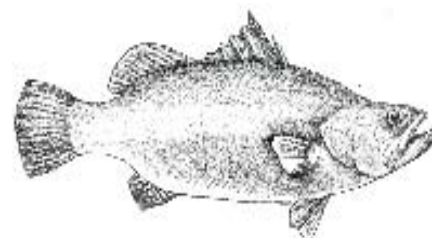




Barramundi farming in South Australia

Most analysts agree that the farming of barramundi, *Lates calcarifer*, has a bright future in Australia. The species is hardy, fast growing, and universally regarded as a premium table fish. Barramundi are well suited to grow-out in recirculating tanks. Being an estuarine fish, it can tolerate a wide range of environmental conditions and, perhaps most importantly, the species thrives at high density. Barramundi also wean readily onto pellet feed, and grow relatively quickly.



Barramundi are currently farmed in Queensland, the Northern Territory, South Australia, Western Australia and New South Wales. They are farmed within cages in ponds in northern Queensland and Western Australian and Northern Territory, and within enclosed recirculating systems in the temperate regions of South Australia, New South Wales and southern Queensland.

To be successful, fish farms need a number of services; proven growout technology, a year-round supply of disease free fingerlings, cost-effective feeds, enlightened farm management, clever marketing, and easy sourcing of all the material and equipment needed on the farm.

Natural distribution

In Australia, barramundi are distributed in tropical coastal and fresh waters from the Ashburton River in Western Australia to the Noosa River in Queensland. Globally, they are widely distributed in the Indo-West Pacific region from the Arabian Gulf to China, Taiwan, Papua New Guinea and northern Australia.

Barramundi move between fresh and salt water during various stages of their life cycle. Mature barramundi live in estuaries and associated coastal areas or in the lower reaches of rivers. Larvae and young juveniles live in brackish temporary swamps associated with estuaries and older juveniles inhabit the upper reaches of rivers.

Culture of Barramundi

Northern Australia

Research into the culture of barramundi in Australia began in 1984 with studies carried out by the Queensland Department of Primary Industries. This work was aimed at adapting culture techniques developed in Thailand to Australian conditions.

Eggs for culture operations initially came from wild broodstock and after hatching, the larvae were reared in a flow-through tank system until they reached fingerling size (30 to 40 mm total length). Most operations now retain captive broodstock and use extensive systems of fertilised brackish or salt water earthen ponds for larval rearing. This method has the advantages of requiring less labour and hence is less expensive than tank system hatcheries and larval rearing facilities for the production of an equivalent number of larvae.

In grow-out operations, fingerlings are usually stocked in floating cages in ponds where they are held until they achieve a marketable size of about 400 grams - usually reached in as little as 6 months. Growth rates vary, and regular grading of the fish is required to reduce cannibalism on smaller fish. Some farms will also produce larger sized barramundi to supply market demand for larger sized.

South Australia

There are currently twenty registered barramundi farms in South Australia. One of these, located adjacent to a hot artesian bore in the south east, rears fish in a flow-through tank system, while the majority utilise recirculating systems to culture barramundi. Using recirculation systems enables year-round production of fish that can be reliably maintained and managed on a commercial scale.

As barramundi are a tropical fish, to produce barramundi in South Australia, they must be reared in a totally enclosed temperature controlled environment. They cannot survive in outdoor ponds south of their natural distribution.

Barramundi farms consist of a fully enclosed, insulated building in which grow-out tanks are housed. A biological filter treats the dissolved wastes in the water, while at the same time providing aeration.

Constant mechanical filtration removes solids and particulate material from the water. The combination of biological and mechanical filtration means that a farm can operate with maximum water consumption of around 10 to 20% total water capacity per day. This relatively low water consumption means the water can be heated and wastewater can be disposed of on land or used for irrigation.

Rotational stocking and harvesting allows a recirculation system to reliably supply quality fresh fish throughout the year. Tanks are stocked with fish in rotation. When production first commences fish are stocked every month into a new tank. After the fifth month of stocking, the fish that were stocked in month one are ready to be harvested. Every month thereafter, fish are harvested from each tank and new fish are stocked.

