature of nearby coastal waters. Another has refrigerated water suitable for marine life that inhabit deeper or northern ocean waters. There is also a heated tank for tropical species. The museum houses several models designed to demonstrate beach formation, wave propagation, and tide and current patterns. Live exhibits include sharks, moray eels and lumbering green sea turtles. Underwater television cameras record activities of the inhabitants of a nearby marine reserve.

A nearby public beach and rocky stretch of coastline to the north provide habitats for an abundance of marine life. Perhaps the most common fish seen along this portion of the shoreline is the sculpin, a fast-swimming tide pool fish. The sting ray, a flat fish with a long, whiplike tail, is occasionally encountered in the area's quiet waters at low tide. The ray's sharp, barbed spine has inflicted many a painful wound. This beach is also a favorite spawning ground for the grunion, a slender, silver-sided fish common to Southern California coastal waters.



*Torrey Pines State Beach*



*Scripps Pier*



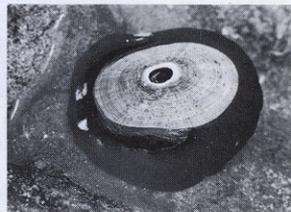
*Display tide pool at entrance to Scripps museum and aquarium*



*View of San Dieguito River lagoon from Torrey Pines Reserve*



*Rock crab resident of Scripps tide pool*



*Keyhole limpet, another tide pool inhabitant*

**7 La Jolla Cove**  
 The city of La Jolla's superlative natural setting has made it a favorite beach resort area since the 1860's. To reach La Jolla Cove, one of the city's most picturesque spots, proceed south from Scripps Institution on La Jolla Shores Boulevard. Turn right on Prospect Street at the first traffic light and follow a sign to La Jolla Cove.

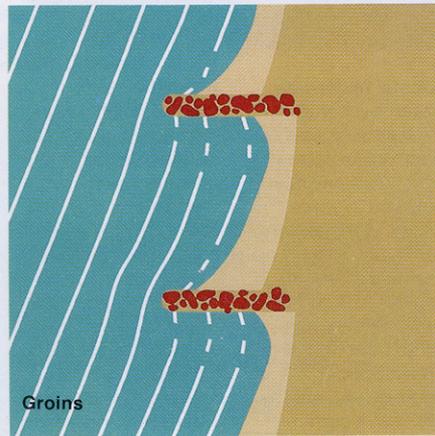
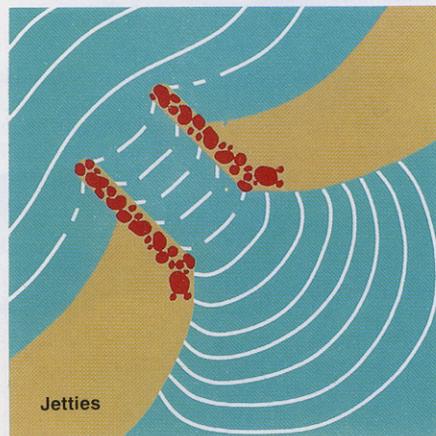
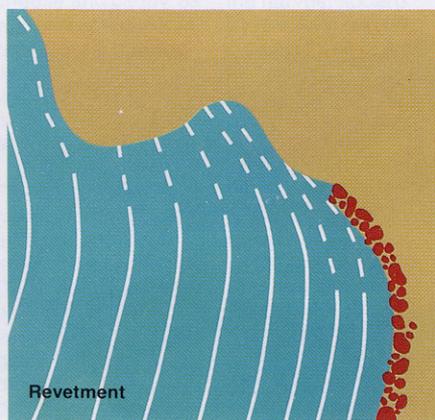
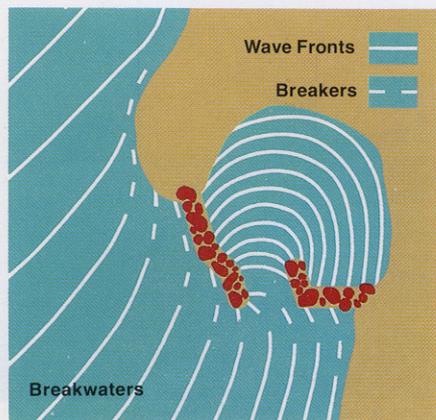
La Jolla Cove is a tiny pocket beach with rocky outcroppings and sea caves on either side. The cove affords an excellent upcoast view of the cliffs at Torrey Pines State Reserve. Located approximately midway between the cove and a pier extending from Scripps Institution is the Scripps/La Jolla Canyon, the southernmost of several submarine canyons found along the California coast. This canyon is believed to intercept the majority of sand

