INTRODUCED SPECIES
Action Plan Summary

MONTEREY BAY NATIONAL MARINE SANCTUARY

NATIONAL MARINE SANCTUARIES ™

THE ISSUE:

Introduced species are a major economic and environmental threat to the living resources and habitats of the Monterey Bay National Marine Sanctuary (MBNMS) as well as the commercial and recreational uses dependent on these resources. Introduced species have become increasingly common in recent decades, and the rate of invasions continues to accelerate at a rapid pace.

OUR GOAL

The sanctuary's goal is to maintain the biological communities and ecological processes of the sanctuary and to protect them from the potentially adverse impacts of introduced species.

Introduced species have become increasingly common in recent decades, and the rate of invasions continues to accelerate at a rapid pace.

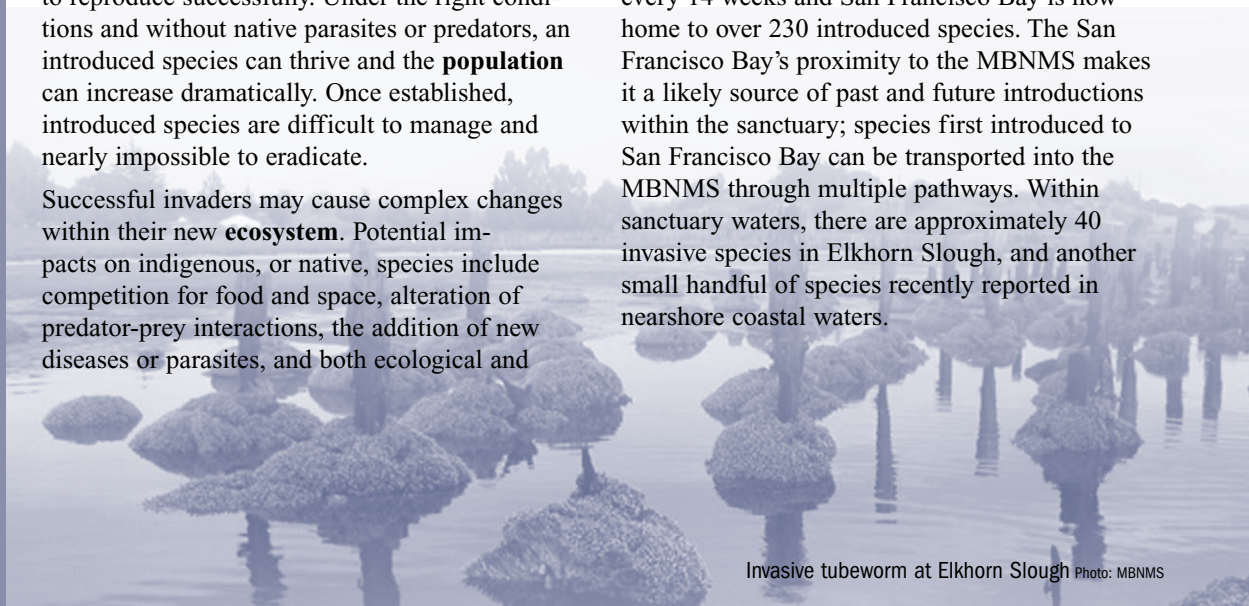
BACKGROUND INFORMATION

In the sanctuary's Introduced Species Action Plan, the term "introduced species" refers to species that have been moved dramatically beyond their original range by human activities. There are a variety of other terms used to describe introduced species and these include exotics, invasives, aliens, nuisance species, and non-indigenous species. No matter the term, introduced species can alter ecological processes and impact resources with biological and economic consequences.

Aquatic introduced species occur worldwide and include a variety of organisms- algae, plants, fishes, reptiles, and **invertebrates**. In their home environments, these organisms live in balance with predators, prey, and competitors. Diseases, **parasites**, and other ecological interactions control their numbers. Although most species that arrive to a new environment do not survive the new conditions, some species are hardy and able to reproduce successfully. Under the right conditions and without native parasites or predators, an introduced species can thrive and the **population** can increase dramatically. Once established, introduced species are difficult to manage and nearly impossible to eradicate.

Successful invaders may cause complex changes within their new **ecosystem**. Potential impacts on indigenous, or native, species include competition for food and space, alteration of predator-prey interactions, the addition of new diseases or parasites, and both ecological and economic damage. For example, the Chinese mitten crab is native to China and Korea but is now also found in northern Europe and in San Francisco Bay. The mitten crab is an excellent digger and burrows into the soft muddy banks of waterways. In areas with high numbers of mitten crabs, erosion increases when burrow-ridden banks collapse. Mitten crabs feed on native invertebrates, competing with native predators. They also impact commercial fisheries by cutting fishing nets with their claws and feeding on the netted catch. With no known predators in San Francisco Bay and a tolerance for wide ranges in salinity, mitten crabs have rapidly increased their distribution and overall population size.

