MIT tests self-propelled cage for fish farming

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(PhysOrg.com) -- A self-propelling underwater cage developed and recently tested by an MIT researcher could not only cut costs for offshore ocean-based fish farms but also aid the movement of such operations into the high seas, avoiding the user conflicts and compromised water quality of coastal zones.

Fish farms account for more than half of the seafood produced globally; 40 percent of the seafood consumed in the United States is farmed in other countries and imported. However, very little of that comes from ocean-based farms.

In conventional offshore fish farming, cages are routinely repositioned to control disease. Stout towboats haul the enormous cages to another site, and both the cage size and typical propulsive inefficiency of boats make such movements very energy-intensive events.

Cliff Goudey, director of MIT Sea Grant's Offshore Aquaculture Engineering Center, is exploring a different approach to moving the cages. By placing large, slow-turning propellers directly on a cage, Goudey frees it from the normal constraints of a boat. His system uses a pair of eight-foot diameter, electrically powered propellers, with 6.2-horsepower underwater motors. The motors are powered through tethers to the surface attached to a diesel generator and a pair of motor controllers mounted on a small boat.

Recently he tested the approach at Snapperfarm Inc., an offshore fish farm in Culebra, Puerto Rico, that grows cobia in submerged cages. By fixing a pair of the propellers to the mid-depth of a 62-foot diameter Aquapod® fish cage in a horizontal line 9 feet apart, Goudey maneuvered the cage as well as any boat-based system.

"These tests demonstrate that the concept of mobile cage operations is technically feasible," Goudey says.

The project is funded by NOAA's Marine Aquaculture Program, aimed at demonstrating the technology needed to raise fish in the vast portions of the oceans that are too deep for conventional anchored fish cages. By operating while submerged and in predictable ocean currents, mobile fish farms need only a modest means of positioning to stay within planned trajectories.

Although the recent tests are promising, Goudey notes that "the economic feasibility [of offshore mobile fish farming] remains an open question, as only a very large-scale operation" could be viable.

However, "the utility of cage self-propulsion extends well beyond the futuristic application of ocean-going aquaculture," he continues.

For example, besides the use of self-propulsion for routine cage movements, the propellers have additional utility. Often, the limiting factor in cage stocking density is dissolved oxygen levels due to fish metabolism during slack water. The propellers provide a ready opportunity to supplement water flow through the cage during those brief events, thereby allowing larger crops of fish.

All involved in the testing were impressed with the performance of the propellers. Steve Page, CEO of Ocean Farm Technologies, developer of the Aquapod, says, "My opinion of the [propellers] is very high. I want to consider using them to help with future installations. There is also a growing demand for self-propelled harvest pens that may be a great market for this technology."

Brian O'Hanlon, founder of Snapperfarm, says, "I was incredibly impressed with the power and efficiency of the [propellers] and Cliff's ability to steer the cage. I see this technology having a broad range of applications in mariculture and other marine industries. This futuristic concept of farming the high seas just came one step closer to reality."

With the technical feasibility proven, Goudey is turning his attention to assessing the system's economic viability, both as a tool for routine cage movements in offshore fish farming and in a business strategy involving mobile cages associated with specific routes in concert with predictable ocean currents or tidal gyres. This future work will involve the collaboration of ocean modelers and aquaculture business people.

Provided by MIT

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