migrating to the south. The sand then moves seaward down the canyon into deeper waters. The impact of the canyon can be seen in the cove's sand-depleted, narrow beach. La Jolla Cove's calm, clear water provides an excellent site for snorkelers and beginning divers. From the cove, groups of fishing boats can often be seen fishing offshore in giant kelp beds.

Downcoast from La Jolla Cove is rocky La Jolla Point, which offers protection for small downcoast coves, popular sandy beaches and surfing areas. The area includes Boomer Beach, world famous for body surfing. During high wave conditions, this beach is suitable for experts only. Following Scenic Drive to Nautilus Street, turn right to reach Windandsea Beach, another popular surfing site. A reef only about 500 feet from shore results



*Upcoast vista from La Jolla Cove*



#### **Man-Made Structures**

The ocean, one of nature's most relentless and powerful forces, provides major challenges to engineers responsible for designing protection for shorelines and harbors. This short glossary identifies several structures designed to help control the awesome, and often destructive, forces of the sea.

**Breakwater.** A structure built to form or protect a shore area, harbor, anchorage or basin from undesirable wave energy.

**Bulkhead.** A structure built to maintain the shape of a shoreline.

**Jetty.** A structure extending seaward from the shore to keep navigation channels free of sediment and safe from breaking waves.

**Groin.** A shore protection structure erected perpendicular to the shoreline to retard the movement of sand along a beach.

**Baffle Breakwater.** A type of breakwater which allows some flow-through of water.

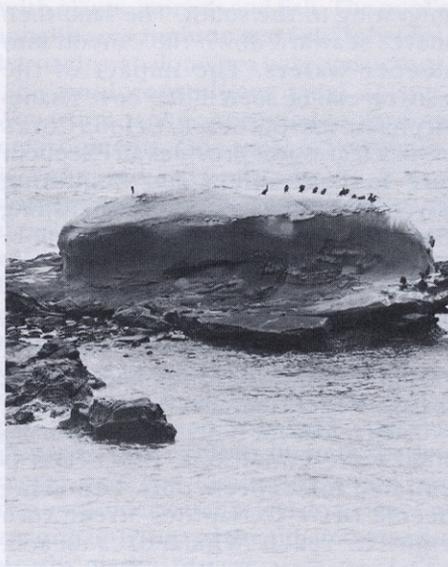
**Revetment.** A sloping facing built to protect an embankment or shore structure against erosion by wave action or currents.

**Training Wall.** A wall or jetty constructed to direct the flow of ocean current.

Common materials used in building such man-made structures include rock, concrete, timber and steel.

in high, challenging waves. A left turn at Nautilus Drive continues the Scenic Drive route and leads to the top of Mt. Soledad. This high vista point overlooks Torrey Pines Reserve to the north and Mission Bay to the south.

Proceeding south on La Jolla Boulevard, turn right on Bird Rock Avenue to reach the ocean. This rocky area between two sandy coves harbors a number of tide pools. At the base of the cliffs, a rip-rap revetment prevents further shoreline erosion. Bird Rock, located about 120 feet offshore, serves as a resting place for cormorants, gulls and occasional pelicans.