The United States is host to at least 4,500 introduced species and the MBNMS sits adjacent to the most invaded aquatic ecosystem in North America, San Francisco Bay. Between 1961 and 1995, an average of one new species arrived every 14 weeks and San Francisco Bay is now home to over 230 introduced species. The San Francisco Bay's proximity to the MBNMS makes it a likely source of past and future introductions within the sanctuary; species first introduced to San Francisco Bay can be transported into the MBNMS through multiple pathways. Within sanctuary waters, there are approximately 40 invasive species in Elkhorn Slough, and another small handful of species recently reported in nearshore coastal waters.



Invasive tubeworm at Elkhorn Slough Photo: MBNMS

HOW DO THEY GET HERE?

It is important to identify the pathways of introduction and to take measures to reduce or eliminate potential introductions. Some human actions that lead to species introductions are accidental, unintentional, or passive. Nevertheless, the ecosystem consequences are the same. The following list briefly describes several pathways for introduced species to enter the sanctuary:

Aquaculture: Cultured non-native species can escape from captivity, and other species can "hitch" along with the species grown in aquaculture. The Japanese mud snail, *Batillaria attramentaria*, hitched a ride into sanctuary waters on oysters, historically cultured in Elkhorn Slough.

Aquarium trade: Wholesale importers, culture facilities, and retail pet stores transport and sell non-native fresh and saltwater plants, fishes, and invertebrates. The release or escape of specimens into the wild by the pet-owners has led to introductions in the United States.

Ballast water: Most ships carry water for stability, called ballast water, which can contain aquatic plants, animals, pathogens, and other contaminants. Marine vessels take on and discharge millions of gallons of ballast water daily in ports and harbors around the world. European green crabs, *Carcinus maenas*, may have arrived via ballast water and now thrive in Elkhorn Slough.

Biological control: Selected non-native species, usually targeted predators, have been intentionally introduced in an effort to control the growth and spread of other introduced species. Sometimes, these actions have unintended consequences; grass carp introduced to control unwanted aquatic plants in inland lakes resulted in native plant species being decimated.

Dispersal of adults, eggs, and larvae: Once introduced to a new ecosystem, introduced species can spread within a region due to dispersal of adults, eggs, and **larvae** on currents.

Fisheries enhancement: US federal and state agencies import game species to enhance recreational fishing. Accidental release and unplanned spread of some species, like the Striped bass, *Morone saxatilis*, now found in Elkhorn Slough, can be a by-product of this activity. Private citizens may also release a favored organism into a body of water with the hope of establishing a population they can **harvest**.

Hull fouling and other non-ballast vessel introductions: Many organisms foul vessel hulls by attaching to the submerged parts of the vessel. Smaller recreational boats can transport species that survive in boat wells. It is likely that the reef-forming Australian tubeworm, *Ficopomatus enigmaticus*, now found in Elkhorn Slough, and Asian kelp, *Undaria pinnatifida*, were both transported to the sanctuary on vessel hulls. An invasive Asian kelp, *Undaria pinnatifida*, was first detected in southern California in spring 2000 and quickly spread throughout southern and central California ports and harbors, reaching as far north as Monterey harbor by August 2001.

Live bait: Recreational fishermen can buy non-native live worms, juvenile fish, and other aquatic organisms for use as bait. Both the bait species and its packing material (e.g., **invertebrate**-laden seaweeds) can result in introductions through intentional and accidental release.

Restaurants, seafood retail, seafood wholesaling, and processing: Packing material for live seafood such as seaweed and seawater contain a number of living organisms and provide an opportunity for species introductions when the unused product, packing materials, and shipping containers are disposed of improperly.

Scientific research institutions, schools, and public aquariums: Private and public research laboratories, schools, and aquariums use non-native species for testing, teaching, research, and display. Accidental release of specimens can occur when strict protocols for animal management are not implemented and followed. Many of these institutions rely on seawater intake and discharge systems that may provide a direct means of accidentally transporting non-native species from the lab or aquarium to the ocean.

The sanctuary plans to characterize each pathway listed above, determine the likelihood of the pathway leading to introductions, assess the severity of the threat provided by each, determine the feasibility of the MBNMS addressing the pathway, and determine the effectiveness of prevention or management issues. Specific activities will be developed to reduce the likelihood of new introductions, with strategies to quickly detect and rapidly respond to new invasions. The discharge of ballast water is considered the largest pathway for coastal aquatic introductions. As a result, the sanctuary is no longer exempting ballast water from the sanctuary's discharge prohibition.

THE SANCTUARY'S ACTION PLAN

The sanctuary's "Introduced Species Action Plan" was developed jointly with a working group comprised of a variety of stakeholders and partners and includes, but is not limited to, the following components:

- Developing and implementing action plans for introduced species to address pathways, threats, and effective prevention and management
- Developing and implementing an introduced species outreach and prevention program targeting audiences most likely to introduce non-native species
- Identifying incentives, necessary infrastructure, and training to reduce risk of introductions
- Continuing to work with Elkhorn Slough National Estuarine Research Reserve to implement and expand a program designed for early detection of introduced species
- Developing and conducting an early detection training program that targets researchers and others who spend a significant amount of time underwater
- Improving knowledge of existing introduced species in the sanctuary through monitoring and research
- Working with partners to coordinate efforts to assess species already introduced in the sanctuary with regard to feasibility of eradication efforts or other management measures designed to limit their spread
- Working with appropriate partner agencies to develop a decision-making framework to guide rapid response to detection of an introduced species
- Assessing the ecological and economic impacts of introduced species in the sanctuary

For a complete listing of the sanctuary's "Introduced Species Action Plan" please visit http://sanctuaries.nos.noaa.gov/jointplan/m_reptoad.html and scroll down the page.