An efficient recirculating system should be fully enclosed and allow a greater degree of disease management than any other type of fish farm. The emphasis of disease management is on preventing the entry or outbreak of disease. There are five ways in which this is achieved:

- All the fingerlings used in the farms are produced according to a strict protocol. Under this protocol the eggs are reared in artificial sea water and the fingerlings tested for any signs of disease in the hatchery and in the nursery.
- The only water which can be used in the farms is bore water. This requirement is specifically aimed at minimising the opportunity for fish diseases to be introduced into the farm through the water supply. Although it is possible to treat the water from rivers or dams to remove disease organisms, the cost of failsafe sterilisation of water is generally substantially greater than the cost of establishing and operating a bore.
- The food which is used in the farms is manufactured and heat treated during the manufacturing process. The feeding regime for the farms is based on a quality controlled and tested pellet diet. The use of local or home made diets is avoided.
- The farms are fully enclosed and the possibility of introducing airborne, water or bird carried diseases is limited. The day to day operations use procedures which limit the opportunity for disease organisms to enter the farm.

- Stocking densities are up to 50 kg/m³. The production tanks are dark in colour and the farms have low light levels. This is to maintain a stress free environment. Fish that are stress free will grow more rapidly and are much less susceptible to infection or disease.

Recirculating systems can cost anywhere between \$50,000 up to a few million to construct depending on the size and the components of the system and its production capacity. Growers claim that it can take up to a year or so before initial returns can be made.

A recirculating aquaculture facility may be established anywhere that there is power and access to adequate water supply. With proper design, recirculating systems use minimal water, make very little noise and produce little waste. Recirculation systems should be isolated from disease, predators and free of uncontrollable environmental changes.

Risks associated with recirculation aquaculture are inherent, in that all facets of life support and culture are placed in the hands of the manager.

Water quality

The use of mains water is generally considered to be uneconomical to operate a large scale recirculating system, so existing SA farms utilise water from bores. Bores provide water at lower temperatures, which is then heated by bottled gas or compressed air through a heat exchanger to 27°C, which is the optimum temperature for the culture of barramundi.

General biological water quality requirements for barramundi are as follows:

Parameter	Range	Optimum
Temperature	20 - 38°C	28.5° C
Salinity	0 - 35ppt	0
pH	6.5 - 8	7
Dissolved Oxygen	6 - 12ppm	11ppm
Unionised ammonia	0 - 0.04ppm	0ppm
Nitrite	0 - 0.04 ppm	0 ppm

Fingerlings

Long-term access to broodstock is important and the industry is keen to encourage the development of South Australia's own broodstock capability. This would in turn improve the opportunities to farm barramundi within the state and result in an increase in the volume being produced.

There is a single hatchery in South Australia who imports eggs from Queensland which are then hatched and reared to fingerlings. They are currently developing techniques to spawn broodstock and produce eggs within the hatchery. However fingerling production from this hatchery is presently limited and can not supply all barramundi farms in South Australia.

The remaining fingerlings are bought in from Queensland with disease free certification. The procurement of stock is a major ongoing expense with fingerlings costing about 30 cents each, based on a standard rate of 1 cent/mm.

When fingerlings are placed within nursery tanks upon arrival at the fish farm, stock should be regularly size-graded, thus keeping similarly sized fish together and reducing the incidence of cannibalism and stunting.

Feeding and growth

Pelleted products are presently the best source of feed for aquaculture in recirculating systems.

Pellet feed is cheap, free of disease, available at short notice, available in a range of sizes and formulations and lasts for long periods without refrigeration.

Several companies produce pellet feed specifically designed for barramundi. Different size feeds contain different ingredients; smaller fish require more protein. As the fish grow they will require different sized feeds. SA barramundi farmers use locally produced pellets which contain 45% fish meal and cost \$850/tonne.

Fish under 100 grams are fed four times a day, while those larger are fed twice a day, usually at 12 hourly intervals. Whilst the food conversion ratio (FCR) is currently around 1.1:1, FCR's have ranged from 0.7 to 2.0:1.