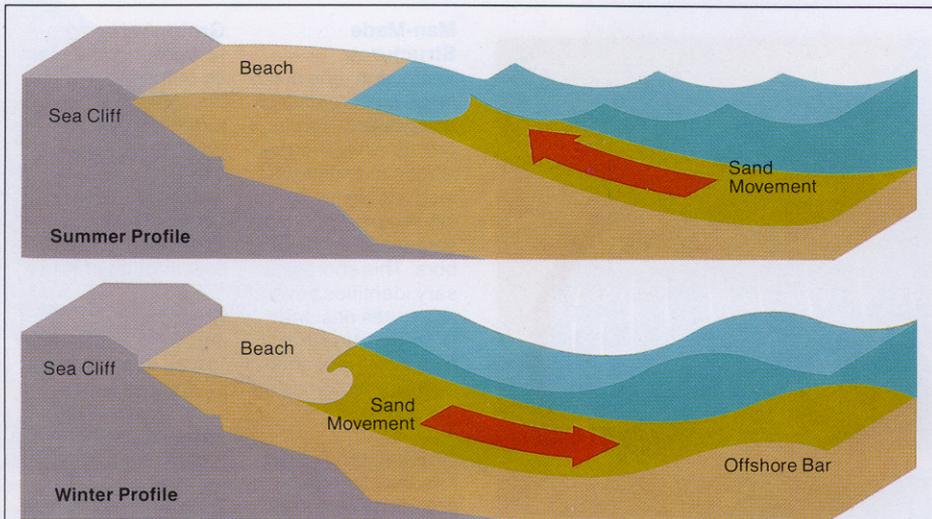


Bird Rock

**8 Mission Bay** Mission Bay, the site of California's first mission, can be reached by proceeding south on La Jolla Boulevard from Bird Rock. Upon reaching Mission Boulevard, continue south until the roadway ends, then turn left on West Mission Bay Drive.

Mission Bay Park, a 4,600-acre recreational development, was built on marshlands formed by the delta of the San Diego River. The park offers fine-grained, white sandy beaches, biking and jogging paths, and grassy parklike areas. Sea World, an oceanarium featuring performing whales and the world's largest collection of live sharks, is another popular attraction.

To reach the area where the Pacific Ocean enters Mission Bay, follow signs to the aquatic headquar-



#### Shoreline Erosion—Cliffs and Beaches

San Diego County tax records show many instances of property destruction resulting from shoreline erosion. In fact, since its founding in 1883, entire blocks of the City of Encinitas have been lost to the ocean. The rate of cliff retreat is dependent on several factors, including geological

formation, ground water seepage and exposure to wave energy. If seacliffs are composed of uniform material, waves tend to straighten the shoreline. If varying degrees of hardness exist, indentations will be cut into softer materials, leaving protruding points of less erosive substance.

Coastal bluffs with protective beaches are less susceptible to shoreline retreat than those directly exposed to wave forces. Beaches are, however, a fragile resource that can retreat up to a hundred feet in a few hours. Some beaches virtually disappear in a single storm, only to return at a significantly slower rate

when the storm ceases. Within historic times, some California beaches have retreated over 1,000 feet. Beach stability depends on wave energy and direction, sand supply and changes in sea level. Among the most stable beaches are those backed by dunes. The dunes act as natural reservoirs for sand replenishment.



One of two long jetties lining Mission Bay entrance channel



Sailboats at Mission Bay marina

ters. Jetties, built to stabilize the shoreline on either side of the entrance to the bay, are clearly visible here. Facing the ocean and looking out the harbor entrance, note a parallel channel to the left. This is the San Diego River flood control channel. During summer, a barrier beach generally forms at the river's mouth.

At one time, the San Diego River emptied into both Mission Bay and San Diego Bay to the south. Because of the river's size, and the protection provided by two rocky headlands adjacent to the mouth, an extensive delta and marsh area once existed here. A significant bird habitat remains today on the north side of Mission Bay.

