Many people still believe that the culprits of polluted water dwell in the corporate world. But today there is a growing recognition that pollution comes from many diverse and scattered sources. In fact, the cumulative activities of average citizens can generate a large amount of pollution.

Because clean water issues involve everyone—corporations, urban dwellers, and rural residents—we all need to work together to protect our coastal waters. In regions such as the Chesapeake Bay, the Great Lakes, and the Florida Keys, water quality has reached crisis conditions, with expensive cleanup efforts underway. In contrast, the generally good water quality of the Monterey Bay National Marine Sanctuary (MBNMS) gives its managers and citizens the opportunity to protect and enhance the region’s marine environment, rather than having to clean up a mess down the road.

What is this Citizen’s Guide?

This is the first in a series of Citizen’s Guides designed to help you understand more about the importance of clean water, and the ways in which our everyday lives affect the quality of water—and therefore the quality of life—on the Central Coast. These Guides will also provide examples of ways in which you can get involved in helping to protect the beautiful waters of California’s Central Coast. This series is produced by the Water Quality Protection Program (WQPP) for the Monterey Bay National Marine Sanctuary. (For more information on the WQPP, please see page 8.)
A Place Worth Protecting:
The Monterey Bay National Marine Sanctuary

It is 6:00 a.m. and first light is just starting to break through a towering kelp forest in Carmel Bay. In the distance, a black oystercatcher lifts its orange chiseled bill to the faint blue sky and cries out, signaling the start of another day along the shoreline of our nation's largest Marine Sanctuary. Further offshore, a 100-ton blue whale breaks the surface, sending a monstrous blow twenty-seven feet into the air. Within just a few seconds, the whale has disappeared below the surface to feed on a swarm of krill.

So begins another day in the Monterey Bay National Marine Sanctuary. The high productivity of offshore waters, fed by seasonal upwelling, makes this area an immensely rich feeding ground for thousands of birds, fish, and invertebrate species. Established in 1992, the Sanctuary extends from Marin County southward to Cambria in San Luis Obispo County. At the northern end of the Sanctuary, red cliffs plummet towards the ocean, meeting energetic waves from the sea. Along Rodeo Lagoon, kids look in amazement as great egrets lift their bodies from the lagoon and fly along the water's edge. Off the coast of Moss Landing sits the entrance to one of the largest submarine canyons in North America. Further south, the wave-carved cliffs of the Big Sur Coast attract thousands of visitors each year. Above it all, sea birds, some of which spend their entire lives at sea, skim across windblown white caps in search of their next meal.

The boundaries of the Monterey Bay National Marine Sanctuary extend to an average of thirty-five miles offshore, for a total of over 5,300 square miles of protected marine waters. Within these boundaries lies North America's most diverse collection of marine habitats—the deep sea, open ocean, kelp forests, sandy beaches, rocky seashore, estuaries, and sloughs. These habitats support a wide variety of marine life, including more than 345 species of fish, 94 species of seabirds, 26 species of marine mammals, 450 species of algae, and one of the world's most diverse invertebrate populations. Amid the Sanctuary's inhabitants are 25 federal and state-listed rare or endangered species.

The Sanctuary at a Glance

Established in September 1992, the Monterey Bay National Marine Sanctuary:
- encompasses 5,312 square miles—about the size of Connecticut
- runs along 350 miles of California's coast
- extends from the high tide mark to as far as 53 miles offshore
- is the largest U.S. Marine Sanctuary and the second-largest marine protected area in the world (after the Great Barrier Reef in Australia)

The Sanctuary features:
- the 10,000-foot deep Monterey submarine canyon
- 25 federal and state listed rare or endangered species
- the largest expanse of kelp forests in the nation
- more than 345 species of fish; 94 species of seabirds; 26 species of marine mammals; 450 species of algae

Glossary

Anadromous fish: fishes that spend most of their life in salt water, but migrate to fresh water to spawn
Basin size: square acreage of an area available for fresh or salt water mixing
Invertebrate: any organism lacking a backbone, such as a crab or jellyfish
Pollutant: a harmful chemical or other waste material generated by human activities. Water-polluting substances come from a variety of sources including industrial plants, agricultural operations, and urbanized areas.
Phytoplankton: plant-like organism, capable of photosynthesis
Runoff: water from irrigation or rain that flows into streams, creeks, or the ocean
Sediment: any material consisting of clay, mud, sand, silt, or any other natural particle that settles on the bottom of waterways
Species: a distinctive group of organisms that can successfully interbreed and produce viable offspring
Symbiotic: characterizing a link between two organisms that is mutually beneficial to both
Tidal mixing: the influence of incoming salt water on out-flowing fresh water in an estuarine system
Sanctuary Habitats

The Monterey Bay Sanctuary boasts a bountiful array of marine habitats. These provide a home to a diverse collection of marine life and the stage for recreation, education, and scientific study for Central Coast residents.

