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The Invasion of Western Waters by Non-Native Species: Threats to the West

Western Regional Panel on Aquatic Nuisance Species

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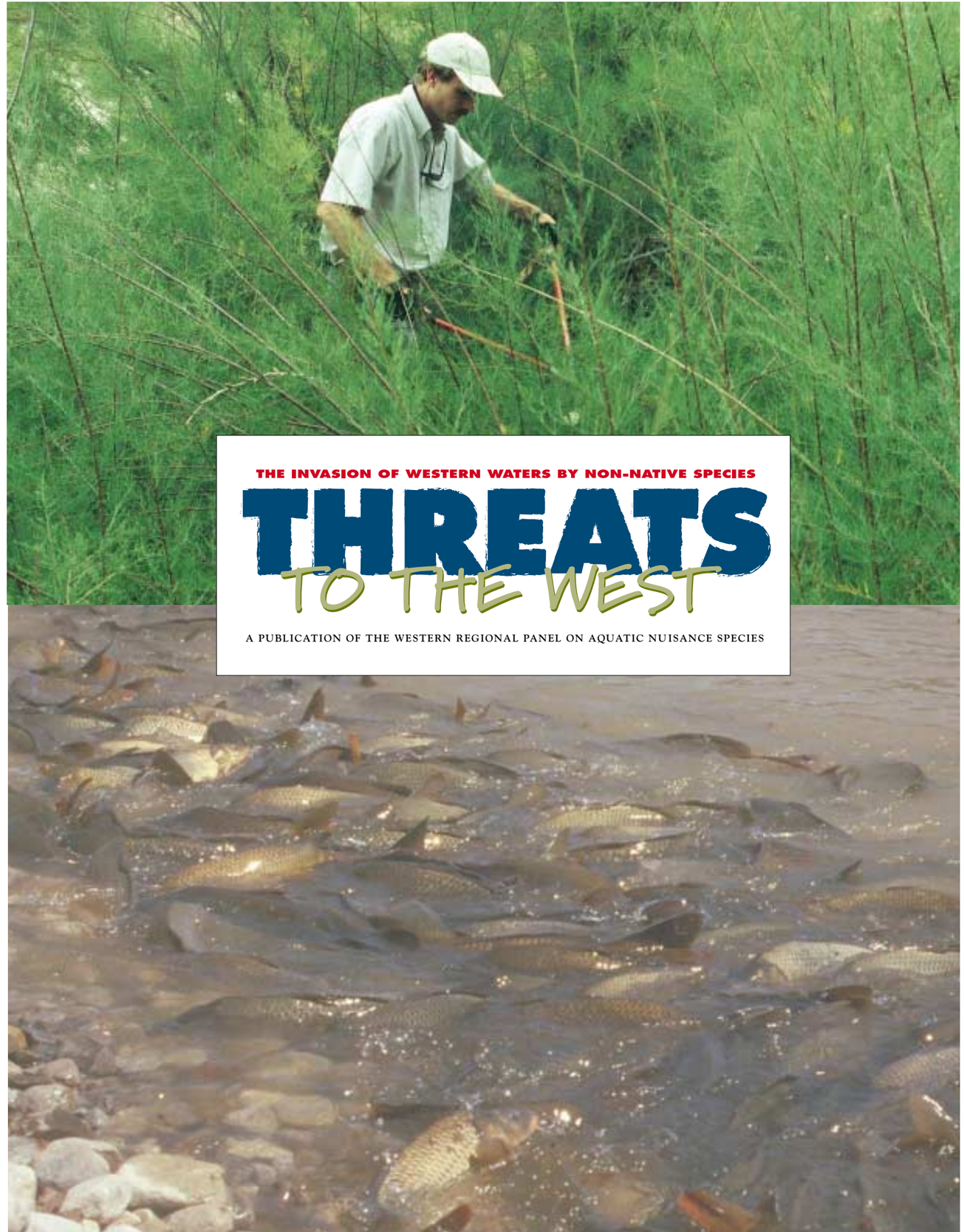