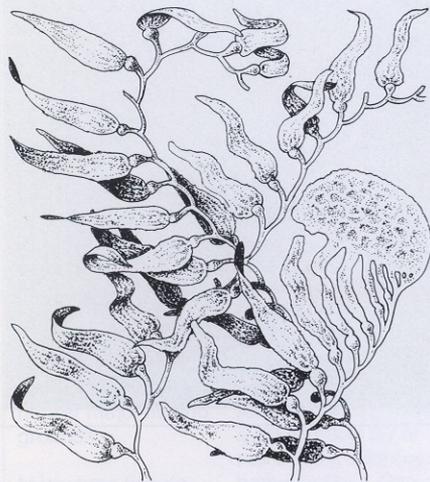
## 9 Point Loma and San Diego Bay

To reach historic Point Loma, the peninsula that forms the west side of San Diego Bay, continue south on La Jolla Boulevard to Sunset Cliffs Boulevard. Most of Point Loma peninsula is included in Fort Rosecrans Military Reservation. Near the peninsula's southern tip is the 81-acre Cabrillo National Monument, administered by the National Park Service. The monument commemorates Portuguese navigator Juan Rodriguez Cabrillo's landing at San Diego Bay in 1542.

From November through February, Cabrillo National Monument provides an excellent vantage point for watching the migration of the California gray whale. Here the whales cruise close to the coast each winter during their 6,000-mile journey from the

Bering Sea to their calving grounds in Scammon's Lagoon. A 1.5-mile Bayside Trail provides an enjoyable hour-long nature walk. The trail winds along the eastern slope of Point Loma and through an elfin forest of coastal chaparral. Along the way, great horned owls, red-tailed hawks, pelicans and great blue herons are frequently sighted.

The Cabrillo National Monument also offers an interesting tide pool area. A fascinating inhabitant is the slug-like sea hare. A large snail with an internal shell, the sea hare can weigh as much as 20 pounds. When disturbed, it exudes a dark purple ink. Other residents of the Cabrillo tide pools are the green sea anemone and the sand castle worm, which builds colonies of fragile, tube-shaped sand dwellings on the undersides of boulders. Common



cheese and candy, as well as for medical purposes. Kelp by-products are also used in the manufacture of paints, auto polishes and acoustical tiles.

Fleets of modern kelp harvesters are operated under regulations of the California Department of Fish and Game. The harvesters, analogous to giant seagoing lawnmowers, push large cutting racks through the kelp canopy, slicing the kelp and gathering it on conveyors that then carry

the harvest aboard. By law, kelp can be cut only three or four feet below the surface to allow for quick regeneration of the plants, which can grow as much as two feet per day. Regular harvesting clears the surface of the kelp forest so that necessary sunlight can reach developing plants and encourage new and heavier growth. Cut kelp is taken to processing plants located along the shores of San Diego Bay.

### Kelp Harvesting

Looking out to the open ocean from Point Loma, it is possible to see broad expanses of giant kelp beds. Forests of this large greenish-brown seaweed grow at depths of more than 100 feet, and serve as significant wildlife habitats. The luxurious growth attracts giant kelpfish, garibaldi, spiny lobster,

shrimp, clams, starfish, jellyfish, sea slugs, moray eels and many other marine creatures.

Giant kelp, or *Macrocystis pyrifera*, is the largest and fastest-growing marine plant in the world. Kelp is considered a health food and its products are used as jelling agents in canned meats, ice cream,



San Diego-based kelp harvesting ship



Vista from Point Loma



San Diego Bay Area

plants are green seaweed, dead man's fingers and feather boa kelp. Giant kelp beds lie offshore.

The old lighthouse at the tip of Point Loma was one of the first built along the West Coast. It was established in 1855, but ceased to be a working light after a new lighthouse was built nearer the water in 1891. Views of San Diego Bay are excellent from this vantage point.

San Diego Bay is one of the most accessible harbors on the Pacific Coast because of its limited tidal currents and natural protection from prevailing winds. The harbor, headquarters for the U.S. Navy's Pacific Fleet, is one of the busiest naval ports in the country. In addition, San Diego is home port for one of the largest tuna fishing fleets in the United States.