While many people think of the ocean as one uniform environment, the reality is that most marine organisms live their entire lives in distinct niches, or habitats. Just as human society partitions itself into cities and neighborhoods, so does marine life. While our cities are obviously not entirely separate entities—there is interchange and influence among them—individual cities do have unique attributes, such as climate and geography. So it is with marine habitats: while these environments are connected in the overall web of ocean life, each has distinct characteristics and inhabitants. The following paragraphs provide brief descriptions of some of the habitats found within the boundaries of the Monterey Bay National Marine Sanctuary.

Rocky Sea Shore

The rocky sea shore, or “inter-tidal zone,” is one of the most visited and scientifically studied marine habitats in the world. Thousands of people explore the hidden cracks and crevices of the rocky shore each year. This area—with its crabs, starfish, and barnacles—is second only to coral reefs in its abundance, diversity, and beauty of living organisms.

Rising and falling tides each day make the residents of the rocky seashore vulnerable to crashing waves, high winds, and terrestrial predators. Organisms living here have adapted to this environment with special modifications to their bodies like suction-cup feet (to hold on tight), hard shells (to protect them from waves during low tide periods), and flexible arms (to help repel predators).

Sandy Beaches

To the casual observer, the sandy beach is nothing more than a barren wasteland, an area to throw down a beach blanket or eat a picnic lunch. But the beautiful beaches in the MBNMS and other parts of California support a vast array of organisms living among the grains of sand. The influences of wind and tides make this an ever-changing environment in which very few plants exist; but many animals have adapted to this erratic, sandy habitat. Clams, worms, birds, and crabs are examples of the creatures that make sandy beaches their home.

Some organisms filter food from the water, others lead a predatory existence, and still others act as scavengers, collecting food that ends up in or on top of the sand. Many of the animals that dwell beneath the sand can obtain oxygen and food from the water above their sandy cover.

Estuaries and Sloughs

Estuaries are semi-enclosed coastal bodies of water that have a free connection to the open ocean. Here, sea water is diluted with fresh water derived from land-based drainages such as rivers and streams. Water movement within an estuary depends on several factors, including volume of incoming fresh water, tidal mixing, and basin size.

Sloughs, on the other hand, tend to be more seasonal, as a sand bar may develop at their entrance and cut off the ocean’s influence during the summer months. Sloughs may be fresh water or salt water, and can be connected directly to the ocean or completely detached. Sloughs connected directly to the ocean, such as the Sanctuary’s Elk Horn Slough, offer protected and calm places for animals to forage and reproduce. The waters of Elk Horn Slough serve as nursery grounds for many fish species, some commercially valuable. Anchovies, jacksmelt, herring, surf perch, sculpins, rockfishes, English sole, and halibut occur in the Slough as larvae or juveniles. In the spring months, leopard sharks and bat rays travel to Elk Horn Slough to give birth. During the fall and winter, flocks of shorebirds interrupt their annual migration to rest along the Slough’s muddy banks.

continued on page 6
Kelp Forests
Like trees in a forest, giant kelp plants tower above the sea floor, swaying gently with the beat of the sea. Here, animals take advantage of the forest's shelter. Everything from the tiniest brittle star to a gray whale can find food or shelter among the blades or fronds of the giant kelp forest.

Growing at nearly two feet per day, giant kelp is the fastest growing marine plant in the world. Its holdfast, which anchors the plant to the sea floor, provides shelter for hundreds of invertebrate and juvenile fish species.

The Sanctuary’s kelp forests are home to many plant and animal species. Almost the entire population of the endangered southern sea otter lives within the kelp beds of the Sanctuary. Sea otters and kelp have a symbiotic relationship: the kelp provides otters with protection and food, while otters control the sea urchin population which grazes heavily upon the kelp.

Open Ocean
In the open ocean daily cycles fluctuate little and there are no hard surfaces on which to attach. Here, in this life without boundaries, organisms swim, float, and move with the pulse of the ocean. Animals living in this environment often take on gigantic proportions, such as the blue whale and giant squid. The open ocean—also known as the pelagic environment—contains the largest percentage of our planet’s plankton stock. Phytoplankton, a single cell plant-like organism, produces roughly fifty to eighty percent of all oxygen found on earth.