THE INVASION OF WESTERN WATERS BY NON-NATIVE SPECIES

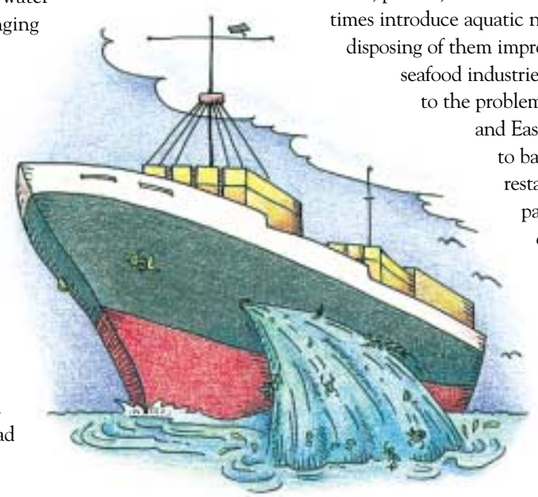
THREATS TO THE WEST

A PUBLICATION OF THE WESTERN REGIONAL PANEL ON AQUATIC NUISANCE SPECIES

The waters of western North America are being transformed by invasive aquatic plants, fish, and other animals from around the world. These plants and animals, which have been introduced both intentionally and accidentally by humans, can irrevocably alter our native ecosystems. While they may be harmless in their own waters, once brought into a new ecosystem where their native predators do not exist, they can harm native species by eating their food, preying on them, transmitting diseases to which the natives have no defenses, or (like many invasive aquatic plants) simply outgrowing them. Not all non-native species cause serious problems, but some do, disrupting entire ecosystems by destroying habitat and altering food chains. These plants and animals are known as *aquatic nuisance species*.

Aquatic nuisance species not only threaten the natural environment, they also cause serious economic damage. Each year, the United States alone spends billions of dollars attempting to control or slow the spread of these plants and animals. Recreational activities are impacted when boating and swimming areas become clogged with invasive plants, and human health can even be affected as some aquatic nuisance species carry parasites and diseases.

Many aquatic nuisance animals are small, but their size belies their danger. One of the best-known aquatic nuisances in the United States is the European zebra mussel *(Dreissena polymorpha)*, a mollusk no bigger than a human thumb nail. The zebra mussel has caused significant ecological and economic damage in the Great Lakes region, disrupting the food webs of native clams, mussels, and fish, and clogging water and electrical utility pipes, bringing operations to a standstill. Hundreds of millions of dollars have been spent fighting this tiny invader. Native to the Caspian Sea, the zebra musssel was discovered in Lake St. Clair (between Lakes Huron and Erie) in 1988, where it probably arrived in discharged ballast water. The zebra mussel quickly spread throughout the Great Lakes and 20 eastern and midwestern states, and is heading west. Dead zebra mussels have been found in the Missouri River in Kansas, and both dead and live mussels have also been found in the Mississippi River and on boats hauled into California and Washington.



HOW DO AQUATIC NUISANCE SPECIES GET HERE AND WHAT TYPES OF HABITATS DO THEY INVADE?

Aquatic nuisance species arrive by various pathways. They are often introduced into open water, such as bays and estuaries, when ships empty the ballast water they carry in their hulls for stability. Some aquatic nuisance species may appear to be too large to be transported in ballast water, but many have smaller larval forms that can be sucked into ballast tanks at one port and carried to the next destination. With faster vessels enabling shorter shipping times, more species are surviving their voyages. On average, close to two million gallons of ballast water containing potential invaders are released into U.S. waters every hour. San Franciso Bay, one of the West Coast's busiest international ports, now hosts over 200 introduced species, many of which are suspected of having arrived in ballast water. Many of these plants and animals are causing serious problems for the Bay's native flora and fauna.

Some aquatic nuisance species—like giant reed or tamarisk—get their start when people plant them to help stabilize creek and riverbanks or to provide wind screens. Pieces of giant reed break off and spread downstream while the seeds of tamarisk disperse by wind. Other aquatic nuisance species get their start when they are dumped into waterways by people who no longer want to keep an aquarium. This releases exotic fish, other animals, and plants into new, vulnerable ecosystems.

Public, private, and academic research facilities sometimes introduce aquatic nuisance species as well, by disposing of them improperly. Even the bait and seafood industries inadvertently contribute to the problem. Live Atlantic bait worms and East Coast lobsters are shipped to bait shops, sports stores, and restaurants around the country packed in seaweed or plants containing insects, mollusks, worms, and other creatures. The bait, packing material, and organisms are sometimes tossed into rivers, bays, and lakes, prompting new invasions.