The Southeastern shore of San Diego Bay, near the boundaries of National City and Chula Vista, includes the extensive 480-acre Sweetwater-Paradise Marsh complex. Home of the endangered light-footed clapper rail, California least tern and California brown pelican, the marsh area also is a habitat for several potentially threatened plant species, including California cordgrass. The productive cordgrass grows three to four feet high and produces from five to ten times more nutrient material and oxygen per acre than wheat. It is also a major food source for the marsh's invertebrates.

**10 Coronado Peninsula**  
To reach the town of Coronado, follow the Coast Highway south through San Diego and take the Coronado Bridge exit to Highway 75. The graceful arch of the Coronado Bridge, constructed to allow naval vessels to pass easily underneath, connects the mainland with Coronado. Coronado is located on the end of a 10-mile-long sand spit. This peninsula, formed from sediments supplied by the delta at the mouth of the Tijuana River, slowly built up until it nearly reached Point Loma. The channel between the peninsula and Point Loma is maintained by strong currents that flow in and out of San Diego Bay.

After crossing the Coronado Bridge, proceed to downtown Coronado to reach the historic Hotel del

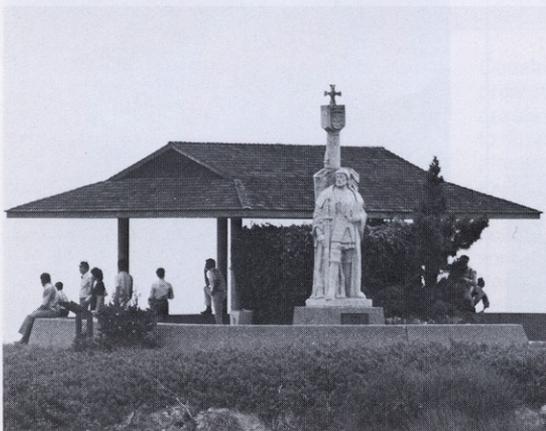
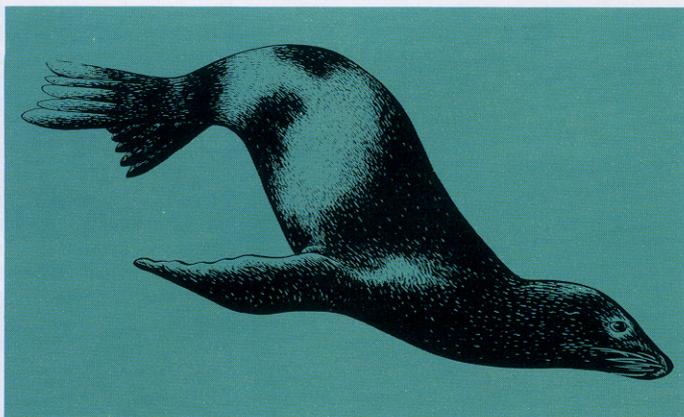
#### Sea Lions

##### Join the Navy

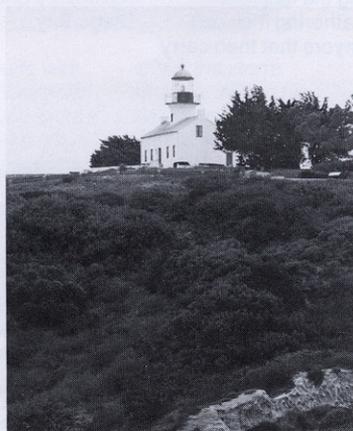
California sea lions lend their unique skills to Naval Special Warfare Group I, headquartered at Coronado's Naval Amphibious Base. Under the auspices of a project called "Quick Find," the sea lions' assignment is to recover experimental anti-submarine missiles in depths up to 800 feet.

