Survival of Aquaculture Cages in Offshore Environments

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The development of offshore fish farming technology is being driven by a wide array of factors which include human impact on near-shore and inland water quality, low dissolved oxygen or oxygen depletion, fear of fish disease transmission to wild stocks, nuisance seal and sea bird predation in near-shore cage sites, lack of availability of new in-shore sites, the current failure of the N.E. fishery and by the need to produce more of the 6 billion dollars of fish products imported annually by the United States, in order to improve our international balance of payments.

To expand, the American aquaculture industry has to move to more exposed sites. To do this an enclosure must be developed that can withstand much higher forces, is less labor intensive to farm and is serviceable under more difficult conditions. The major limitation to expanding aquaculture into these exposed sites is the inability of existing surface based cage systems and their fish stocks to survive storm waves.

Recent field studies have shown that spherical and elliptical submersible cages can be designed and built that withstand ocean conditions. These designs succeed because of their inherent high strength ability to submerge and their novel mooring system.

In bad weather, once submerged beneath the surface, these cages and their contents of farmed fish are subjected to dramatically lower forces from large storm waves than are conventional cages left to survive the unpredictable surface conditions. The system is self-cleaning, for example, they require no net changes, allow for mortality removal and harvesting of fish without the need for specialized equipment or trained divers, employ a mooring system developed for offshore conditions and improve on methods for net-cage attachment to reduce shock loading.

Three different conditions have been used to test the 12 m (1000 m^3) cage design: an exposed site in the Bay of Fundy (severe winter storms, strong tidal currents, spring ice), a more protected site in the Bras D'Or Lakes (excellent growing conditions, stressful warm surface water for 2 months, severe spring ice) and a new high current, heavy ice site. At the Fundy site, a 1000 m^3 cage survived severe winter storms undamaged, while steel and flexible collar cages at adjacent sites suffered total loss or incurred damage. At Bras D'Or, a similar cage operated through its first winter successfully and will produce 20,000 charr this year. The St. Lawrence site has yet to produce any data. An exposed site in the Seribu Islands, Indonesia will employ four 12 m cages for warm water fish culture, delivery in 1994.

A new fish cage has been designed, manufactured and field tested that is an efficient culture enclosure, has a competitive initial cost, lower operational and maintenance costs than conventional cages, is simple to operate and is self-cleaning of biofouling. Submersible geodesic fish cage development and concomitant improvements in operational logistics at exposed sites may prove to be a major contribution to extending aquaculture offshore.