As home water gardens become increasingly popular, nurseries, too, are contributing to the problem. Many sell non-native aquatic plants and fail to warn customers of their potential for becoming pests. Not all problem plants have been listed as noxious weeds. Giant reed, water hyacinth, and purple loosestrife are among the problem species still sold by nurseries in parts of the West.

Aquatic nuisance species are also spread, unwittingly, by recreational boaters. Many boaters fail to notice and remove invasive plants and animals from their boats and boating accessories after an outing. When the boater visits a new lake or river, surviving aquatic nuisance species are introduced into a new ecosystem.

WHAT IS BEING DONE TO PREVENT FURTHER INVASIONS?

In 1990, largely in response to the zebra mussel invasion of the Great Lakes, Congress passed the Nonindigenous Aquatic Nuisance Prevention and Control Act. Among other measures, the Act established a national Aquatic Nuisance Species Task Force (ANSTF) and authorized the creation of regional panels to address aquatic nuisance species problems. In 1996, when the law was reauthorized as the National Invasive Species Act (NISA), the Western Regional Panel (WRP) was created. The WRP is comprised of representatives from U.S. federal, tribal, state, and local agencies, Canadian federal and western provincial agencies, and private environmental and commercial interests from the states west of the 100th Meridian, including Guam, Hawaii, and Alaska. The WRP is charged with taking action to prevent the spread of zebra mussels and other aquatic nuisance species, and to provide information and recommendations to the ANSTF.

The ANSTF and the WRP recently developed the 100th Meridian Initiative, a collaboration among state and federal agencies, private industries, and citizens working to prevent the westward spread of zebra mussels through education and outreach, and by encouraging such measures as voluntary boat checks. This partnership includes the six states that straddle the 100th Meridian (100º longitude), the Canadian province of Manitoba, and most of the western states.

One of the WRP's main goals is to educate the public and decision-makers about the need to prevent further invasions in the West. This brochure describes some of the aquatic nuisance species that have already arrived and suggests ways you can help prevent their further spread.

WHAT CAN YOU DO TO HELP?

You can help prevent the spread of aquatic nuisance species by following these guidelines:

- Report sightings of invasive species toll-free to: (877) STOP-ANS or (877) 786-7267.
- Report sightings to your local Fish and Game office, county agricultural office or resource conservation district, or the U.S. Fish and Wildlife Service.
- Learn more about non-native species and their invasion pathways (see Resources, back page).
- Plant native plants in your garden; join a community group that is removing non-native, invasive plants and restoring native habitat.
- Never empty aquariums into rivers, streams, or other waterways, including storm drains—or into any type of wild area. Check with your local pet store for safe disposal options.

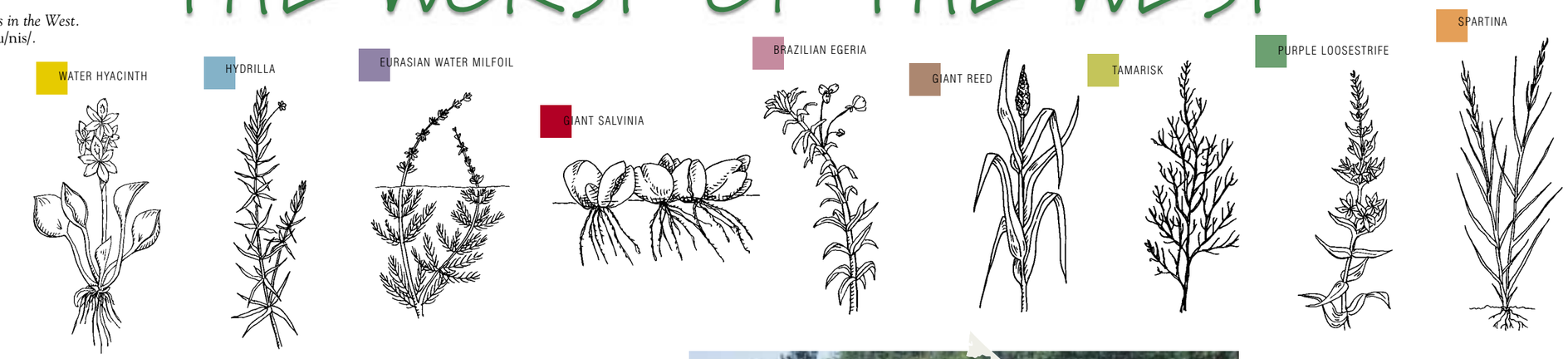
IF YOU ARE A BOATER:

- Drain livewells, bilge water, and transom wells before leaving the vicinity of where you have used your boat.
- After leaving the water, inspect your boat and boat accessories, and dispose of any plants or animals you find by placing them in a garbage bin.
- Empty bait buckets on land, never into the water.
- Never dip your bait or minnow bucket into one lake if it contains water from another lake.
- Never dump live fish or other organisms from one body of water into another.
- When you get home, wash your boat, tackle, downriggers, and trailer with hot water.
- Flush water through your motor's cooling system and other parts of the boat that normally get wet. If possible, let everything dry for five days in the hot sun before using your boat in another water body.

THE WORST OF THE WEST

INVASIVE AQUATIC PLANTS

Here are a few of the most troublesome species in the West. For a more complete list, see www.clr.pdx.edu/nis/.



WATER HYACINTH
(Eichhornia crassipes)

Native to South America, water hyacinth is an attractive, purple-flowered, floating plant probably introduced to U.S. waters in the late 1800s. Populations of water hyacinth can double in 12 days. The plant forms mats on the water surface, sometimes blocking boat traffic, limiting recreational access, and outcompeting native plants.

HYDRILLA *(Hydrilla verticillata)*

Individual hydrilla plants can grow up to an inch per day, invading deep, dark waters where other plants cannot grow. Native to India and Korea, various strains of hydrilla were imported into the United States for aquarium use. It was first found growing wild in Florida but has spread throughout the southwest, California, and Washington. Hydrilla causes problems for boaters, swimmers, and anglers, and can also block power plants and agricultural irrigation systems.

EURASIAN WATER MILFOIL
(Myriophyllum spicatum)

This plant was accidentally introduced to North America from Europe. It was discovered in the eastern United States in the 1940s and is now one of the most widely distributed aquatic nuisance species, having been recorded in 45 states. Milfoil has infiltrated inland lakes, ponds, and irrigation canals throughout the country. Tangling itself around propellers or other boat or trailer parts, it hitches a ride from one water body to the next.

GIANT SALVINIA
(Salvinia molesta)

A free-floating aquatic fern from southeastern Brazil, this plant is an aggressive invader. In parts of Texas and Hawaii, giant salvinia has formed mats so extensive that migratory birds can no longer nest or forage in their usual areas. Texas anglers find it difficult to cast into water covered with thick mats of giant salvinia. Although the plant is prohibited in many states, it is still being cultivated and sold.

BRAZILIAN EGERIA
(Egeria densa)

This common aquarium plant native to Brazil roots at the bottom of waterways. Probably introduced into western waters several decades ago from an unwanted aquarium, the plant can grow to 12 feet tall, forming a dense canopy in the water column and making some waterways impassable. Egeria cannot be easily eradicated with herbicides and is difficult to remove by mowing or other mechanical means because broken-off clumps can fall to the bottom and root, allowing the plant to persist and spread.

GIANT REED *(Arundo donax)*

Originally from India, giant reed was probably introduced into southern California by the Spanish in the 1800s for erosion control along drainage canals. The reed escaped and invaded native riparian (streamside) ecosystems throughout the state. Today, it is purchased by home gardeners and planted along backyard streams. Pieces of stalk or root break off, wash downstream, and can establish themselves wherever they are deposited. The plant's towering stalks guzzle groundwater, reducing habitat for songbirds that use native riparian vegetation.

TAMARISK *(Tamarix sp.)*

Tamarisk, also known as saltcedar, was brought to the United States from Central Asia in the early 1800s and planted for its ornamental value, to create windbreaks, and to stabilize stream banks. Saltcedars have devastated riparian habitats in the West, displacing native vegetation, reducing water tables, increasing surface soil salinity, causing flooding problems, and offering little habitat for native animals. Tamarisk is still sometimes planted intentionally.

PURPLE LOOSESTRIFE
(Lythrum salicaria)

A wetlands plant accidentally introduced into the northeastern United States from Europe in the mid-1800s, purple loosestrife has spread to 48 states. Because of its showy purple flowers, loosestrife is often planted as an ornamental garden plant. Each plant produces up to 300,000 seeds per year. As the wind carries the seeds—each the size of a grain of pepper—the plant spreads far and wide. Loosestrife crowds out native plants used by wildlife for food and shelter, destroys marshes and wet prairies, and chokes streams and other waterways.

