Plastic Shellfish Gear Potential Issues

Shumway et al. (2023): "[T]he data to date clearly demonstrate extremely low numbers (<10 per individual) of MP in filter-feeding bivalve molluscs globally. There are no data demonstrating presence of MP in these molluscs is a serious risk to human health, and few data to demonstrate negative impacts on the shellfish at environmentally relevant concentrations".

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Overview of Potential Issues Identified for Plastic Aquaculture Gear

- Loss of gear contributing to marine macroplastic load
  - Surveys show negligible contribution from shellfish aquaculture to marine macroplastics
  - Permit conditions and active control by growers prevent gear loss
- Contribution to increased microplastics in shellfish
  - Low levels of microplastics are now ubiquitous in the environment and are mostly from land-based sources
  - Reliable studies do not show increased microplastics in farmed shellfish
- Contribution to increased metals or organic chemicals in shellfish
  - Aquaculture gear does not release detectable metals or plasticizers to the environment
  - Aquaculture gear also does not transfer organic chemicals from the environment to shellfish

Plastic Shellfish Gear Has Negligible Impact on Microplastic and Chemical Exposures

- FAO (2017) and others (Monteiro et al. 2018; Li et al. 2021) found that aquaculture gear has not been identified as a significant source of marine microplastic pollution
- Other studies have found that the primary source of marine plastic pollution is land based (Lambert et al. 2014; Coyle et al. 2020)
- Shumway et al. (2023) state "[G]enerally speaking, there are no data to support a claim that shellfish aquaculture increases the presence of MP [microplastics] in the cultured animals."

Surveys of marine plastic debris show little contribution from aquaculture

- Land-based sources (80% of marine plastics arise from):
  - Dumpsites, industrial and municipal outfalls, stormwater, recreational and tourism littering
- Major sea-based sources of marine litter:
  - Shipping, fishing activities and associated gear (vessels, angling & fish farming), offshore mining and extraction, legal & illegal dumping, and natural disasters

- Debris collected during a five-year period from 2001-2006 (Ocean Conservancy 2007) was almost 90% from land-based or general sources
- Most debris was plastic straws, balloons, plastic bottles and plastic bags
- Ocean-based sources (11.3% of items, none uniquely associated with shellfish aquaculture) included rope, floats and buoys, fishing line, traps/pots and pipe-thread protectors

Industry management systems to reduce loss of gear

- Pacific Coast Shellfish Growers and BC Shellfish Growers' Associations have codes of practice
- Standards on the use and maintenance of gear include routinely inspecting gear, designing and constructing equipment to withstand extreme weather conditions, and repairing and replacing gear as needed.
- Similar requirements to use appropriate gear, frequently monitor gear, replace damaged gear, and remove gear when it is no longer needed or not actively being used are typically included in regulatory conditions for approval of aquaculture operations (United States Army Corps of Engineers; USACE 2015)

