

- ***Hydroides elegans***

It was introduced unintentionally, and was widely distributed at offshore areas in Asia. It lives on hard substrata in intertidal zone, propagates by traveling long distance attached to the hulls of vessels, and was found in China, Japan and Russia. Usually *Hydroides elegans* adheres to shellfish, corals, alga, rocks, vessels, port structures and other hard objects. It is dominant species at the bottom of docking ships, and is an important biofouling organism worldwide. It could destroy shellfish farming and decrease output of farmed oysters.



- ***Spartina anglica***

Spartina anglica grows in wetlands, and is distributed in China widely. It was introduced intentionally from Europe to reinforce dams, improve soil condition, produce feedstock for animals and make paper. It has strong invasive capacity and propagates quickly. It grows fast, and invades habitats of native coastal plants causing not only disappearance of mangroves but also suffocation of shellfish, crabs, algae, and fish. It competes for nutrients with kelp and other plants, destroying coastal aquaculture.



What can we do?

- Understand the issue of marine invasive species and how they can affect your local environment.
- Keep your eyes open and notify relevant authorities or scientists if you notice an unusual animal or plant.
- Do not release the individually-feed alien species into natural environment.
- If you go for fishing, diving or boating: check your gears and boats, then clean them if necessary, so you don't provide a ride to unwanted organisms.
- Do not discard bait or weed where it could find its way into local waterways or the sea.
- Do not empty fish bowls, contents of ornamental ponds or aquaria in natural waterways (and remember that many drains in urban areas may carry organisms to a river or the sea).
- Encourage your family and friends to get involved in raising awareness.
- Support monitoring efforts on marine invasive species in your local area.
- Cooperate with decision makers to address marine invasive species as an important environmental issue.



What can we do to prevent biological invasions to the marine environment?

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What are biological invasions to the marine environment?

Biological invasions normally refer to the natural range expansion process as well as the human-mediated spread where non-native species from the original distribution region entered into a new region, whose establishment and spread threatens ecosystems, habitats or species with economic or environmental harm. With the development of economy, trade and transportation, more and more biological invasions to the marine environment have been taking place.

Pathways of biological invasions to the marine environment

• Ballast water and hull fouling of ships

A large number of marine invertebrates, often referred to as biofouling, include barnacles, mollusks, hydra, polychaetes, algae, and also shrimps and snails. These invertebrates move from one part of the world to another through the hulls of the vessels. Majority of invasive species, including fish (especially in planktonic stage), are transported from one ecosystem to another through the ballast water in the ships.

• Intentional introduction

Intentional introduction is one of the main pathways of bioinvasions in marine environment. Along with economic development, lack of management will cause these species to thrive, causing harm to native marine ecosystems and biodiversity.

• Aquaculture

Aquaculture is an important way of biological invasions to the marine environment. Due to lack of effective management, cultured species begin to reproduce and spread to adjacent marine environment. This movement negatively affects indigenous species in coastal and marine ecosystems.

Impacts of biological invasions in the marine environment

• Damage to ecosystems

- ◇ Change ecosystem functions and biodiversity
- ◇ Cause of genetic changes in coastal organisms



• Impacts on economy

- ◇ Direct losses: marine invasive species cause great losses of aquaculture production. Meanwhile, costs of cleaning and controlling invasive species are huge.
- ◇ Indirect losses: compared with direct economic losses, indirect losses caused to society, ecosystem, environment and resources are more difficult to estimate. For example, the uses of large amounts of chemicals (e.g. pesticides and herbicides) to tackle the invasive species may cause severe environmental pollution, and bioinvasion will also have negative impacts on shipping.

• Public health impacts

Many marine invasive species are human pathogens or vectors of the pathogens that could be epidemic. Those are harmful to human health, and can invade human body easily, spreading illness.

Common marine invasive species

• *Molgula manhattensis* and *Ciona intestinalis*

Molgula manhattensis and *Ciona intestinalis* were introduced unintentionally, and propagated by traveling long distance by adhering to the hulls of vessels. *Molgula manhattensis* is distributed in coastal areas and can be found in China, Japan and Russia. *Ciona intestinalis* is distributed in sea ports, and can be found in China, Japan, Republic of Korea and Russia.

These two ascidians species usually adhere to ships and port structures. Also, they influence mariculture and compete with indigenous shellfish and algae for their habitats. They also compete with farmed sea cucumbers for habitats and consume dissolved oxygen. Their metabolites can restrain growth of sea cucumbers.



Molgula manhattensis



Ciona intestinalis