



South Australian barramundi farming policy

The farming of barramundi (*Lates calcarifer*) has a promising future in Australia; the species is hardy, fast growing and universally regarded as a premium table fish. Being an estuarine fish, it can tolerate a wide range of environmental conditions and perhaps most importantly, thrives when cultured at high density. Often grown in sea cages in south east Asia and extensive systems of brackish or salt water earthen ponds in northern Australia, barramundi are well suited to grow out in the recirculating systems used in South Australia.

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.

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 200 tonnes of fish annually with a value of \$2.5 million, and production is expected to double by the year 2000.

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 has provided an excellent 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.

Much of the following text and policy has been adapted directly from the New South Wales Barramundi Policy (March 1995); Staff at PIRSA Aquaculture are grateful to the contribution by NSW Fisheries.

The introduction of exotic fish (*ie* does not occur through natural evolution) into South Australia requires strict control because of the threat they pose to endemic and aquaculture fish stocks. PIRSA Aquaculture SA is concerned that introduced fish may; compete with native fish, there is the possibility of hybridisation of species and they may introduce exotic diseases.

In order to protect the developing aquaculture industry and protect existing native wild fish stocks, PIRSA Aquaculture SA controls the movement of exotic species and interstate fish and regulates fish farming operations. This is achieved by the permit application process and enforcement by PIRSA Aquaculture SA Compliance Officers.

Background

Barramundi

Barramundi (*Lates calcarifer*) are found in northern Australia and the Indo-West Pacific region. Its range extends in Australia from the Noosa River in Queensland to the Ashburton River in Western Australia.

At different life stages, barramundi move between salt and freshwater habitats. Mature animals are located in estuarine/coastal areas and older juveniles are found in the upper reaches of rivers. Barramundi are predators with a diet of crustaceans and fish, they can reach weights of up to 60kg.

The breeding and rearing of barramundi commenced in the early 1980's and has resulted in the development of a significant aquaculture industry both in Australia and in South East Asia. Currently it is the only native finfish that is bred and farmed on a significant commercial scale in Australia.

Introduction of Barramundi to SA

Barramundi is an exotic species in South Australia and therefore its importation into South Australia has associated risks.

PIRSA Aquaculture SA has three major concerns that need to be addressed before a barramundi aquaculture permit shall be granted. These are:

1. Prevention of fish escape
2. Control of and disposal of effluent
3. Prevention of disease transfer.

Impact of introduction

An area of particular concern in the farming of barramundi is the occurrence of an associated virus tentatively called barramundi picorna-like virus from a group of nervous necrosis viruses. More recent work suggests that the virus is in fact a nonoviridae therefore is now referred to a Nodavirus.

The development of the barramundi industry was initially hampered by the occurrence of Nodavirus associated with mass mortality of larvae. This Nodavirus may infect larval barramundi, usually between day 12 to 25 after hatching. Mortalities occurred in Australian hatcheries using intensive culture of barramundi larvae until the introduction of appropriate hygiene control measures.

The Nodavirus in barramundi is still poorly understood. Questions remain over whether it can be transmitted from parent to offspring; the mode of transmission; longevity of the virus outside the host and means of clinical detection. It is likely that the nervous necrosis viruses are already present in NSW and other Australian marine waters. Silver trevally (*Pseudocaranx dentex*) occurs widely along the coast and are known to be affected by this group of viruses (Munday 1995 Pers com). Glazebrook (1995), reports in an unpublished thesis that Macquarie perch, Silver perch and Murray cod were susceptible to barramundi Nodavirus while Mulloway, brown trout and barramundi were capable of acting as asymptomatic carries of the Nodavirus disease.

The disease has been diagnosed in Australia, Thailand and Tahiti and is believed to be closely associated with a virus occurring in striped jack and silver trevally in Japan. It is likely that the barramundi virus and closely related viruses are widely distributed around the Pacific Ocean (Munday, Austasia 8 (2) 1994). Undoubtedly, the control measures introduced in hatcheries

have been very successful in eliminating economic loss due to BPLV and further supports the suggestion of Munday that vertical transmission (parent of offspring via the eggs) is not common. Indeed, the disease has become a regulatory, rather than an economic problem.

Until reliable diagnostic techniques are developed for detecting the virus, such as the immuno-assay techniques, PIRSA Aquaculture SA must adopt a conservative attitude in the establishment of barramundi farms in South Australia. This means that the potential for viral contamination of our waterways through establishment of a barramundi farm must be absolutely minimised.

South Australian legislation

Fisheries Act, 1982

Section 49. (1) A person must not:

- (a) bring, or cause to be brought into the State; or
- (b) sell, purchase, deliver, possess or control, any exotic fish to which this section applies except as authorised by a permit granted by the Director under this section.

Section 50. (1) Subject to this section, a person must not release or permit to escape into, or deposit in, any waters:

- (a) any exotic fish; or
- (b) any farm fish; or
- (c) any fish that have been kept apart from their natural habitat.

Section 51. The Governor may make regulations for the control of exotic fish, the regulation of fish farming, and the control of disease in fish, and, without limiting the generality of the foregoing, may by such regulations:

- (d) prohibit, restrict or regulate the bringing into the State or possession or control of fish that may be affected by disease.

South Australian barramundi growout farming protocol

Note: Throughout the following policy, larvae are young which are dependent on their yolk-sac, fry are considered to be juvenile fish less than 21 days old or less than 10 mm in length; the time at which metamorphosis occurs. Fish older than 21 days or greater than 10 mm are termed fingerlings.

