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Next Generation Scientists—Next Opportunities

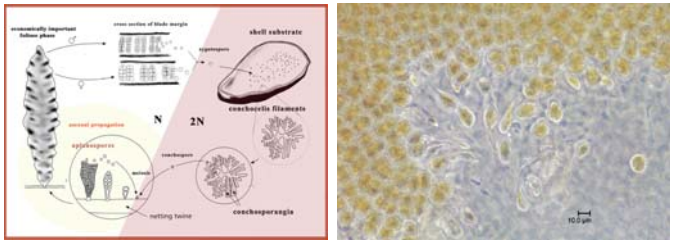
Use of Native Seaweeds for Bioremediation of Coastal Waters in the Gulf of Maine

Environmental Issue

Fish farming along the coast of Maine has increased over the past several years due to increased demand for fish coupled to a dwindling wild harvest of commercially important fish. Fish farming in the United States is focused primarily on salmon; however, the culture of flounder and cod is also underway on a smaller scale. Depending on flushing rates, fish farms could lead to eutrophication of coastal waters.

Eutrophication of coastal waters from terrestrial sources is well known (Gowen et al., 2000), but eutrophication of nearshore waters by salmon mariculture was unanticipated. After demonstrating that fish farming had an effect on water quality in Norway (Ackefors and Enell, 1990), the finfish mariculture industry worked to improve their systems. Even with these improvements, annual discharge per ton of raised salmon was estimated at about 35 kg nitrogen and 7 kg phosphorus in parts of New Brunswick (Chopin et al., 2001).

Experimental system at UMaine's Center for Cooperative Aquaculture Research (left). *Porphyra* growing in the intertidal zone at Schoodic Point, Maine (center and right).



Generalized life history of *Porphyra, (*left, Adapted from Graham and Wilcox, 2001). Asexual spore release (right, also see yellow highlight on left).

Scientific Approach

- Hypothesis

Asexually generated *Porphyra* spp. ("nori") can reduce nutrient inputs from fish farms as part of integrated mariculture.

- Research Plan
  - Determine the physical and biological factors that control the switch between sexual and asexual reproduction in native *Porphyra* spp.
  - Assess the effect of seaweed mariculture on dissolved nutrients (e.g., nitrogen) in the water column.
  - Assess the effect of fish farming on growth rates of *Porphyra* spp.

Impact

- Gulf of Maine
  - Establish sustainable integrated mariculture in Maine.
  - Provide additional fisheries-related jobs while producing edible sea vegetables.
- Wider application
  - Use of nori in other areas of the temperate Atlantic to sustain coastal water quality.
  - Bioremediation of areas with known point sources of terrestrial nutrients.

A typical salmon farm (photo courtesy of Chris Bartlett).

Literature cited:
Ackefors, H.; Enell, M. (1990). Discharge of nutrients from Swedish fish farming adjacent to sea areas. *Ambio* 19, 28-35.
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Gowen, R. J.; Mills, D.; Trimmer, M.; Needwell, D.B. (2000). Production and its fate in two coastal regions of the Irish Sea: the influence of anthropomorphic nutrients. *Marine Ecology Progress Series* 208, 51-64.

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