JUST AGRICULTURE
multidisciplinary e-Newsletter

Floating In-Pond Raceways (IPR) – Sustainable Alternative to High Density Aquaculture in Ponds.

Jane Jacob[*1]
[*1]ICAR-CIFE, Mumbai

ARTICLE ID: 026

Introduction

Aquaculture is classified into open, semi-closed, and closed systems. Open aquaculture is done in the open waters directly such as in ponds or raft culture of bivalves in a water body. The semi-closed system is that in which the water passes through the culture system only once. Raceways are typical examples in this category which is also called the flow-through or once-through system. The advantage of using the once-through system is that when water flows in a certain velocity, it can efficiently aid in the removal of faeces and leftover feed particles in the culture system. Flow-through aquaculture is practiced in earthen ponds, concrete tanks/channels, vats, silos, and also tanks made of other suitable materials like FRP, Plastic, etc. the shape of structures used in flow-through also varies, it is mostly rectangle but there are circular tanks as is in the case of vats and silos. Overall, the water enters through an inlet and exits through an outlet into a water discharge system making use of it only once. Considering the design aspects, it is certain that flow-through aquaculture can be done only in regions with sufficient water supply all-round the year and availability of natural slope or pumping mechanism to pump water in and out of the system. Thus, over the years flow-through systems/raceways have been practiced widely in the culture of salmonids and other high-value fishes which can survive in high DO and shallow depth. But, what if the raceways could be used to culture any species anywhere in the world? That would be a very useful technique for fish culture. The answer to this is floating raceways or floating IPS (in-pond raceways). Floating raceways were also developed for salmonid culture but for rearing them at a lesser cost.

JUST AGRICULTURE
multidisciplinary e-Newsletter

Floating raceways are similar to floating cages but they are made of FRP or similar durable materials instead of the net bags. It is similar to raceways in that it is facilitated with a water flow with the aid of mechanical devices. It mimics the culture conditions of a pond culture but with higher control and waste disposal mechanism than pond culture. It is also called in-pond raceways (IPRS) and in that case, it may not be the floating model.

Floating IPS/IPRS

These raceways are technically zero-water exchange intensive aquaculture systems and they are versatile so that they can be placed in any water body like a freshwater pond, coastal pond, or even other open water bodies like a reservoir with slight modifications. These raceways are a synergy of cages and pond aquaculture. It nullifies the adverse effects in both and gives a whole new environment for fish culture. It provides containment for the fishes in culture and also prevents their escape into the water body which is of utmost importance in open water bodies. It is also advantageous because the flow-through system of the raceways helps to remove the waste and carry it into the pond but away from the culture system improving the physio-chemical quality of the culture water. Also, the stocking density can be increased potentially in comparison to pond culture. Also, different species can be cultured in the same water body simultaneously. They can take up shape as per the convenience of the fish farmer and site conditions. It may be rectangular, circular, hexagonal, or even conical. As the raceways are made with solid substance i.e., not a net, it has also been used for maintenance of bio-floc within a large water body. Thus, floating raceways/IPRS may be strategic to bio-floc aquaculture or multi-species aquaculture in reservoirs and open water bodies in the future. The in-pond raceways are commonly referred to the concrete raceways built into smaller water body like ponds and the floating raceways are used in reservoirs, estuaries, and coastal areas.

Structure and design components – a general view

The following are the components of a floating raceway/in-pond raceway

The floating raceways primarily consist of the culture tanks, water transport system. The culture tanks are called the raceway cells and they may vary with the size of the ponds. Typically, 3 celled tanks are preferred in a pond of 1 ha. The cells must have baffles that

JUST AGRICULTURE
multidisciplinary e-Newsletter

regulate the water flow and also aerate the water in the process. The cells are also covered with meshes in the ends to prevent the escape of fish into the main water body. Next is the pumping system which varies with the size and number of the raceway cells. Another important component is the backup generator which can be operated in the event of a power failure. When installed in reservoirs or open water bodies, it will depend on the water body and the permitted level of intervention for aquaculture in them.