Deep Sea
Directly off the coast of Moss Landing lies the entrance to the Monterey submarine canyon—one of the largest submarine canyons in North America. Here, a variety of mysterious creatures live in a cold, dark world visited only by deep-diving marine mammals and man-made devices. Much of our planet’s deep sea environment remains yet undiscovered. However, in Monterey Bay, we are fortunate to have access to this mysterious realm just offshore.

At Moss Landing, the canyon slopes downward from sixty feet and extends some sixty miles offshore to depths of 12,000 feet. This close proximity allows researchers to study deep sea marine life close to shore where laboratory and resource facilities are readily available. Many unusual creatures make the deep sea their home; for example, the angler fish produces its own light in the form of a lure at the end of its spine. This fish is not alone in creating its own light; most animals in deep sea environments have this capability, and may use the light to see or to communicate.

Human Impacts...
This area’s relatively clean water played an important role in Sanctuary designation. However, increasing coastal urbanization brings potential threats to water quality. Our region’s expanding human population is a direct result of the attractions of coastal environments.

MBNMS provides local residents and visitors with a wide variety of resources. The Sanctuary is easily accessible and offers many recreational opportunities such as surfing, kayaking, sailing, windsurfing, SCUBA diving, and fishing. The Central Coast attracts thousands of visitors, who contribute over $2 billion each year to the area. Coastal tourism, agriculture, and commercial fisheries for salmon, rockfish, squid, and anchovy are all pillars of the region’s economy. In addition, the rich biodiversity and close proximity to the deep sea provide unparalleled research opportunities for approximately twenty marine research facilities and agencies.

Central Coast residents know that this region holds valuable marine resources. They also recognize the stresses being placed on those resources. Their efforts to keep our waters clean continue beyond the National Marine Sanctuary designation of our coastal waters. The Sanctuary acts as a catalyst to bring together these citizens, agencies, and businesses to work toward the protection and enhancement of our coastal environment. Through an interagency effort, MBNMS encourages uses and activities that protect the marine environment, with heavy emphasis on research and education in order to promote awareness and stewardship of Sanctuary waters.
Coastal Links

So, what do these ocean habitats have to do with the land—and with us, as land-dwellers? The connection between land and sea can be hard to visualize. To many people, terrestrial and marine environments seem as different as earth and another planet.

However, the coastal zone and the marine environment are closely related, and our activities on land influence the Sanctuary—and its habitats—in many important ways. The many habitats described above are all fragile ecosystems. The plants and animals found in kelp forests, the open ocean, sandy beaches, and all the other marine environments can be negatively impacted by pollutants from our everyday activities.

These pollutants, whether generated on land or along the shore, drain into Sanctuary waters, and can degrade water quality here and in the rivers and wetlands that sustain many Sanctuary species. Accordingly, effective water quality management extends beyond the ocean, up into the mountains and valleys where rainfall and irrigation water begins its journey down through streams, rivers, and wetlands out to the ocean.

What is a watershed?

If you live on land, you live in a watershed. Your watershed is a geographic area where water from streams, rivers, neighborhoods, and agricultural areas carries sediments and dissolved materials to a common outlet such as a stream, estuary, or the ocean. Each watershed has its own unique set of water quality issues defined by features such as its size, boundaries, terrain, soil, uses, and social trends such as the local economy and employment.

A healthy watershed is one that is in harmony with the needs of its people, land, and natural resources. Healthy watersheds are vital for a healthy environment and economy. They act as natural filtering systems for pollutants; support habitat, migration routes and spawning for steelhead and salmon; and provide drinking and irrigation water for urban and rural residents.

Joined together, coastal lands and watersheds where rainfall and irrigation water runs downhill to streams, rivers, and wetlands, ultimately out into the Sanctuary. Eleven major watershed areas drain to the Monterey Bay Sanctuary. These include the relatively pristine forested watersheds of Big Sur, lightly urbanized watersheds such as Carmel Valley and the San Lorenzo River; densely populated cities such as Santa Cruz, Salinas, and the Monterey Peninsula; and heavily farmed regions such as the Pajaro Valley, Elkhorn Slough, Salinas Valley, and the San Mateo coast.