The sea lion's participation eliminates the need for human divers handicapped by an inability to work underwater for long periods of time, poor visibility, swift currents, and a requirement for decompression chambers and other surface support. The California sea lion, familiar to most as the trained circus seal, is not limited by such restrictions.

Sea lions are found from Vancouver Island, British Columbia to the Tres Marias Islands off Mexico's coast. Males are dark brown and often weigh up to 1,800 pounds. Females are usually a lighter brown or tan and weigh up to 700 pounds. Primary sea lion breeding grounds are located on islands off the coasts of Southern California and Mexico.



*Cabrillo Monument and viewing area*



*Historic Point Loma Lighthouse*

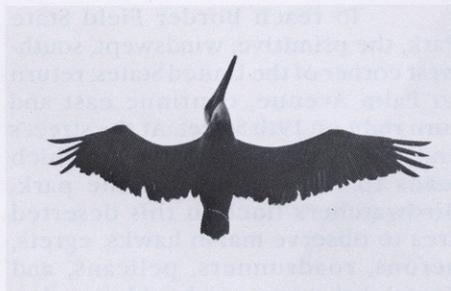


*Hotel del Coronado*

Coronado on Orange Avenue. This grand, rambling Victorian hotel, designed by Stanford White, was built in 1888 on land bought by two enterprising financiers for \$110. Thomas Edison himself supervised installation of the hotel's electric lighting. With its peaked roofs, cupolas, turrets, verandas and Victorian gingerbread, the Hotel del Coronado is an opulent reminder of an extravagant era.

Continue south to Silver Strand State Park, considered to be one of the country's finest day-use parks. Silver Strand Park stretches for 2.5 miles along the central portion of the Coronado Peninsula. The ocean side of the park is a wide, sandy beach with low dunes. On the bay side are shaded picnic areas, a boat launch for water skiers and a calm water swimming basin.

Along the roadway on the southern portion of the Coronado Peninsula are extensive salt marshes. Salt-tolerant plants such as glasswort, pickleweed, saltbush and Torrey sea blite dominate this area. These plants provide vital cover for nesting and resting birds. Near the end of the peninsula is a U.S. Naval Communications Station.



*California brown pelican in flight*

## 11 Imperial Beach and Tijuana Slough

Imperial Beach, a popular surfing beach, lies to the south of Silver Strand State Park at the end of Palm Avenue. The beach offers an excellent vantage point for viewing the Coronado Islands, located 12 miles south in Mexican waters. This grouping of three islands, the southernmost of the Channel Islands chain, was discovered by the Cabrillo expedition in 1542. Named for the Spanish explorer Coronado, the islands are barren and uninhabited.

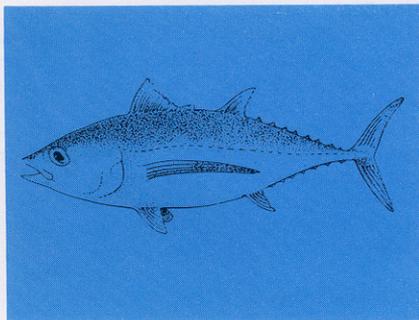
Upcoast is the long Imperial Beach Pier, which was severely damaged in heavy winter storms in 1980. Beyond the pier, several rock groins extend perpendicular to the shore. These structures were built many years ago by the Corps of Engineers in an

### Tuna Fishing

San Diego Harbor serves as headquarters for one of America's largest tuna fishing fleets. Tuna boats are typically from 200 to 300 feet in length and have facilities for freezing fish on board. The tuna are usually caught off the coasts of Mexico and Latin America. Catches are brought not only to San Diego, but also to facilities nearer major fishing grounds.

Many tuna fishing vessels use weighted purse seines. This type of net is dropped

over a school of tuna and closed by tightening a line, much as purse strings are tightened. To catch the smaller, highly prized albacore, the boats use from eight to fourteen fishing lines with feathered lures or live bait. The migrating albacore are more difficult to find and are common only in waters where the temperature averages 58-68° F. Albacore fishing usually takes place 50 or more miles offshore, between Baja, California and Vancouver Island, British Columbia.