Case studies

The in-pond raceways system was highly investigated as a research aspect in the 1990s in the Auburn University. Lately, they were endorsed by several institutions in the USA such as the USSEC, the Soy Aquaculture Alliance, the Alabama Cooperative Extension System, the Alabama Agricultural Experiment Station, and Pentair Aquatic Eco-Systems. The initial trials were on the concrete-based IPRS but now it has evolved into the FRP floating raceways. This has led to various levels of commercialization and promotion worldwide. It was successful in China, Vietnam, Mexico and it was also tried in India on an experimental scale.

USA

USA is the founding country for IPRS which was started in a conventional pond in Auburn University. It was made using HDPE and airlift devices were used to create the water recirculation between the raceways and the pond. They also developed a model made from aluminium. Commercially, it is has been successfully used for catfish production in US with a FCR 1.25 to 2.49.

China

The IPRS in China started in 2013 with the introduction of grass carp in IPRS by the U.S. Soybean Export Council (USSEC) at the Pingwang Fish Farm in Shanghai. With the highly ambitious aquaculture industry in China, they are facing threats because of increased cost combined with pollution and they consider the IPRS to be a sustainable option in the aquaculture frontier for China. By the end of 2019, there was an estimated 6000 IPRS operating in Chinese aquaculture.

JUST AGRICULTURE
multidisciplinary e-Newsletter

Mexico

The In-pond raceways tried in Mexico were of the non-floating model. It was made of cement concrete and constructed in a pond of 2.6 ha. Earthen ponds. It was done in 7 raceways. The fish stocked was tilapia in 1.88, 2.13, 2.09, 1.96, 2.04, and 1.52 kg/m^3. The final biomass harvested was very promising they obtained higher growth than conventional pond culture. They concluded that a stocking density of 17,000 fish per raceway (113 per m^3) could produce a total of 69 tons/ha/yr. with an average survival calculated at 86%.

Vietnam

Marine fish farming is a very promising area in Vietnam but the investment for hatchery production of marine fish seeds is very high and also it had reduced survival in most of the cases and hence cheaper alternatives were sought. In the search for such alternatives were the floating raceways which were inexpensive, higher survival, and at the same time sustainable. This is because it can be installed in already existing coastal ponds, high stocking density with reduced predation is seen in larvae and they are nourished by the natural food in the pond. It was developed as part of the Smart agriculture Technology (SMART) project in Vietnam in collaboration with Australia.

India

Superior aquaculture Pvt. Ltd. has invested in the development of an In pond raceway system (IPRS) in India. They are based on the patented IPRS technology from North America mentioned earlier. They plan on introducing bio-floc in India and claims it to be less costly than RAS. It can reduce water usage and it is sustainable. They have their first project in freshwater to be set up in Jharkhand and the second in Maharashtra would be a salt water model. They expect a 40 to 50 tonne annually from a pond of 1 ha.

Conclusion

Thus, even though it is a relatively new and expensive technology, it must be tried by farmers who can afford it, and also it can be taken up for research ideas in India to develop low-cost versions. It is advantageous because it needs no water exchange for the maintenance of water quality. Moreover, the water quality is almost always ideal due to the aeration created by the

JUST AGRICULTURE
multidisciplinary e-Newsletter

water pumping. In addition, it has several encouraging management conveniences, it reduced feed loss as the feed can be calculated for the exact number of fish in the culture at a given time and no assumption. It also helps in hassle-free harvest and cleaning operations.

References

1. Jharkhand Farmer, First In India To Adopt US Fishing 'raceway' Technology (glamsham.com)
2. Floating raceways provide option for marine fish fingerling production « Global Aquaculture Advocate (aquaculturealliance.org)
3. Commercial demonstration of in-pond raceways « Global Aquaculture Advocate (aquaculturealliance.org)
4. In-pond raceway systems in China aquaculture - Undercurrent News
5. GOAL 2016 preview: IPA technology catching on in China « Global Aquaculture Advocate (aquaculturealliance.org)