Water hyacinth clogs a creek entering the San Francisco Bay Delta. Photo by Lisa Viani.

SPARTINA *(Spartina sp.)*

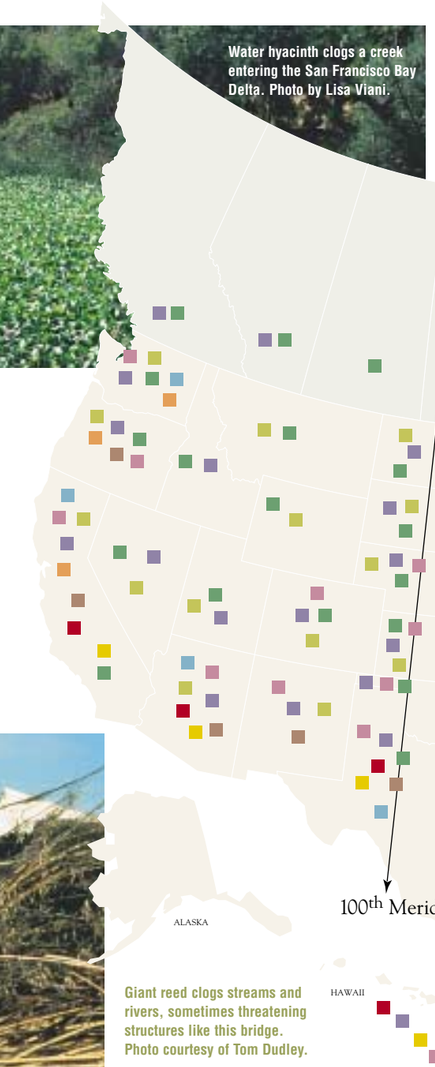
Commonly called cordgrasses, several species of *Spartina* are spreading and establishing themselves in the West. *Spartina alterniflora,* native to the eastern United States, was introduced intentionally to southern San Francisco Bay around 25 years ago. The plant hybridizes with native cordgrasses, causing the native cordgrass, *Spartina foliosa,* to become locally extinct. *Spartina alterniflora* is also a problem in Washington, where it transforms mudflats into vast expanses of cordgrass, destroying foraging habitat for shorebirds. It also reduces habitat for fish and shellfish.

Hydrilla

Eurasian water milfoil

Brazilian egeria

Giant reed clogs streams and rivers, sometimes threatening structures like this bridge. Photo courtesy of Tom Dudley.



A mat of milfoil, which appears red under certain conditions, spreads across a lake in Washington. Photo courtesy of the Washington Department of Ecology.

KEY
- WATER HYACINTH
- HYDRILLA
- MILFOIL
- SALVINIA
- BRAZILIAN EGERIA
- GIANT REED
- TAMARISK
- PURPLE LOOSESTRIFE
- SPARTINA

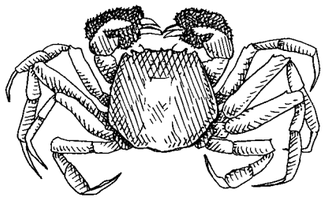
Boxes indicate presence of species in the state or province and do NOT depict exact location.

THE WORST OF THE WEST

INVASIVE AQUATIC ANIMALS

Here are a few of the most troublesome species in the West. For a more complete list, see www.clr.pdx.edu/nis/.

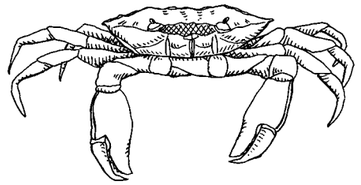
MITTEN CRABS



MITTEN CRABS
(Eriocheir sp.)

The Chinese mitten crab *(Eriocheir sinensis),* native to mainland China and coastal areas along the Yellow Sea, was first spotted in San Francisco Bay in 1992, by shrimp trawlers who reported the sighting to the California Department of Fish and Game. The mitten crab, introduced accidentally in ballast water or intentionally as live seafood, has flourished in the Bay. Mitten crabs are omnivores, eating both plants and other animals. Another species of mitten crab, the Japanese mitten crab *(Eriocheir japonica),* was found near the mouth of the Columbia River in Oregon in 1997.