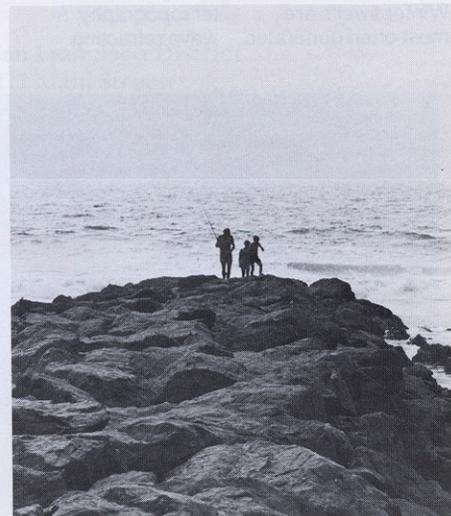
*Lush marshes at Tijuana Slough*



*Shoreline homes protected by revetment*



*Imperial Beach Pier as damaged by 1980 winter storms*



*Groin north of Imperial Beach pier*

attempt to stabilize the area's fragile shoreline. In 1977, the beach was replenished with more than one million cubic yards of sand brought from a dredging project in San Diego Bay. That effort, however, represented only a temporary solution to an ongoing erosion problem.

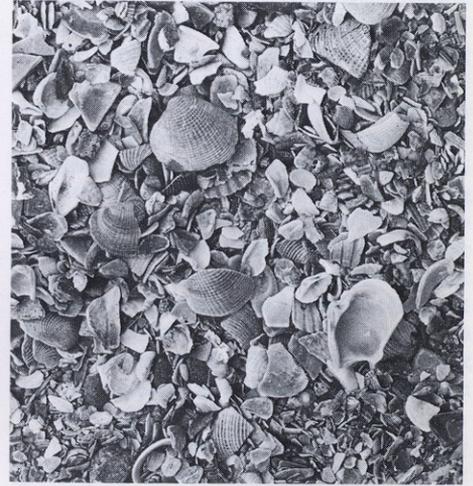
Because Point Loma provides a natural protection from storm waves coming from the northwest, Imperial Beach is one of the few locations in California where the dominant direction of sand movement is toward the north. The delta of the Tijuana River just north of the Mexican border, is the normal sand source for this beach. In recent years, however, the building of dams and other flood control devices along the river, and the lack of heavy rainfall needed to move massive amounts of sediment to the ocean, have

resulted in the depletion of the delta. This, in turn, has severely limited the amount of sand being transported to Imperial Beach.

South of Imperial Beach are the lushly vegetated Tijuana Slough which extend nearly to the Mexican border. These valuable marshes are habitats for several endangered species, including Belding's savannah sparrow.

To reach Border Field State Park, the primitive, windswept, southwest corner of the United States, return to Palm Avenue, continue east and turn right on 19th Street. At the street's end, turn right on Monument, which leads to the entrance of the park. Birdwatchers flock to this deserted area to observe marsh hawks, egrets, herons, roadrunners, pelicans, and occasional ospreys and golden eagles.

Snowy plover, killdeer, quail, meadow-larks, Belding sparrows and redwing blackbirds also nest here.