Under the optimal conditions, barramundi are able to grow from 30 mm (0.5 grams) to 300 mm (375 grams) in five months. Saleable or 'plate size' fish are between 330 grams and 600 grams.

Barramundi grow slightly faster in fresh water and do prefer very low light levels, with a slight 24 hour elevation to simulate soft day light. Maintaining good water quality keeps the growth rate high, and helps in the prevention of disease.

Disease problems

Some bacterial or fungal diseases are airborne, and may occur in a system whenever water quality is poor or fish have been severely scarred by attempted cannibalism. Others may be introduced to a system through careless management. Introduced diseases such as viruses or parasites pose more of a threat than airborne pathogens. With good equipment proper management and sensible stocking densities, disease problems are minimal.

Barramundi are also susceptible to a nodaviral infection which effects their nervous system and spinal cord. The Nodavirus in barramundi is still poorly understood and questions still remain over whether it can be transmitted from parent to offspring, mode of transmission, longevity of the virus outside the host, transmission to other species and means of clinical detection. It is therefore extremely important that barramundi are certified free of this virus before they enter South Australia and that barramundi are housed within fully enclosed systems when they reach the state.

Marketing

The majority of the world's farmed barramundi is produced in south east Asia, however, the product is generally considered to be inferior to that produced in Australia. Australia's annual barramundi production is currently between 500 and 600 tonnes.

Barramundi caught in the wild generally measure around 600mm, but barramundi farmers are promoting smaller, plate size fish. Various domestic markets require different sizes, with the Adelaide and Melbourne markets taking 330 to 360 gram fish. Fish are sold live, gilled and gutted, whole or smoked.

More than half the production from South Australia is transported live to markets in Sydney and Melbourne where it is popular with the Asian community. In South Australia, barramundi farms are currently producing around 250 tonnes of fish annually.

The Sydney market takes fish in the 380 to 420 gram range, while some of the large fish (above 550 grams) are sold in Sydney, the majority go to the Melbourne markets. About 20% of SA fish are sold fresh (not frozen) and chilled to local buyers in Adelaide. Between 500 and 625 kg of barramundi worth \$5 to 15/kg farmgate depending on the quality of the fish.

Domestic and export opportunities, particularly for live product, is expected to develop further, with considerable opportunity for enterprising farmers to develop and exploit new markets. The supply of farmed barramundi from northern Australia is seasonal, with harvesting occurring from

December through to June. This factor may provide a window of opportunity for South Australian farmers who can demand higher prices for fish sold outside of this period. The relatively close proximity of South Australian growers to the high demand for live fish in Sydney and Melbourne has also provided a competitive edge over northern producers.

However it must be noted that with the increasing number of farms that are operating throughout Australia, increases in production of barramundi has the potential to saturate the markets. The Australian Barramundi Farmers Association are aware of this potential marketing problem and are currently identifying strategies that will address the future of marketing barramundi.

Regulations

A number of government agencies have regulations which relate directly to land based aquaculture operations in South Australia.

Primary Industries and Resources SA (Aquaculture SA) has responsibility for all fish in waterways of the state and the administration of all regulations relating to preventing the escape of animals and the associated risk of introducing diseases into natural populations.

The transfer of live animals from one waterway to another without a permit is forbidden. Fish farmers must ensure that animals cannot escape from their farm into natural waterways. Animals exotic to South Australia, like barramundi, can only be farmed after receiving a permit from the Director of Fisheries. Live fish can only be brought into South Australia if they have been certified free of disease.

It is illegal to sell fish in South Australia unless you are a professional fisherman or a registered fish farmer. Registration forms are available from Primary Industries and Resources SA (Fisheries) by request on (08) 8226 2311.

The Department of Water Resources has responsibility for the quality of water in natural water bodies within the state. This department also controls access to and use of underground waters. In many regions access to this resource is limited.

Some local councils have placed limits on aquaculture developments within their district. This is certainly the situation in the Mt Lofty Ranges council areas. Development approval from local council is required for construction of buildings, undertaking activities such as processing and for change of land use.

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