NOAA 2011

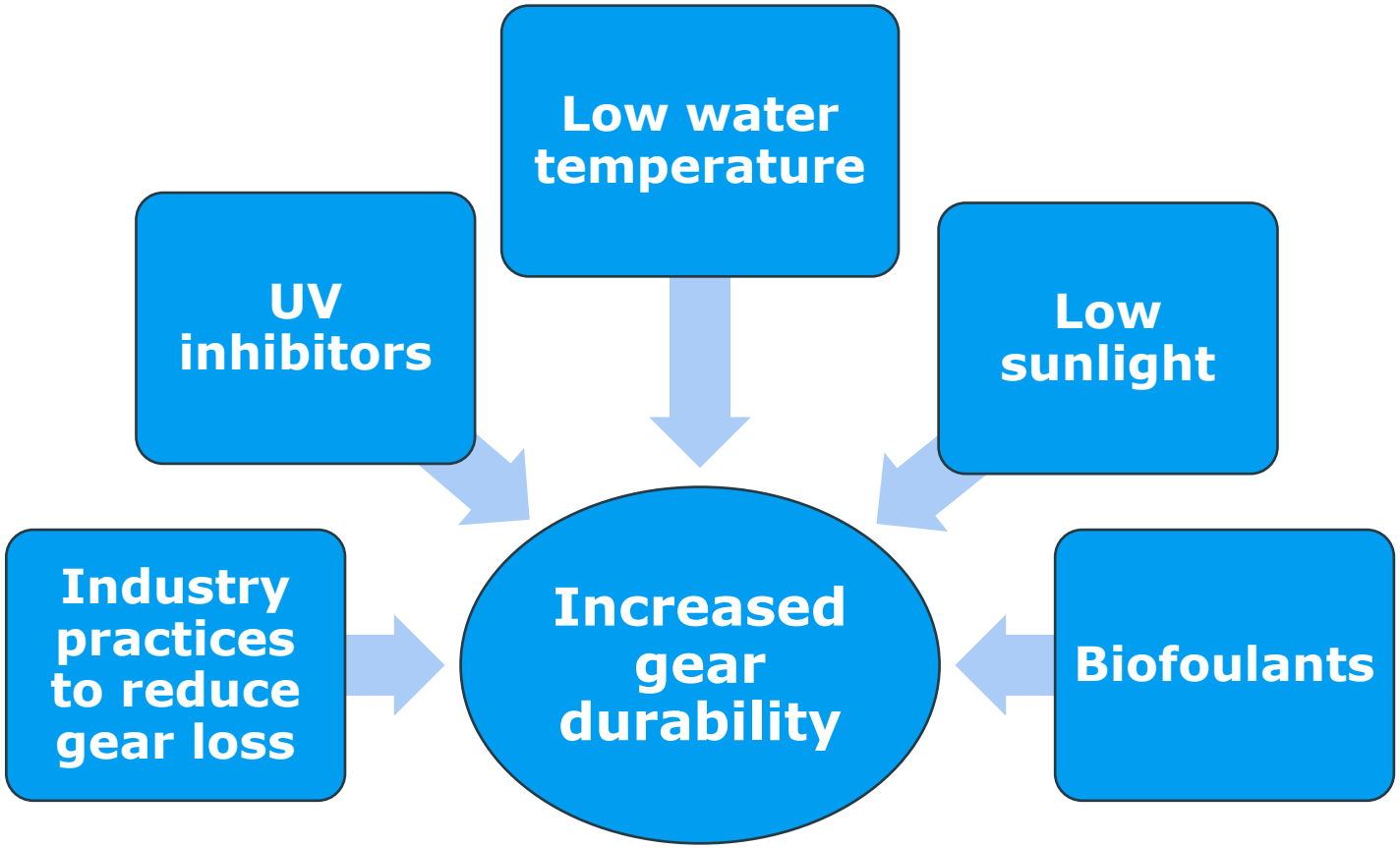
http://marinedebris.noaa.gov/info/plastic.html

Bi-annual beach cleanups reduce marine debris of all kinds

- Washington shellfish farmers have organized bi-annual beach cleanups resulting in a sharp downward trend in the amount of aquaculture-related marine debris over the past 15 years demonstrating the effectiveness of management practices and permit conditions (SHB 2013).
- The vast majority of marine debris collected during these cleanups is from non-aquaculture sources (SHB 2015).
- Accordingly, shellfish aquaculture operations may be responsible for a net reduction of marine debris.

UNEP 2009

Many factors minimize degradation of plastic gear in Puget Sound; limiting potential MP production and chemical release



Data for the Salish Sea do not suggest release of microplastics from aquaculture gear

- **No microplastic particles were detected in samples close to the PVC tubes** or in an updrift control area of a Puget Sound geoduck farm that had been in operation for 10 years (ENVIRON 2011)
- Puget Sound water column **microplastic concentrations were highest in urban areas** and lowest in remote areas (LaRocque, et al. 2011)
- Plastic marine debris was higher near urban areas and the **lowest levels were found in beaches of south Puget Sound, in areas with the highest density of aquaculture** (Davis and Murphy 2015)
- The **urban origin of most Salish Sea anthropogenic debris** was confirmed by surface water trawls, showing debris was dominated by micro-fragments of expanded polystyrene foam (Davis and Murphy 2015)

Cultured shellfish do not have more MPs than wild shellfish

- Wootton et al. (2022) conducted a systematic review of 628 potentially relevant studies from which 49 studies were identified and selected as investigating microplastic presence in oyster species. Of these, 29 studies met the criteria for data extraction.
- These studies showed that wild-caught oysters contained more than double the amount of microplastics than aquaculture-raised oysters (2.18 ± 0.77 microplastic particles per gram of organism wet weight [MPs/g] and 1.03 ± 0.33 MPs/g, respectively), although the differences were not statistically significant.
- The authors believed that these data likely reflect the clean/pristine water conditions where aquaculture oysters are commonly cultivated.

Chemicals adhered to microplastics are not a source of exposure

- Bakir et al. (2017) conclude that "*ingestion of microplastic does not provide a quantitatively important additional pathway for the transfer of adsorbed chemicals from seawater to biota via the gut*."
- Beckingham and Ghosh (2017) concluded that uptake of chemicals from microplastics by sediment-dwelling aquatic organisms is likely to be very small compared with uptake from sediment particles

USEPA 2015

Conclusion: Plastic gear is not contributing measurable microplastics or chemicals to the aquatic environment

Specifically, plastics, such as HDPE and PVC that are used for shellfish aquaculture do not contribute significantly to microplastic pollution, microplastic consumption by marine organisms, or leaching of chemical components