EUROPEAN GREEN CRAB



EUROPEAN GREEN CRAB
(Carcinus maenas)

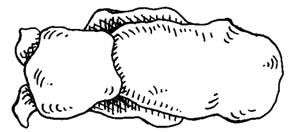
This crab is native to Europe's North and Baltic Seas but was introduced to the Atlantic Coast of the United States in the mid-1800s. By 1990, the crab had made its way (probably via ballast water or in live bait shipments) to south San Francisco Bay, where it established itself, feeding on bivalve mollusks and native shore crabs. The crab rapidly expanded its range and is now found along the Pacific Coast from Morro Bay, California to Vancouver Island, British Columbia. In Bodega Bay, north of San Francisco, the crab has reduced native clam and shore crab numbers by 90 percent.

NEW ZEALAND MUDSNAIL

NEW ZEALAND MUDSNAIL
(Polamopyrgus antipodarum)

This tiny creature was probably accidentally introduced to North America in shipments of trout eggs from New Zealand. The snail was discovered in Idaho's Snake River in 1987, where it now exceeds 100,000 snails per square meter along some reaches. These snails have an extraordinary survival mechanism: they close a "trap door" in their shells when they are eaten by fish and birds, which allows them to pass through undigested, depriving the birds and fish of any nutrition. In the Madison River in Yellowstone National Park, the New Zealand mudsnail now outnumbers all native crustaceans. It is also now established in the lower Columbia River.

NEW ZEALAND SEA SLUG



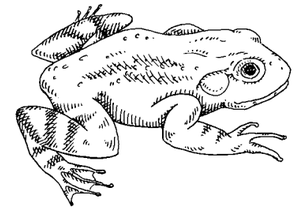
NEW ZEALAND SEA SLUG
(Philine sp.)

Two species of marine mollusk were introduced to San Francisco Bay from New Zealand some time in the past few decades, probably in discharged ballast water. In 1993, the sea slugs were plentiful in the south Bay, but have since spread throughout the Bay and along the California coast north to Bodega Harbor and south to San Diego. The slugs compete with native sea slugs and other mollusks. Since the slugs prey on bivalves and other mollusks that are food for shorebirds, they may be having an impact on both aquatic and terrestrial food webs.

Mitten crabs clog a screen at the Tracy fish facility in the San Francisco Bay Delta. Photo courtesy of U.S. Bureau of Reclamation.

A New Zealand sea slug burrows in mud. Photo courtesy of Michelle Chow.

AMERICAN BULLFROG



AMERICAN BULLFROG
(Rana catesbiana)

With many native western amphibians in decline, concerns about the American bullfrog are on the rise. Native to the eastern United States, the bullfrog was introduced to western states in the late 1800s, where it was cultivated in streams and ponds and sold to restaurants for its tasty legs. The bullfrog is now widespread throughout the West, where with less of its native predators—the pikes, snapping turtles, and water snakes of the eastern United States—it is thriving.

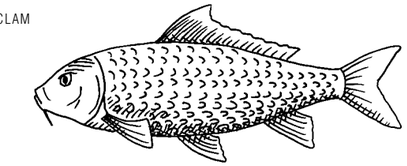
ASIAN (FRESHWATER) CLAM

ASIAN (ESTUARINE) CLAM

ASIAN CLAMS
(Corbicula fluminea [Freshwater] *and Potamocorbula amurensis* [Estuarine]*)*

C. fluminea, which lives in fresh water, was introduced in the 1800s by Chinese immigrants as a food item and was later discovered along the Columbia River in Washington. It has spread into 38 states. *P. amurensis,* which is also native to Asia but inhabits estuaries, is a big problem in San Francisco Bay. The clam arrived in California in the mid-1980s and now numbers, on average, 2,000 clams per square meter in the north Bay.

