Open Ocean Aquaculture: From Ireland to the Future

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The real first commercial salmonid cage farm in Ireland was established circa 1976 in an inshore bay in Connemara, Co. Galway, using square wooden cages. From there, technological advances, a better understanding of salmon biology and feeding requirements, not to mention legislation, environmental pressures/concerns, and the availability of sites, cage farming has developed from close inshore small wooden cages to offshore sturdy, strong, capable, flexible cage farms able to withstand the severest weather conditions and currents and yet still produce excellent quality fish in a reasonable time period. Without a doubt in a short time, fish farming has made huge leaps and bounds and offshore cages are an integral part of most marine farms in Ireland these days. Whilst a variety of different types of cages and materials have been tested and used, varying from plastic to steel, submerging or floating, the type and size can really be dependent upon the site location, currents, winds, number of fish, but more importantly upon costs.

It costs a lot of money to buy, service, and maintain an offshore cage farm, with equipment being specialised and accordingly quite expensive. The running costs of an offshore farm can be daunting by comparison to those of an inshore facility. Strict budget controls will need to be applied and adhered to, as the price of salmon does fluctuate regularly and costs can rapidly climb in relation to market price. Also due to the nature of the sea, an offshore farm will receive quite horrendous treatment from currents, wave action and winds. The ancillary equipment therefore needed,
from ambitious to ripping and holy, will need to be of the strongest quality attainable (or affordable).

As mentioned, there is a variety of cage types available for offshore farming. The type to use is always a choice for the potential buyer, but there are a few major points to remember before deciding upon which system one will use. Firstly, there is the cost of cage, parts, etc., and of course its actual design capability. What types of wind strength will it stand up to and how durable and secure is it? The costs, whilst a major factor, must be balanced in relation to proposed site locations and the amount of fish to be cultured. Will the numbers of fish give a realistic profit at the end of the day? Don't forget, the running costs of the equipment, and ancillary costs, i.e., net washers, antibiotics, food, fuel, repairs, maintenance, etc.

Establishing an offshore cage facility is fun:

(a) Better growing conditions, i.e., deep water, fast-flowing currents, good water exchange.

(b) Production increases, faster growing fish.

(c) Environmental friendliness, out of sight — out of mind. No by-catch of local species, or pollution-related incidents, and subsequently, little opposition from the powerful environmental lobby.

(d) Maintenance. Once assembled, having occasional and routine maintenance programmes, there is little need to spend much more repairing these types of cages.

(e) Profits. More space equals more fish equals more money.

Due to the size of these cages, more fish can be cultured than at an onshore site. This always profit margin for those wishing to go offshore.

While these offshore cage systems have proven their worth on many commercial farms, in Ireland, we must ask what is involved in establishing, maintaining, and running one of these cage systems, and more importantly, are they viable elsewhere?

Well, like in current licensing laws, the lack of suitable license sites and severe environmental and political pressures, due to the industry in Britain, has led to the move to deeper waters, out of view of public eyes and environmental concerns. This all has resulted in the decision to develop offshore sites in accessible areas where leases and infrastructure are available. Certain government agencies operating in peripheral locations, and who provide grants for aquaculture and these have been used. But in some areas, quite suitable for offshore sites, there has been no grant available. Typically, some farms started from virgin offshore sites, and others slowly developed from there, dependent upon cash flow from previous and prior developments.

So how do we start an offshore site? There are some serious decisions to be made before a farm is assembled. Laid out and moored in a position some distance out to sea.

These include:

- location: navigational rights, fishermen's rights
- tidal conditions, water depth, quality
- bottom type: mud, sand, hard base
- wave direction and type
- height
- availability of local infrastructure, power, roads, etc.
- staff qualifications, experience, availability
- disease status: any natural stockfishe disease in area
- grant aid: available, tax breaks or incentives
- site potential: further development requirements
- health and safety rules and regulations: dangerous place to work.
These having been considered, then financial costs must be studied:

- How much will the desired cages cost?
- How much will the cage equipment and nets cost?
- How much will the ancillary equipment cost (blocks, buoys, etc.)
- Staff costs?
- Licensing fees?
- Spare costs (in case they are not self-supplied)?
- Feed costs?
- Medications; vaccines?
- Maintenance/repairs?

Running costs in general — these have to be carefully detailed, assessed and estimated for the whole growing cycle of the proposed stock.

Performance:

How do offshore cages perform in the ambient conditions expected of them? Each cage system must be tough, durable, flexible, non-corroding, sturdy, workable, and produce with confidence, fish of superior quality and size. So what makes a good offshore cage? Besides the actual testing, the monitoring system (cage size, chains, and layout) is of paramount importance. How the cages are monitored will ultimately determine their survival against the elements. As each type of cage system may have its own manufacturer's guidelines, it is a specific type of monitoring layout, the most practical will be determined by:

- Sediment type
- Previous experience
- Weather conditions, on average
- Cost analysis and affordability

(c) Equipment used.

Many variables of monitoring systems have been used, and the most favoured or used by myself in the three types concrete eyed mooring block, two-inch link-stud chain, 14-tonne welded boxes, 15-inch trawl ring and 22 mm double-beaded 220 kg rope tie rope. Each cage is monitored by two blocks per corner and when adjacent, connected through separate contacts to the adjoining cage 300 m away, by surface ropes.

Disease/Treatment:

Disease due to the sheer working area of an (octagonal cages) defines 13 000 m watching the stock has been and will be difficult, but it can be done. Extrinsically, specific host specific host system and feeding behaviour will alter a good manager/biollogist to pending problems. Treatment for disease or cell can usually be done via one of two methods.

