



THE GLOBAL THREAT OF INVASIVE SPECIES

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The benthos of the ocean, like most environments, is currently the stage for a global war with the diversity of the planet at stake. All around the world, oceans have been invaded by alien, introduced, non-indigenous, or non-native species. These names are all synonyms for the same thing; a species that has moved beyond the area in which it has evolved. A subset of these introduced or non-indigenous species that cause impacts is referred to as invasive species.

Invasive species

Invasive species, like climate change, are a form of global change currently occurring which, without action, will critically affect the distribution and abundance of species and therefore the biodiversity of our planet. Invasive species are not limited to every continent but are also found in every ocean. Globally, they have been estimated to cause over a hundred billion US dollars in damage. One example of these global invasive species is the benthic predator, the European green crab (*Carcinus maenas*), which until a few hundred years ago was found only on the western coast of Europe. Now it is found on parts of all non-polar continents. In these places, it can reach large size - compared to its size in the native range - and densities and causes ecological and economic impacts. In North America, it has colonised both coasts and has greatly decreased the yields of commercially raised, native shellfish species.

The International Union for Conservation of Nature (IUCN) lists *C. maenas* as one of the world's one hundred worst invasive species. The IUCN list is long, so there was a large pool of candidates from which to choose. Every day it is estimated that thousands and thousands of species are transported around the world by a variety of vectors (e.g., boats, planes, trains, transport of plant and animal products). Most do not become established but some do and of these, some can cause great harm to the recipient biotic community. Drs. James T. Carlton and Andrew Cohen coined the term ecological roulette for this scenario. This risky game is as addictive as gambling, as across the globe it is being played at an exponentially increasing rate. In the Mediterranean Sea, Great Lakes of North America, Atlantic Ocean, Pacific Ocean, and elsewhere, the rate at which invasive species are being detected has increased alarmingly over the last hundred years.





For this reason, I want to illustrate how benthic invasive species can affect the benthos, humans, and how we can ameliorate or minimise the impact of this important current and global problem of invasive species. Many of these benthic organisms on the sea floor are economically important such as species of shellfish, e.g., clams, mussels and oysters. These organisms are filter feeders and need to filter water. Other types of filter feeders called tunicates are accidentally being introduced to shellfish farms and can suffocate the farmed species causing loss of life and profit or at least increase the time and effort to process the shellfish. Sometimes the shellfish are not even visible as the tunicates completely cover the shell. This problem has affected shellfish farms around the world. For example, the vase tunicate, *Ciona intestinalis*, has caused problems in North America among many other places around world. The shellfish industry in Prince Edward Island, which is the smallest Canadian province, has produced more than 80% of North America's mussels, but is now in danger of collapse. This would lead to the loss of jobs and livelihoods of many people.

While invasive species are causing great damage, each of us can help minimise this problem. Therefore, please consider the following steps, so you can make a positive difference:

- When travelling, make sure you are not transporting new species by carrying foods (e.g., fruits and vegetables), soil or animal products (e.g., untreated wood or shells). Once when travelling to a certain remote place in the Galapagos, I was not allowed to transport or even to eat food with seeds (e.g., tomatoes and cucumbers) 48 hours before I arrived at the location to avoid bringing these plants to new areas. Another time when entering Australia, I had a hacky sack confiscated as it might have been made with seeds. While these are two extreme cases, it highlights the fact that precautions need to be in place that you might not have thought about, so declare the food and any suspicious items, just in case, as they could be a risk. In some countries, failure to do so could lead to a hefty fine and sometimes criminal charges.
- Learn more about what species are native and introduced in your region, so you can determine what invasive species can be found in your general region or those at risk of being brought to your area; monitor local beaches, docks and marinas for their arrival.
- Report any potentially new invasive species to local experts such as aquatic biologists, professors and government scientists.

- Invasive species can be spread by various unexpected ways, so make sure you clean your boat, fishing tackle, snorkeling, and scuba diving equipment before heading to new areas.

- On boats, use approved and effective anti-fouling paint to reduce the likelihood of bringing hitchhikers on the trip with you. Also, make sure you add extra paint in high risk areas such as trailing edges, stern tubes, propellers, and sea chests.

- If transporting your boat to a new area, disinfect the boat and trailer by sponging or spraying them with vinegar.

- Regularly clean your anchor and chain to lessen chances of the buildup of fouling organisms, mud and seaweed. Always clean the hull if undertaking a large voyage and international trips.

- Avoid releasing bilge or ballast water in areas that the water was not collected from as that released water can transport many species.

- If using a trailer for your boat, make sure the vessel and trailer are clean of macrophytes as they can transport plants and hitchhiking animals on them.

- Support strong policy and regulatory measures against actions of industries, such as live fish trade and shipping, as they spread invasive species.

- When fishing and using bait, do not dump the rest of the bait into the lake, bay or ocean as it may be non-native or carry non-native species on it or in the packaging.

The problem of introduced species is important and, like climate change, caused by humans, it is accelerating a natural process at an unnatural rate. Although we have caused the problem, we can address the issue by changing our actions to reduce the probability of new introduced species being transported and becoming established. We can also support and participate in projects managing the currently established invasive species. Finally, contact your local and national governmental agencies and push for better regulation of the movement of species, how to deter their spread, and for increased funding for research so we can better study, understand and manage invasive species.

