

Mariculture in Perspective

By Andre Bok

Today, almost 50% of all fishery products (freshwater and marine) come from aquaculture. Marine aquaculture, or 'mariculture', is the term given to the agricultural activity of cultivating any plant or animal in salt water. It is a broad term incorporating the full spectrum of farming activities from 'extensive' to 'intensive' and 'capture based' to 're-seeding'.



Left: Yellowtail juvenile at 3 months old. **Middle:** POEL Cob Brood Stock. **Top right:** Juvenile Cob at 4.1g after 77 days. **Bottom right:** Dusky kob in tank 2 - Mtunzini 120511 - day 55 - ave weight 0.5g

Mariculture disciplines are almost entirely brand-new with the vast majority of them being younger than 50 years in the making, and a direct result of human populations requiring an alternative to overexploited natural fishery resources.

The global demand for seafood has increased to the point that almost all wild fisheries are fully or over exploited. Managing our natural resources wisely is the first step towards making our fisheries more productive. Fishery resources are most productive and environmentally sustainable when their populations are at around 50% of original standing stock. But, what are the alternatives if the supply of fishery products from a well-managed fishery is still insufficient?

Changing market demand is the first logical step. Getting people to eat smaller fish at the lower end of the food chain (e.g. anchovies, sardines, horse mackerel, etc.) would make the utilization of protein from fishery resources many times more efficient. However, changing market perception is an extremely costly and risky undertaking. There are few (if any) organizations or governments that are willing to risk investing in this process.

Mariculture offers other alternatives that are more directed towards satisfying existing market demand. Today, many wild fish populations are classified as 'collapsed' i.e. the wild spawning stock is no longer robust enough to ensure the adequate recruitment of juveniles to sustain its population. Extensive mariculture activities include the re-seeding of hatchery-reared juvenile fish into the wild to help sustain

collapsed fish populations and any associated fishery.

Less extensive mariculture activities include the on-growing of prawns and fish in land-based ponds. Intensive mariculture activities on-grow hatchery-reared juveniles to market size using formulated feeds in relatively high densities and in a controlled environment. Capture-based mariculture occurs when wild seed is on-grown in a controlled environment to market size, e.g. mussel farmers use the natural settlement of mussel spat (juveniles) and on-grow them on artificial structures to market size.

All of these mariculture activities have some impact on the environment – only the type and extent of the impacts vary. Organic enrichment is the first and most obvious form of impact. Today, our marine environment is sustaining (on the whole) far less than 50% of its original standing stock, i.e. there are far fewer fish eating and excreting in the wild today than there were before humans had a significant impact on reducing wild fish populations. The holding of relatively high concentrations of marine animals in man-made enclosures results in a concentration of metabolic waste products.

However, it is not simply the volume of metabolic waste that requires management. The key is, rather, the adequate breakdown or assimilation of these nutrients into the environment while ensuring existing nutrient cycles are not overly disturbed or disrupted. Mitigation measures here include the use of land-based on-growing systems which treat effluent water (much like conventional wastewater treatment systems) while sea-based on-growing systems employ environmentally friendly stocking

densities and feeding practices (maximising feed efficiencies) and the fallowing of on-growing sites.

Potential genetic impacts include the escape or intentional release of 'tank-raised' juvenile fish into the wild. These juveniles have had a 'privileged upbringing' by being raised through the vulnerable larval rearing stages in a controlled environment free of predators and disease agents where feed is supplied at regular intervals. These juveniles have not had to endure the same forces of natural selection that wild fish would have had to endure and so may not be as 'fit' to occupy a niche in the wild as naturally recruited juveniles. However, a variety of measures including the use of brood stock from local sources and mating designs to maintain genetic variation can ensure that the compatibility of farmed and wild populations is maintained.

