Optimizing Atlantic striped bass aquaculture through the integration of duckweed and macroalgae

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This New Jersey Sea Grant project employed duckweed's and macroalgae's water purifying and nutritive qualities within an integrated multi-trophic aquaculture (IMTA) system. The system coupled fish and macrophyte growth into a single, closed setup that rears bass sustainably and cost-effectively. By reducing the need to purchase water cleaners and fish food, the IMTA system boasts several advantages over traditional aquaculture, including lower production costs and environmental impacts. In addition, the project shed new light on alternative foods' value by determining that partial diets of IMTA-grown vegetation can cultivate striped bass as successfully as commercial pellet diets.

The ability to uptake and convert wastewater contaminants into nutrient-rich, digestible biomass makes duckweed and macroalgae apt fish foods and aquaponics components (Leng, Stambolie, & Bell, 1995; Zitouni et al., 2014). Duckweed can reduce wastewater concentrations of ammonium and nitrate by 90% and 70%, respectively, while maintaining neutral water pH and reducing suspended solids (Ziegler, Sree, & Appenroth, 2016). In addition to stabilizing water quality, macroalgae can reduce fishpond ammonia concentrations by 90% (Cohen & Neori, 1991). Usually lost, excreted macronutrients are also nitrified by duckweed into usable forms for fish. Duckweed is nourishing for both tilapia and carp, the latter increasing in mass by 1 gram daily after eating only 4% of its weight in duckweed (Hassan & Edwards, 1992). Macroalgae can also expedite trout, tilapia, and salmon growth, making it a great candidate for this alternative fish food study (Ortiz et al., 2006).

The project shed new light on the macrophyte's nutritional value compared to commercial food. It showed that IMTA- and conventional aquaculture-grown fish mature similarly when the use of macrophyte is 40% of the fish diet. Throughout the project's life, 12 students were introduced to aquaculture, its strengths, and the technology's challenges. The students' work on this project led to a Cap-Stone thesis on the use of macroalgae in sequestering carbon and a Cook Honor College thesis simulating an IMTA system growing salmon, Ulva (macroalgae), and Sea Urchins.