COMMON CARP



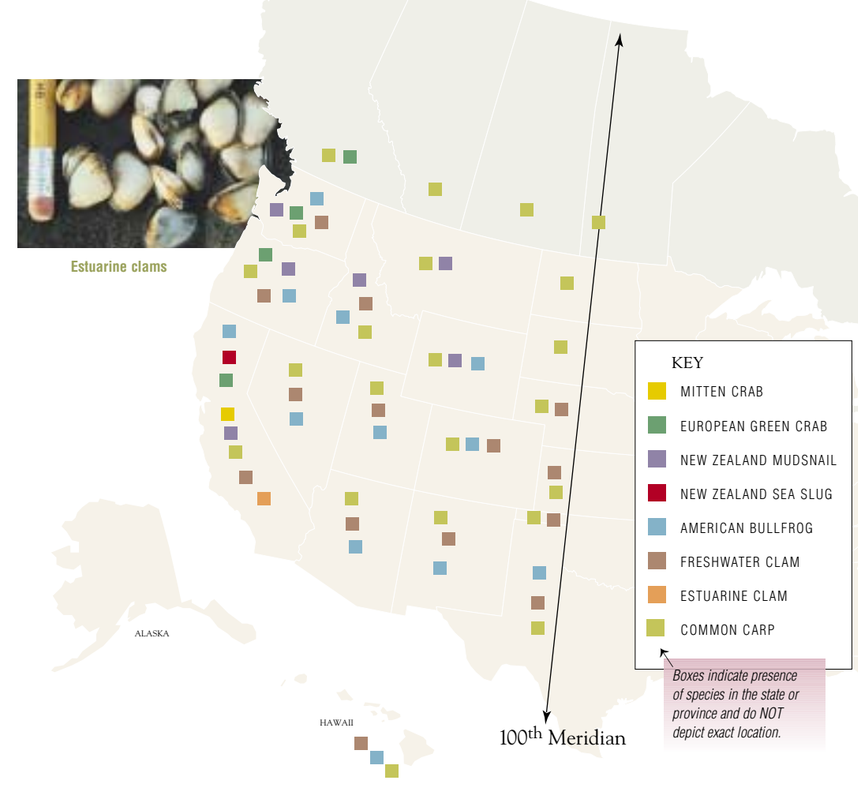
COMMON CARP
(Cyprinus carpio)

Many non-native fish were released into western waters years ago by federal and state resource managers before there was good scientific understanding of the potential problems associated with such introductions. The common carp was brought here from Europe, probably in the mid-1850s (it had been introduced to Europe from Asia) because it was popular as a food source and easy to raise in ponds and other waterways. Carp have become a widespread problem in North America, consuming the food resources needed by other fish; they also eat the eggs of native fish and destroy spawning habitat.

Estuarine clams

Bullfrogs pose serious threats to native frogs and turtles. Photo by Bill Leonard.

A green crab devours *Hemigrapsus oregonensis*, a small shore crab native to the West Coast. Photo by Ted Grosholz.



RESOURCES

Center for Aquatic and Invasive Plants
University of Florida
http://plants.ifas.ufl.edu/invasive.html

Invasive Species Information System
http://www.invasivespecies.gov

National Aquatic Nuisance Species Task Force
http://www.anstaskforce.gov
(703) 358-2148

National Ballast Water Clearing House
(Smithsonian Environmental Research Center)
http://invasions.si.edu

Pacific Northwest Marine Invasive Species Team
http://seagrant.orst.edu/mist/news.html

University of California, Davis
http://www.ridnis.ucdavis.edu
(530) 752-3419

U.S. Coast Guard Ballast Water Management Program
http://www.uscg.mil/hq/g-m/mso/mso4/
(202) 267-0500

U.S. Fish and Wildlife Service
http://www.fws.gov/
(303) 236-7862 (Denver)
(505) 248-6471 (Albuquerque)
(503) 872-2763 (Portland)

U.S. Geological Survey
(with distribution maps)
http://nas.er.usgs.gov

West Coast Ballast Outreach Project
California Sea Grant Extension Program
http://ballast-outreach-ucsgep.ucdavis.edu
(650) 871-7559

Western Regional Panel
Aquatic Nuisance Species Coordinator, U.S. Fish & Wildlife Service, Region 6
http://answest.fws.gov. See also www.clr.pdx.edu/nis/.
(303) 236-7862

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Design: Bobbi Sloan
Illustration: Lisa Krieshok

FRONT COVER, TOP: *A resource manager tries to control a tamarisk infestation by hand-cutting it. Photo courtesy of Tom Dudley.*

FRONT COVER, BOTTOM: *Carp threaten to enter and destroy marsh vegetation in Cootes Paradise, Ontario. Photo courtesy of the Royal Botanical Gardens, Hamilton, Ontario.*

BACK COVER: *Giant reed towers over a worker. Photo courtesy of Tom Dudley.*

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