Marine fish farming operations are often accused of killing more fish than they produce, and this is true in the case of carnivorous marine fish production practices today. A study of aquaculture industry feed efficiencies in 2007 estimated that it took on average 2.2 kg of fish protein to produce a kilogram of farmed fish. Fish protein is a major cost constituent of formulated feed, and industry is working hard at improving these efficiencies in an effort to reduce costs and environmental impacts. When relating feed conversion efficiencies in aquaculture to the natural feed efficiencies of wild carnivorous fish, it is estimated that only one tenth of the food ingested is converted into body weight, i.e. a wild carnivorous fish will use 10kg of fish protein to build 1kg of bodyweight. The reason for this is that farmed fish use relatively less energy for basic survival strategies such as migration, surviving periods of starvation, escape from predators, reproductive behaviour, etc., and can, therefore, more efficiently use the protein in their diet for growth.

Other relevant environmental impacts include animal health management, chemical pollutants, bio-fouling, endangering wildlife, social concerns and animal welfare. All impacts have mitigation measures and have been discussed in detail in an *Environmental Impact Information Document* compiled by and available from the Marine Finfish Farmer's Association of South Africa, or 'MFFASA'.

At this time, mariculture activities offer some alternatives to satisfy the growing demand placed on wild fisheries. The global mariculture industry is young, innovative, and has a growing awareness of its environmental responsibilities. It has made mistakes, learnt from them and continues to develop.

Many of South Africa's fishery resources are at an all-time low while our human population grows. Improved conservation measures and better resource management have the potential to improve the situation. However, an increasing market demand for marine finfish in South Africa is making marine finfish farming an investment opportunity for well-resourced investors with an appetite for risk.

The local mariculture industry will need to make informed decisions about where it is going and how it is going to get there. How farmers, regulators, researchers and environmentalists work together will determine its fate – both economically and environmentally. Constructive debate will facilitate this process and MFFASA encourages all interested institutions to participate in this process. ✖

Andre Bok
Chairperson
Marine Finfish Farmer's Association of South Africa
andre@pureocean.co.za

AQUACULTURE IN LESOTHO

Landlocked Lesotho was historically one of the poorest countries in the world, its only marketable export resource being human labour to dig gold from South African mines. Since the completion of Phase 1 of the Lesotho Highlands Water Project (LHWP), water exports have become a major source of revenue, with the project supplying its 'white gold' to the economic and industrial heartland of Gauteng. The LHWP also generates 72 MW of hydropower, providing much of Lesotho's electricity requirements. The revival of the gem diamond industry added to the growing stream of foreign direct income. Now trout aquaculture in the dams of the LHWP adds another dimension to the economic development of the Mountain Kingdom.

The Katse Dam is the highest, deepest, coldest dam in Africa. It provides ideal conditions for farming Rainbow Trout in floating cages. Katse Fish Farms (KFF), based at Ha Lejone at the top end of the dam, has pioneered aquaculture in Lesotho, learning through hard experience how to produce high-quality fish for the local market (smoked trout from Woolworths outlets). After five years of pilot studies, KFF is poised to ramp up production to the next level. One of the reasons for a cautious approach by the authorities in Lesotho is to ensure that the quality of the water exported to South Africa is not in any way compromised by aquaculture activities. Learn more at <http://www.royalehighlandstrout.co.za/>

Highlands Trout (HT) is a new player now growing out its first fish near the Katse Dam wall. With a significant capital investment and using equipment and expertise from aquaculture experts in Norway, this exciting new initiative has secured contracts to deliver frozen trout from the Lesotho Highlands to the demanding fish markets of Japan. This will require the highest levels of aquaculture management and hygienic processing to be conducted in the harsh mountain environment of Lesotho. The global demand for fish products is driven by increasingly sophisticated and wealthy consumers who perceive fish to be a healthier protein alternative to red meat. From an environmental perspective, fish have much higher conversion rates (food to flesh) than other farmed animals. Learn more at <http://www.highlandstrout.co.za/>

The aquaculture industry is keen to move into the LHWP's Mohale Dam, but the presence in the tributaries of this reservoir of the Critically Endangered Maluti Minnow *Pseudobarbus quathlambae* is barring any trout-farming activities until the minnow can be effectively protected. There is an opportunity here for the developers to invest in biodiversity conservation so that they may conduct their business without the shadow of a deliberate species extinction hanging over them.

Dr John Ledger – Editor