GLOSSARY

Ecosystem:
All of the living things in an area plus all the non-living components of the environment.

Harvest:
To collect marine life.

Invertebrates:
Animals that do not have a backbone.

Larvae:
Immature stage of an animal, may look different from the adult.

Parasites:
Plants or animals that live in or on another plant or animal and obtain nourishment from it.

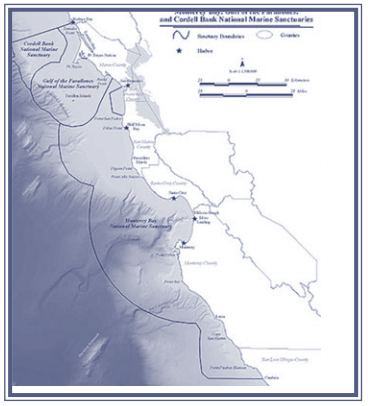
Population:
An interbreeding group of organisms.

Once established, introduced species can be extremely difficult, if not impossible to eradicate.

The Joint Management Plan Review (JMPR)

"Introduced Species" is one of the action plans in the Monterey Bay National Marine Sanctuary Draft Management Plan. The MBNMS Draft Management Plan includes twenty-eight plans that, once finalized, will guide sanctuary management for the next five years. The plan is a revision of the original management plan, adopted with sanctuary designation in 1992, and is focused on how to best understand and protect the sanctuary's resources.

The National Marine Sanctuary Program (NMSP) is updating the management plans for the Cordell Bank, Gulf of the Farallones, and Monterey Bay National Marine Sanctuaries in a process known as the Joint Management Plan Review (JMPR).



Some Simple Things You Can Do to Reduce Introduced Species

- Place unwanted aquatic plants in the trash and dispose of aquarium water into a toilet or sink.
- Remove all aquatic plants and animals from hulls, propellers, intakes, trailers, and gear before leaving a launch area. Where known invaders are present, dispose of these organisms where they won't wash back into the water.
- Eliminate water from all boating or fishing equipment at the site before transporting it home. Draining water at home could introduce an invasive hitchhiker to a local stream through the storm drain system along your street.
- Always wash boats and other recreational water gear (i.e. SCUBA gear, fishing gear, etc.) land-side before traveling to a new waterway.
- Return unwanted pets to a local pet shop for resale or trade, give it to another hobbyist, or donate it. Think carefully about your commitment before purchasing a pet.
- Learn to recognize common invaders and keep an eye out for signs of new ones. If you think you've found a new infestation, contact the California Department of Fish and Game or the MBNMS. Early detection is crucial to stopping an invasive from becoming permanently established!
- Never release live fishing bait onto the shoreline or the water where you are fishing. Dispose of your bait at home in the garbage or give it to another angler.
- Never transport water, animals, or plants from one waterbody to another.

How You Can Get Involved in the MBNMS Management Plan Process

The MBNMS welcomes your ideas about important resource management issues in the sanctuary. A Draft Management Plan and Draft Environmental Impact Statement are scheduled for release to the public in 2006. Following their release, hearings will be held in several locations throughout the region to gather public comment. Written comments will be accepted as well. To find out about public hearings, or how to submit written comments, please visit our website at http://www.sanctuaries.nos.noaa.gov/jointplan.

Resources

California Department of Fish and Game http://www.dfg.ca.gov
Elkhorn Slough National Estuarine Research Reserve http://www.elkhornslough.org/invader.htm
Exotic Species of the Monterey Bay National Marine Sanctuary http://montereybay.noaa.gov/sitechar/spex.htm
Monterey Bay National Marine Sanctaury http://montereybay.noaa.gov
Sanctuary Integrated Monitoring Network (SIMoN)
http://www.mbnms-simon.org

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THE MONTEREY BAY NATIONAL MARINE SANCTUARY

Stretching from Marin to Cambria, the Monterey Bay National Marine Sanctuary encompasses 276 miles of shoreline and 5,322 square miles (4,625 nautical miles) of ocean, extending an average distance of 30 miles from shore. At its deepest point, the sanctuary reaches down 10,663 feet (more than two miles). The sanctuary was established for the purposes of resource protection, research, education, and public use. Its natural resources include one of our nation's largest kelp forests and one of North America's largest underwater canyons. It is home to one of the most diverse marine ecosystems in the world, including 33 marine mammal species, 94 seabird species, 345 fish species, and numerous invertebrates and plants. This remarkably productive marine environment is fringed by spectacular coastal scenery, including sandy beaches, rocky cliffs, rolling hills, and steep mountains.

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