When the watersheds that drain into Central Coast waters become polluted by our activities—sediment from roads and construction, oils from motor vehicle use, and pesticides and nutrients from urban lawns and agriculture fields—the watersheds’ wildlife and the Sanctuary’s resources can be affected. For example, sedimentation clogs streams, covers salmon spawning grounds, and can literally choke fish by clogging their gills. Sediment also reduces sunlight needed by tiny aquatic plants, decreasing the food supply for animals, and also harbors pollutants such as metals, pesticides, and nutrients. In addition to runoff from urban and agricultural activities, marinas and boating practices can generate pollutants such as oils and toxic metals.
Land-Sea Interface

Lands that are transitional areas between terrestrial and aquatic systems are extremely important. Habitats that drain into the Sanctuary—such as river mouths, streams, creeks, and mud flats—offer food, protection, and breeding grounds to countless species of plants and animals. More than fifty rivers drain into the Monterey Bay Sanctuary. These serve as migratory routes for endangered anadromous fish species, such as steelhead and salmon. The importance of this marine-land interface is obvious when one considers the potential impact land-based activities such as industry, agriculture, and urban runoff can have on marine habitats.

Coastlines

Coastal marshes, rocky shorelines, and sand dunes serve to protect the coastline from erosion in addition to offering food, resting areas, and breeding grounds to seabirds and marine mammals. Birds such as the brown pelican and cormorant hunt at sea, but rest and sleep on shorelines. Cormorants are often seen resting on cliffs or rocks, wings spread to dry their feathers. Marine mammals such as harbor seals “haul-out” on land to rest and to give birth.

Wetlands

Once one of the most productive areas on the continent, coastal wetlands have changed dramatically since the Spanish first arrived in the late 1700s. Today, most of California’s marshes, which once could be found up and down the coast, are gone—lost to housing, airports, business developments, and ports. In addition, much of the fresh water that once flowed into our estuaries has been lost or re-routed. Fortunately, these wetlands—once considered mosquito-infested wastelands—are now receiving more protection.

Wetlands, with their land/water links, provide critical food and habitat for fish and wildlife. Many fish and shellfish rely on tidal wetlands at some point in their life cycle. Tidal wetlands also calm wave action and prevent shoreline erosion. Non-tidal wetlands act as a natural filtering system, providing a buffer to watersheds by retaining stormwater runoff and capturing pollutants such as sediments, nutrients, and toxins, all of which pose threats to the Sanctuary’s health.

Rivers

Anadromous fishes such as steelhead trout and salmon spend most of their lives in Sanctuary waters. However, during the fall, fishes such as salmon migrate to freshwater rivers and streams to spawn. Swimming upstream, they reach their original place of birth, hollow out nest depressions in the river bed, then lay and cover their eggs with layers of gravel. The spawning salmon die shortly after, often just a few feet from their original birthplace. As spring approaches, the young salmon hatch and remain in the rivers and streams for up to two years before traveling downstream into Sanctuary waters.

...And Related Water Quality Issues

Urban runoff, marinas and boating practices, agricultural runoff, wetlands and riparian degradation, and point source pollution all stem from human activities and all impact the Sanctuary and its watersheds. For example, we will see in the following sections that the bioaccumulation of toxins in shellfish, birds and marine mammals; declining fish populations; alteration of our wetland areas; and limitations on human recreation such as swimming or surfing in contaminated areas are all results of human activities in the coastal zone.

Everyone who lives in or visits the Monterey Bay area has an important stake in these issues. We all want the benefits of a clean environment, and in MBNMS (and everywhere), our environment depends on clean water. The more people who understand their connection to our ecosystems and change their behaviors accordingly, the better off we—and the Sanctuary’s waters—will be.

Sources of pollution

When the Water Quality Protection Program (WQPP) was established, regional water quality experts identified existing problems in the Sanctuary and its watersheds, and their five main sources. Key problems include sedimentation; toxic pollutants in sediments, fish, and shellfish; high fecal coliform levels; fish population declines; low flows in rivers and streams; wetlands alteration; and habitat degradation. The sources of these problems are diverse, and include urban runoff; marinas and boating activities; agricultural runoff; point source pollution; and wetland/riparian degradation. The following paragraphs briefly introduce these topics. These sources of pollution, and the plans to address them, will be described more fully in subsequent Citizen’s Guides.
Urban Runoff

From our cities and towns, storm drains funnel runoff directly into Sanctuary waters. Paved surfaces and rooftops make forty to ninety percent of an urban area impervious. Rainfall collects on these hard surfaces and flushes many kinds of materials accumulated on the ground during dry weather—oil, grease, coolants, metals, garden fertilizers, pesticides, pet droppings, and litter. This polluted stormwater doesn’t pass through a treatment facility; it travels directly through storm drains to local rivers and streams, which carry these pollutants into the Sanctuary.

Point Sources

In addition to the “nonpoint” sources of pollution mentioned above, impacts to the Sanctuary’s water quality originate from “point” sources as well. Point sources may include outfalls from wastewater treatment plants, power plants, and coastal-dependent industries, as well as offshore oil spills. Many of these point sources have shown improvements over the past twenty years, but they still remain a concern.

