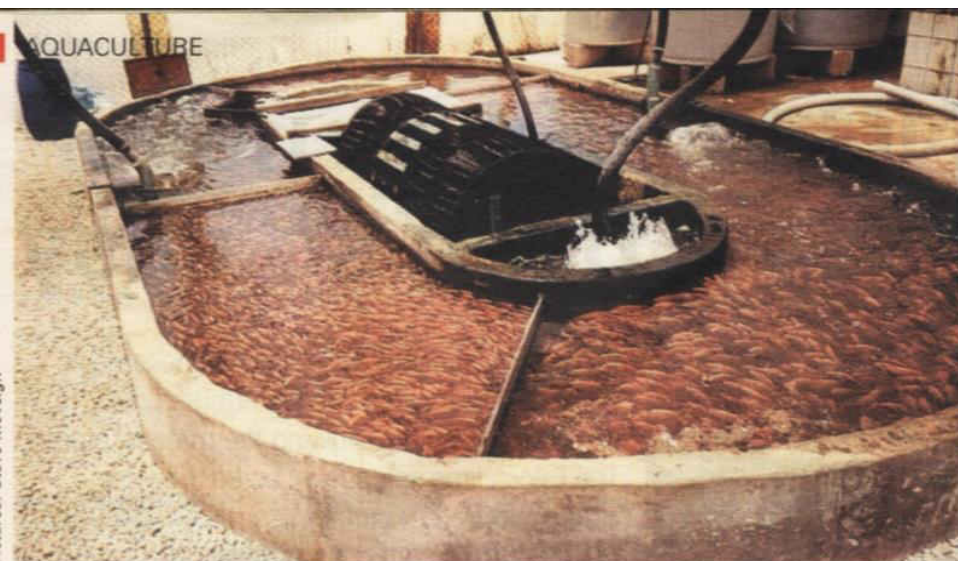


AQUACULTURE



LEFT: An IFF recirculation aquaculture system, heavily stocked with fish.

A breakthrough in recirculation aquaculture in Lebanon has been designed by a South African fish-farming specialist. Aquaculture journalist **Steve McVeigh** spoke to **Ramon Kourie**, the research and development force behind the new IFF one-tank fish-farming system.

Super-efficient fish tank

RECIRCULATION aquaculture is vital in land-based fish-farming, where water is a limiting factor. Take the harsh conditions of the Middle East, for instance. Here fish-farming specialist, Ramon Kourie, CEO of Intensive Fish Farming (IFF), an SA-based aquaculture development concern, has put his designs to the test at the Hadath Tilapia Farm near Beirut in Lebanon. He has shown that water recirculation can be effectively applied to produce a wide range of finfish species.

Ramon's IFF one-tank system is a very competitive space- and energy-efficient recirculating aquaculture system. Visually impressive, the prototype is now in its third year of operation at Hadath, where it is used to produce red tilapia fish. The Hadath Tilapia Farm was established to demonstrate how efficiently the system works, says Ramon. There's also a farmer developing a 50 tons-per-year system in which he grows tilapia, also in Lebanon, and one with a 50

tons-per-year multi-species marine finfish on-growing farm in Syria. These enterprises use much larger tank systems than those used at the Hadath Tilapia Farm, but they retain the concept first explored and prototyped by IFF in South Africa for land-based salmon production.

"The goal during the development of the one-tank system was to come up with a water-, labour- and energy-efficient fish-production system that would be practical and inexpensive," Ramon says. "It had to be compact so it could be placed close to the market and not some distance away. I believe we have achieved this, making it possible to place our fish-farming units strategically either near or in metropolitan areas. Farmers using the system can retail freshly slaughtered fish directly to the con-

sumer and the local catering industry on demand. Airfreight, trucking, handling and middleman costs and commissions – the so-called 'value chain' – are eliminated. This means more profit for the producer."

Low energy input

The new system allows a huge reduction in energy use for water movement, treatment and aeration. Most recirculated aquaculture systems are multiple tank systems and make use of external water treatment units. They require an elaborate system of water pumps and piping for treating and moving the water, and can use as much as 4 to 6 kilowatt hours to raise a kilogram of fish, according to Ramon.

Not so at the Hadath Tilapia Farm. The system is extremely energy efficient. The

BELOW LEFT: The hatchery and nursery set-up employs transparent plastic photo-bioreactors.