The first involves — in the food. This, whilst probably the reliable method, does have its drawbacks in that it's difficult to answer the following questions:

(a) Are all fish getting food plus medication?
(b) Is the dominating factor preventing some from feeding?
(c) Are the stock actually feeding in the initial phase and that receiving antibiotics?
(d) Is the antibiotic compatible with mixing in the feed?
(e) Are large amounts of antibiotics too costly?

The other way to be successful in this method is to have the early warning of problematic fish. It is the responsibility of the engineer/biollogist to respond. Remember early diagnosis means early treatment, before the problem escalates and is physically/medically unreatable. Another point to remember is the cost of
treatments. An antibiotic treatment in food feed for 30 days to a number of cases is very effective. One wants to have more results and be addicted. This is done by constant vigilance and knowledge and experience of the stock.

The second method is the fish treatment. This is an arduous task, involving much labour. The fish must be lifted, and if possible a large tank placed all around and under them. This is a difficult task, and the fish approach to some cases has just been to raise them to 6-10 ft, close them in the tank, place a lamp around the sides, and then apply the chemicals into the cage, hoping that contact with the crowded fish will achieve results.

As can be imagined, this is not a good method of treatment, as:
- It produces high levels of stress;
- The water volumes, calculations and decision factors may be inconsistent;
- It is expensive with both labour and chemicals;
- Treatment may not be effective;
- It is hard to monitor the results; and
- The levels drop quickly and the oxygen systems have to be used.

Accordingly, in my view the best way to prevent or treat any serious problems really will be in the ability of the farm personnel to spot the problems at an early stage and treat before the situation really develops.

A good rule I go by is: whatever you can do on the surface, do it by five and set the situation within the stock. Get the problem at the start. This is where constant vigilance by the farm personnel, divers and biologists is of paramount importance.

Feeding:

Feeding in these offshore cages can only be effective if all the stock have a chance to receive the pellets being offered. In this respect, the most popular method is to get maximum spread and amount by air compressed systems mounted on barges and drop, or blow water/corn feeders in boats. Each method is effective and the mechanics are available at a reasonable price from suppliers. Again, vigilance by the feeding crew is essential in order to ensure the success of the stock, as it only takes a short period to feed for a problem to occur. The use of water systems is not practical due to the size and depth of the water. Most feeding, while more controllable in smaller pens, does produce good fish. In the larger biogas units, the sheer logistics can pose problems and the size of the cages will allow for more waste. Food conversion ratios (FCR) of 1:1.2 are achievable and this can be monitored among humane counters and good feeding practices.

Diving:

Again due to the sheer size and depth of these cages, plus the "hostile" environment, diving in or around offshore cages can pose problems. Safety must be the prevailing thought in everyone's mind, most especially the divers. This is not like diving in shallower marine pen facilities, where bottom diving occurs. Depths of up to 40 m will require specific dive times and decompression stops. Only experienced, qualified divers should work on offshore cages. Their duties can include: small dots, moving block, anchor, and bottom adjustments and net inspections. Diving in biogas units requires time, so careful planning is essential.

Harvesting:

The harvesting from offshore cages is an expensive essential part of the operation. Ropes, pumps and cranes are needed onsite, with transport and packing facilities at a deliberate distance on the shore. Most offshore sites are close to large areas of land and thus, with temperature (ice) systems to cool down the fish.
from the cages. On average, 20-30 tonnes per cage per day are usually harvested and if the fish are hILD, the blood products are harvested for use in biomedical industries. From these processing plants, fish are sent to European markets within 24 hours. This allows a completely fresh product to be harvested, packed, and presented to the customer within two working days.

Conclusion:

Salmon farming is a profitable business. We now have the technology, experience, equipment, and ability to develop it further. However, whilst a base for salmon farming, we have not exceeded their potential. We now have to venture further and this means offshore, either in coastal or protected areas or in the open ocean. Now that we have the necessary combinations to achieve offshore cage culture, and it’s been tried, tested, and proved in other aquaculture, each of which satisfy the same criteria of sustainability, the opportunity has been shown to be there. All that’s needed is somebody or some company to take the initial steps to get the licence, the staff, and then the equipment to put them together and start farming.

It’s your future, you have to control it. You have to drive it forward and progress and control your own industry to be established and survive in the world aquaculture market. Be under no illusions: offshore cage farming is costly and initial start-up has to be done properly and use the knowledge and experience of those who have already done it. But the potential is unlimited and profits await you. The future is out there, go get it!

About the author/presenter:

Joe McElwee qualified from college in Galway in 1980 within the aquaculture field. Initially having spent time working at local salmon hatcheries, he went to Oregon and spent 9 months working for Oregon State Fisheries at one of their Pacific Salmon Hatcheries. Whilst there, he was also involved in some initial work on Atlantic salmon aquaculture, in its infancy stages at that time.

In 1987 Joe returned to Ireland to take up a management position at En-Nore, one of Ireland’s most modern and technologically sound hatcheries, producing in excess of 800,000 smolts p.a. In 1990, Joe took up the position of Scientific Officer in the Western Fisheries Board to work on science investigations and support procedures.

In late 1990, Joe was appointed to the Management position of Kenmare Salmon L.I.D., a large purpose built facility producing salmon and trout. Whilst in this position, Joe was extensively involved in the first salmon trials in Ireland, and the project was a remarkable success. In late 1994, Joe was appointed to a management position to run the large Bridgeport Marine site in Co. Louth. This involved much pioneering work with regard to Bridgeport and the setting-up of two new sites.

In 1995 he took up his present position as Manager of Mullaghmore Sea in Galway.