Agricultural Runoff

Runoff from agriculture fields often carries sediment, pesticides, and nutrients into rivers, wetlands, and Sanctuary waters. Some of the chemicals found in this water break down or are neutralized before reaching streams and rivers. However, others are not fully degraded and remain active in sufficient concentrations to threaten aquatic life. Many organisms are very sensitive to pesticides, and even small amounts of agricultural chemicals can result in failures in reproduction and the ability to feed. Additionally, activities such as poor grazing practices and poor soil management aggravate erosion problems, which increases the runoff that contains sediments, pesticides and fertilizers.

Marinas and Boating

Marinas and boating activities generate pollutants that drain into Sanctuary harbors. While individual boaters and marinas usually only release small amounts of pollutants, when multiplied they can cause distinct water quality problems in coastal waters. These pollution problems fall under four general categories: toxics from anti-fouling paints, oil and gasoline from motor operation and maintenance, solid waste and debris, and bacteria and nutrients from boat sewage.

Water Quality Impacts

Industrial

Urban

Boating & Marinas

Agricultural

Wetlands/Riparian Management

Finally, the management of our freshwater resources, wetlands, and riparian areas can also contribute to the Sanctuary’s water quality problems. Heavy use of fresh water by cities and agriculture has left many rivers that feed the Sanctuary with greatly reduced flows. Dry creek beds are left behind, making travel to upstream spawning areas nearly impossible for anadromous fishes such as steelhead and salmon. In addition, reduced water flows cause the trees, shrubs, and plants lining rivers to die off, leading to even greater sedimentation. Shrinking of wetlands and riparian areas also reduces their natural ability to filter pollutants.
Protecting The Sanctuary:
The Water Quality Protection Program (WQPP)

The WQPP is a coalition of twenty-seven federal, state, and local agencies, public groups, representatives of the agricultural and boating communities, and businesses working to develop and carry out a long-term, proactive water quality management plan for the Sanctuary region. The program’s goals are to address existing water quality concerns and to prevent the kinds of expensive water pollution crises that have occurred elsewhere in the country.

Local residents have been involved in the WQPP from the beginning, and their contributions have shaped today’s program. The program’s workshops and Action Plans emphasize communication, partnerships, and watershed stewardship, rather than using a traditional regulatory approach. This means that businesses, landowners, and the public are closely involved in the development of plans and their implementation.

As part of the MBNMS designation in 1992, a Memorandum of Agreement to develop the WQPP was signed by federal, state, and local agencies. Since the Monterey Bay region has over 100 existing projects that deal with some aspect of water quality in the Sanctuary and its watersheds, the WQPP is developing ways to coordinate these agencies and programs, direct them to Sanctuary problems, address gaps and redundancies, and work together more effectively.

WQPP Milestones

- Memorandum of Agreement to develop the WQPP signed by federal, state, and local agencies at Sanctuary designation
- Establishment of committees made up of federal, state, and local agencies and public and private organizations
- Identification and evaluation of over 100 existing management and monitoring programs
- Establishment of watershed-based education program
- Development of consensus among diverse parties throughout watersheds
- Establishment of Action Plans for urban runoff; regional monitoring, data access, and interagency coordination; marinas and boating; agriculture; wetland/riparian issues; and point source pollution
- Initiation of model pollution control program for small cities
- Development of pollution control measures and programs for marinas

Where Do We Go From Here?
What YOU Can Do To Help Keep Sanctuary Waters Clean

The WQPP offers us the chance to enhance stewardship and form partnerships by pooling resources to address problems, and to prevent crisis conditions that other regions face. Achieving long-term protection of the Sanctuary and its watersheds depends heavily on the involvement and commitment of this region’s government agencies, businesses, landowners, teachers, students, scientists, and environmental groups. In this respect, public education and outreach play significant roles in spreading a sense of community stewardship towards the Sanctuary and its watersheds.

Everyone can participate in the process of improving water quality. Wherever you live, your daily activities ultimately affect the Sanctuary, and all water sources around you. Here are some things you can do to minimize the flow of harmful elements into the Sanctuary:

TAKE used motor oil to a certified recycling station or hazardous waste site

CHECK your car regularly for leaking oil or antifreeze

RINSE paint brushes from water-based latex paint in the sink; take unused paint supplies to a hazardous waste facility

USE garden pesticides and fertilizers sparingly; if possible, use non-toxic alternatives

EDUCATE yourself and others about water resources in this area, and your local watersheds

JOIN a volunteer group that cares for your local river, stream or beach

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