Anti-fouling Paints and Boat Bottom Maintenance

3.1 Reasons That Invasive Species Connected with Boating are on the Rise

Why are marine aquatic invasive species on the rise?
Additive effects of natural and manmade conditions:

- Natural barriers to dispersal:
  - distance
  - currents
  - temperatures
- These natural barriers have been breached, increasing the potential pool of aquatic invasive species, and increasing the pool of regional invasive donors.

What are some mechanisms of aquatic invasive species transfer?

- Movement of fouling "communities" on boat bottoms.
- Movement and intentional release associated with:
  - aquaculture
  - fisheries
  - bait species

NOTE: It is not just the invasive species that are the problem but also diseases and parasites they may carry.

- Connection of waterways via canals.
- Release of species associated with pet industries or management practices.
- Release of organisms in ballast materials of ships.
  - Ballast water is usually taken from bays and estuaries and so it is a potentially enriched source of species (e.g., fish, crabs, and mollusks).
  - Primary invasion may make a community more susceptible to subsequent invasions.
  - Natural controls are often lacking for foreign invasive species that would be present in THEIR native areas.

Estuaries are very common sites of invasions, but extent of invasion has not been estimated for most estuaries or coastal regions.

- Estuaries and embayments have been invaded more frequently than rocky or sandy shores of outer coasts.
- Estuaries and embayments are where most human activities associated with invasives occur.
- Invasive organisms often originate from estuarine environments and are thus more likely to survive there versus outer coastal habitats.

Examples of Invaders:

- Mollusks
- Bryozoans
- Crabs
- comb jellies
- vascular plants
- tunicates

Health Risks Associated with Aquatic Invasive Species

- Increased frequency of toxic red tides (partly due to dinoflagellate transfer in ballast water).
- Ship mediated Cholera (Vibrio cholera) transfer is part of the cycle in humans, especially in South and Central America since the bacteria may be in ballast water of some ships.
  - Vibrio bacteria attach to a variety of marine and estuarine organisms including some invasive ones.
  - Viruses are also common in ballast water.

NOTE: Release of ballast organisms is ecological roulette.

Invasive species have significant effects on endangered and threatened species in fresh water.

The greatest threat from marine invasive species is on islands.

Increasing global surface temperatures are likely to have a huge influence on marine invaders.

- Alterations of temperatures change the pool of species likely to invade.

Regional temperature shifts would broaden ranges of those invasive populations currently limited in spread due to temperatures.

Changes in temperature will affect interspecies interactions and reproductive, growth and survival rates.

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