MARINE FINFISH AQUACULTURE NETWORK

Offshore opportunities for artisanal aquaculture

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Traditional cage aquaculture utilising basic floating net structures in protected coastal environments has long been a fundamental means of raising fish for the Asia-Pacific region. While this approach has provided success, it is also due for reassessment and improvement as near shore production sites become crowded and polluted and new technologies emerge that stand to benefit both the environment and fish farmers.

Development of open ocean aquaculture has created opportunities to transfer and apply new technologies to established production methods. While commercial scale open ocean aquaculture operations are capital intensive and not realistic for the average family farmer, a strong argument can be made for the feasibility of using small submersible net pens designed for exposed conditions in artisanal applications by apply in low volume high density (LVHD) production methods. Two such examples of this equipment are the OCAT pen designed by the United Soy Board and Micropods engineered and produced by Ocean Farm Technologies, Inc.

With large scale aquaculture applications it is a common assumption that bigger net pens are better based on the decreasing cost per unit of volume of larger net pens. Yet this assumption can only be validated when stocking densities remain fixed regardless of the size of the net pen. Upon further analysis one can conclude that smaller net pens suitable for artisanal production are capable of higher stocking densities under appropriate conditions.

The concept of LVHD aquaculture is well established and based on the fact that in open water production systems, smaller pens maximise the exchange of water per unit of volume when compared with larger pens. Essentially smaller pens have more surface area in relation to their production space than big pens. This means that the number of fish metabolising between the clean water source and interior space is minimised. Under these circumstances environmental conditions in the pen are optimised and allow for higher stocking densities than might be reasonable in larger cages which have slower water exchange rates. This improves the economic feasibility of small scale operations for artisanal farmers.

Yet this concept can only be fully realised when smaller net pens are placed in exposed sites with ample current and depths. Until recently this has not been feasible because traditional pens are not designed for this environment. By utilising small scale versions of fixed volume offshore pens such as those previously mentioned, one can address many of the challenges faced by traditional surface pens situated in protected bays and waterways.

Three Micropods of various sizes waiting to be positioned in Puerto Lindo, Panama.

First and foremost environmental impacts can be reduced when pens are placed in water with both reasonable depths and currents. These conditions improve the distribution of pen effluent and allow the surrounding environment to better assimilate it. Naturally a reduction in concentrated waste accumulation benefits the local ecosystem and minimises the likelihood for disease outbreaks at the farm site. In turn the high water exchange rate at exposed sites provides ideal dissolved oxygen levels inside the cage and rapidly flushes away metabolic wastes benefiting the crop.

Relocating operations further from shore eliminates common use conflicts in crowded regions where demand for water space can be high. In addition to providing a better natural environment for the culture of crops, moving offshore reduces exposure to coastal pollution sources. Contact with runoff and direct contamination from land can be minimised with exposed site conditions.

Storm damage and subsequent crop loss is also an issue in near shore production areas where typhoons can devastate surface pens. Available OOA equipment offers solutions to these challenges. This is because wave energy decreases substantially with increasing depth. Submersion of pens prior to storms reduces the energy levels and the associated risks which the equipment is exposed to. Moorings can also be designed to provide self-submersion in storm surges.

Predators are another consistent challenge faced in all types of aquaculture operations and typical netting materials are often inadequate at preventing persistent intrusion attempts.

The application of vinyl coated steel wire mesh to the rigid frame of Micropods eliminates the threat of crop damage or loss posed by predators whether it is at or below the surface.

One must also consider the distribution of risk when working with smaller pens. The opportunity for total crop loss is diversified when multiple pens are used. The total risk posed by disease, damage to equipment and subsequent escape opportunities are all reduced when an entire crop is distributed in multiple pens.

Of course the requirements for any new equipment must not exceed the reasonable capacities of current farmers if such a transition is to occur. First the pens must be of a reasonable size that makes management by an individual or small crew easy. Existing boats should be sufficient to service them and if necessary tow them from one location to another. Routine operations also must require minimal equipment so that a barrier for entry is not created.

In the case of Micropods which have diameters of 10m or less, raising and lowering of the pen from the surface can be accomplished with a hand operated winch and all feeding, harvesting and repairs can be conducted near the surface by rotating the pen. This permits users to work almost exclusively from the surface. Diving requirements on pens of this size are mostly restricted to mooring inspection and maintenance and a simple hookah apparatus should be sufficient for most applications. The OCAT pen design also facilitates work from the surface.

Micropods are easily cleaned by rotating portions of the pen at the surface for drying. If appropriate, cleaning with a portable pressure washer can greatly accelerate the speed and ease at which fouling can be removed. According to the Soybean Industry's engineering manual the application of antifouling paint to the OCAT pen proved valuable in minimising the cleaning required.

Assembly of Micropods is relatively simple, can be accomplished in less than a day by a small crew and once completed can be rolled from a beach into the water, eliminating the need for docks or other major infrastructure elements that may be difficult or expensive to come by in some regions.

Local residents roll a Micropod off the beach.

Most submersible pens can be moored with a simple single point mooring system. In this configuration the pens swing freely in a watch circle with the prevailing current. These are the simplest systems to deploy as well as the most economical. Additionally, the larger site footprint created by a single point mooring further reduces the potential for concentrated waste deposition.

The benefits to moving production away from protected waterways to exposed ocean sites are clear and the time has arrived where such a move is not only feasible but it is reasonable. Adaptation and acceptance by established entities will take time and the initial steps may require the assistance and collaboration of government or NGO organisations to realise this. This new platform may also provide a means for artisanal fishermen to convert to aquaculture, especially because they are adapt at working at sea. Just as commercial scale aquaculture begins to accept the advantages and necessities of placing production in exposed open ocean sites, small scale artisanal farmers will likely draw the same conclusions. Until this transition begins the best interests of both the fish farmer and the environment cannot be realised.

Reference

Cremer, M.C., Lan, H.P., Chappell, J. (2008). Engineering Manual: Soybean Industry OCAT Offshore Ocean Fish Culture Cage.

EUS...from page 28.

The project created a strong Regional Aquatic Animal Health Programme in Asia. Within Asia, the Technical Guidelines provide the basic Biosecurity framework and guidance for national and regional efforts in reducing the risks of diseases due to trans-boundary movement of live aquatic animals. Since 2000, supporting the implementation of the key elements of the technical guidelines has remained the focus of NACA's regional aquatic animal health programme. EUS in Africa has succeeded in focusing the attention of policy makers and researchers on issues of risks associated with movement of live aquatic animals and the need for effective national and regional aquatic animal health management strategies. Recognising the serious consequences of EUS, several southern African countries have now come together and taken preliminary steps to address the issue of aquatic animal disease management. In response to requests of FAO member governments for technical assistance, a regional Technical Cooperation Project *Emergency assistance to combat EUS in the Chobe-Zambezi River* has recently been approved by FAO for implementation. This regional project in operation since October 2007 is being participated by seven southern African countries (Angola, Botswana, Malawi, Mozambique, Namibia, Zambia and Zimbabwe). Several activities including capacity building, surveillance and disease reporting are being held as part of this project with the long term objective of developing and implementing an effective aquatic animal health management programme for southern Africa. NACA's regional aquatic animal health program executed in close partnership with FAO of the United Nations and the Office International des Epizooties (World Organisation for Animal Health), could serve as useful model for development and implementation of a possible future regional aquatic animal health programme in Southern Africa.