BELOW: Ramon Kourie in front of the 30m³ IFF one-tank prototype system.



whole system is entirely driven by low-pressure air – a single high-speed centrifugal blower is used. Biological filtration is achieved by means of rotating biological filters in the inside area of the D-ended raceway tank. The system includes a lamella separator – for large solids capture – and a floating foam fractionator to remove fine solids. The blower also drives in-tank airlift aerators and airlift pods to pull water through the water treatment system. A peripheral side-stream treatment is recommended if top-up water is limited. UV sterilisation and/or ozonation further improves the quality of the water.

The farm can produce 10 tons of tilapia annually from one 30m³ IFF one-tank system. In addition, some 300 000 4g fingerlings are produced each year from 10 small circular breeding tanks and one primary rearing 6,5m³ tank housed in the same tunnel, and they all run on the same air-supply system.

Optimum use of rearing volume

The tank system is designed so that the farmer can insert screened partitions all along its length, enabling several cohorts – age and/or size classes – to be reared simultaneously. Each cohort of tilapia is only two or three weeks older than the next, and is kept separate from others by means of in-tank screens. The screens, designed to maximise horizontal water movement, are lifted and the fish ushered into the next rearing compartment every two or three weeks as they develop.

Keeping the cohorts separate, rather than mixing a whole variety of age and size classes in one tank, eliminates the need to grade the fish, except at the end of the production cycle of five to six months when the fish should have reached the ideal harvest weight of 500g to 700g, depending on the strain or breed and its growth potential. Not having to net, handle and grade the fish means they are not exposed to this stress, and there is no hiccup in their growth and development.

The size and number of compartments is carefully calculated to maximise the use of the rearing volume. This is achieved by providing just sufficient space for a two- or three-week growth period and by adopting a stocking density, based on fish size, that capitalises on tilapia's ability to grow faster when reared at high stocking densities. Annual yields have been impressive at the Hadath Tilapia Farm, proving that even at average operating stocking densities of around 45kg/m³, harvest yields of over 300kg/m³ per year are achievable.

"With the best breeds of tilapia in the

Manufacturing the IFF one-tank system

ALL THE dedicated components of the IFF system were made in Lebanon by Ramon Kourie. "A manufacturing base is being set up in South Africa. Its weak currency favours exports, and thanks to its broad-based economy that includes sophisticated mining, manufacturing and agricultural sectors, raw materials and labour are cheap," says Ramon.

"Cell phones are no longer manufactured in Europe or the US, but in the East. Likewise, South Africa is an excellent country to set up a high-quality and low-cost aquaculture-equipment manufacturing business. Items such as UV sterilisers and ozone generators are already being manufactured very competitively in South Africa."



The IFF one-tank primary rearing system. Dedicated components were manufactured in Lebanon.

world today, such as the Nile tilapia (*Oreochromis niloticus*) from Fishgen in the UK, production-to-capacity ratios of nearly 8:1 are possible due to the shorter cycle length and faster production," explains Ramon.

IFF has developed a special feed formulation for use in recirculation systems. It's highly digestible, and makes for improved feed conversion and low solids and ammonia production.

"Premium A-grade tilapia, free of off-flavours, don't have to cost more to produce," says Ramon. With cost savings in production, such as those achieved at Hadath, farmers can afford to take additional care to maintain total organic carbon (TOC) at really low levels.

The results are encouraging

The lessons learned at the Hadath Tilapia Farm indicate that either sufficient "make-up" water needs to be introduced, at least 10% to 15% of the recycled volume, or additional water treatment systems have to be used, such as ozonation and foam fractionation, to remove fine suspended solids and excess bacteria.

"The fillet yields and firmness of fillet flesh we have achieved have been particularly encouraging," says Ramon. He believes that tilapia raised in moving water,

as they are at Hadath, have improved white-muscle hypertrophy (muscle enlargement), resulting in improved fillet yields and firmer meat texture.

The combination of faster growth rates, improved feed conversions, lower mortalities, improved productivities and high annualised yields per cubic meter, and low power consumption coupled with the year-round availability of premium-quality tilapia are some of the reasons why Ramon believes the IFF system can out-compete traditional cage-, raceway- and earth-pond-type tilapia production systems.

More to come

The use of organic tilapia feed and the addition of a hydroponic unit grafted onto the fish production unit to effectively use the nutrients generated by the fish are some of the tasks which lie ahead for IFF. The technology used at the Hadath Tilapia Farm offers some interesting applications, including inland marine-fish farming, production of tropical species in temperate climates, meeting GMO-free labelling requirements, eco-labelling and certified organic production.

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