Shells along Imperial Beach shoreline

#### Surfing Waves

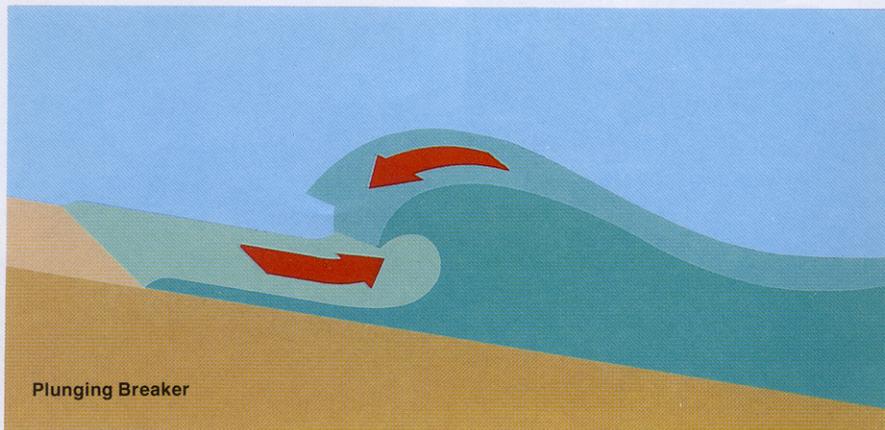
The most spectacular surfing waves along the Southern California coast occur in areas where the off-shore islands do not inhibit powerful storm swells from reaching the shore. Large waves arriving on the California coast in summer originate from storms in southern seas as far away as New Zealand. Winter swells are most often generated

by North Pacific storms.

To a skilled surfer, the best wave is what oceanographers call a "plunging breaker." This type of wave curls as it breaks, making possible a fast, thrilling ride. Plunging breakers are the result of clearly defined swells rolling ashore over sharp changes in underwater topography. A wave refracting

around irregular coastal features such as reefs allows a longer ride.

La Jolla Shores and Doheney State Beach are among the best areas for beginning surfers. For the more advanced, Imperial, Windandsea, San Onofre, Del Mar and Oceanside beaches are excellent choices.



Plunging Breaker



#### Belding's Savannah Sparrow

Belding's savannah sparrow is a member of the finch, sparrow, bunting and grosbeak family. This small brown-and-beige songbird is the only one of this family, however, that has adapted almost exclusively to life in the coastal salt marshes of Southern California.

In 1977 the savannah sparrow's total Cali-

fornia population was estimated at 1,600 pairs, more than half of which inhabit a limited number of sites, including the Tijuana Sloughs. The species has severely declined in numbers in recent years, chiefly as a result of the destruction of its habitat by urbanization. It is believed that the bird can survive only if its current home sites are protected.

# The Year of the Coast

In keeping with President Carter's declaration of 1980 as "The Year of the Coast," the U.S. Army Corps of Engineers has joined other public agencies and private organizations in focusing attention on the need to manage, preserve and protect our nation's coastal areas. To assist in this worthwhile objective, the U.S. Army Corps of Engineers will, throughout 1980 and 1981, publish a series of brochures highlighting key natural and manmade features of the California Coast. It is hoped that this series will both inform the public of coastal features and processes and assist in the development of a greater appreciation of the critical need to insure the protection and management of coastal resources.

For additional details on these brochures and other public information and education programs available from the Corps of Engineers, please contact the following Public Affairs Offices:

South Pacific Division  
630 Sansome Street  
San Francisco, CA 94111  
(415) 556-5630

San Francisco District  
211 Main Street  
San Francisco, CA 94105  
(415) 556-0594

Los Angeles District  
300 N. Los Angeles Street  
Los Angeles, CA 90012  
(213) 688-5320

Sacramento District  
650 Capitol Mall  
Sacramento, CA 95814  
(916) 440-2183

# The Year of the Coast

The year of the coast is a year of change and challenge. The coastal zone is a dynamic and complex environment, and the challenges it faces are many and varied. From sea level rise to coastal erosion, from ocean acidification to marine pollution, the coastal zone is under increasing pressure. The year of the coast is a year of action and innovation, as we seek to address these challenges and protect our coastal resources for the future.

erated in the deposition of the delta. This in turn has severely limited the amount of sand being transported to Imperial Beach.

Seven of Imperial Beach are the lushly vegetated riparian Slough which extend nearly to the Mexican

border, along with other riparian areas. The riparian areas are a vital part of the coastal ecosystem, providing habitat for a variety of plants and animals. The riparian areas are also a source of sediment, which is transported to the beach.

