

Environmental Effects of Marine Aquaculture

- Escapes/biological pollution
- Pollution
- Habitat and site-specific issues
- Issues associated with the culture of carnivores

Escapes/biological pollution

- Introduction of non-native species
 - Competition for food and habitat
 - Predation on native species
- Genetic effects on native species from:
 - Native genotypes with selection of traits beneficial for culture
 - Non-native genotypes (e.g. European strains of Atlantic salmon) capable of breeding/hybridization
 - Genetically modified organisms (GMOs)
- Disease and parasites
 - Transmission from cages/pens to the wild
 - Transmission via escapes

Discussion Questions

- Do we care about genetic effects on wild populations, on ecosystems, or both?
- Is it possible to generalize about the risks of culturing exotic vs. native species or do we have to evaluate each case?
- Is it better to get broodstock from wild populations or accelerate creation of “domesticated” varieties?
- Is there a level of escape/introduction that is acceptable?
- How does culture of fully marine species, which can potentially release viable gametes from net pens, change the equation?
- Can disease and parasites be adequately contained when using open systems?

Pollution

- Nutrients
 - *Nitrogen*
 - *Phosphorus*
- Wastes (organic pollution)
 - *Feces*
 - *Uneaten food*
 - *Dead animals*
- Therapeutic drugs and chemicals
 - *Pesticides*
 - *Antibiotics*
 - *Anti-fouling coatings*
 - *Others?*

Discussion Questions

- What is important—scale, intensity of culture, density of farms, oceanography (currents, tide, depth, etc.)?
- How significant a threat is pollution to marine wildlife and ecosystems at current and expected levels of production?
- Are therapeutic drugs and chemicals a significant concern?
- Does concern about transmitting disease or parasites to the wild outweigh the risks of harm from therapeutic agents?
- Should pollution costs be internalized? If so, how?

Habitat and Site-specific Issues

- Predator control
 - Effects on protected species
 - Ecosystem effects
- Displacement or disruption of native species
 - Effects on migratory routes
 - Displacement or degradation of habitat
- Benthic habitat modification
 - Short vs. long-term effects
 - Local vs. ecosystem effects
 - A function of duration and intensity of culture?

Discussion Questions

- What types of ecosystem effects could be avoided through zoning/siting?
- What are the potential ecosystem effects of predator control?
- Do farms provide habitat for marine wildlife?
- Do/could shellfish farms have a significant effect on nutrient/plankton dynamics?