1. A person requires a permit under the section 49 of the *Fisheries Act, 1982* to import exotic fish into South Australia or section 50 to release exotic fish within the state.
2. Barramundi eggs or early larvae can only be obtained by a Primary Industries and Resources South Australia (PIRSA) Aquaculture SA approved hatchery. Eggs and early larvae can only be obtained from:
 - a) A PIRSA Aquaculture SA approved hatchery based in South Australia which adheres to the South Australian Protocol for the Supply of Barramundi eggs and larvae; or
 - b) A licensed interstate hatchery.
3. Barramundi fingerlings can only be obtained from:
 - a) PIRSA Aquaculture SA approved hatchery based in South Australia which adheres to the South Australian Protocol for the Supply of Barramundi fingerlings; or
 - b) A licensed interstate hatchery.
4. Barramundi fingerlings shall only be imported to authorised aquaculture permit holders.

5. Shipments of fingerlings entering any farm in South Australia must be accompanied by a copy of the certification of clearance of Nodavirus disease from a PIRSA Aquaculture SA recognised laboratory under the terms of the Protocol. The Director of PIRSA Aquaculture SA must be notified of all shipments of barramundi fingerlings imported to an authorised aquaculture facility. Written notification must be within 48 hours prior to stock arrival and be accompanied by a copy of the certification for the clearance of Barramundi Nodavirus disease.
6. PIRSA Aquaculture SA reserves the right to take samples of barramundi held on the fish farm for purposes of disease testing at any time.
7. Any disease outbreaks or batch mortalities of fingerlings in any form resulting in the death of more than 5% of stock over a 24 hour period on the fish farm are notifiable events and the PIRSA Aquaculture SA shall be contacted immediately.

Depending on the mode of farm operation and the location of the proposed site any combination of conditions 8, 9, 10, 11, 12, 13(A), 13(B) or 13(C) will apply. This will be based on proximity and characteristics of local waterways, precipitation and local climatic conditions.

8. The grow-out facility shall be housed in a fully enclosed building.
9. The site to culture barramundi must be above the 1/100 year flood level.
10. The site must be at least 500 m away from natural waterways
11. There will be zero uncontrolled discharge of liquid effluent from the fully enclosed building.
12. A bund wall shall be constructed around the fully enclosed building to hold culture waters in the event of an accident. The bund wall shall be constructed in consultation with the PIRSA Aquaculture SA and designed relative to the maximum water release possible in an accident.
13. Once waste water has left the rearing tanks it must be contained in pipes and/or held in a sump inside the on-growing facility, transferred by closed pipes to an external treatment pond. As part of waste treatment all water in the storage pond must be sterilised with an appropriate agent ie, iodine 50ppm/10 mins (0.4% available iodine), chlorine 50 ppm/10 mins (2.3% available chlorine), ozone 0.1 ppm/2.5 mins, UV 1.0×10^5 $\mu\text{W}\cdot\text{sec}/\text{cm}^2$ prior to discharge:
 - A) The council sewage system,
 - B) An evaporation pond,
 - C) Natural waterways including the ocean.

For maximum effectiveness sterilising agents should be prepared just prior to application.

- 1) A record of water discharge must be kept. All filtered residues and filters must be destroyed in a manner approved by PIRSA Aquaculture SA.
- 2) Storage ponds and the evaporation ponds must be fenced at all times so that no agricultural stock are able to reach the water. The storage pond and evaporation pond should be designed so as not to receive any surface runoff or overflow during periods of heavy rain. Pond bottom should be of clay with low permeability or entirely lined where appropriate. The evaporation pond should be of sufficient surface area to balance discharge rates from the farm and evaporation and precipitation rates in the area. It should be of a design approved by PIRSA Aquaculture SA.

- 3) Externally located storage and evaporation ponds must be adequately covered to prevent access by birds and other predators. Storage ponds must be capable of holding at least half the entire volume of the farm.
- 4) Any mortalities of barramundi or any part thereof (ie processed waste) should be disposed of in a burial pit and limed with hydrated lime. The pit must be approved by PIRSA Aquaculture SA (lime pits must be adequately covered to prevent retrieval of offal by domestic animals or wildlife).
14. Adequate provision will be made such that there is no escape of fish from farms or hatcheries as approved by PIRSA Aquaculture SA.
15. No alteration may be made to the waste water system or any provisions to prevent stock escape without written approval from PIRSA Aquaculture SA. All waste treatment must comply with the requirements of the EPA and/or SA Water at all times.
16. Any fish sold live from the premises may only be sold to holders of current permits issued by PIRSA Aquaculture SA to buy live barramundi from the farm, unless the fish are sold for human consumption in which case no permit is required. All other fish must be sold dead.
17. Any barramundi leaving the site must do so in containers which are labelled to identify the permit holder, licence number, and the address of the fish farm.
18. All equipment, clothing and footwear used in the killing and packing of barramundi must not leave the on-growing facility under any circumstances. All equipment used in the on-growing facility may not be removed from that facility. Equipment must be surface sterilised prior to leaving the facility. Equipment used in packing should be sterilised after use.
19. Foot baths of fresh hypochlorite solution should be position at all appropriate access points to the operation. Visitors to the farm or hatchery are required to use the footbaths.
20. If there is evidence of any Nodaviral infection or other serious disease agents affecting the stock then PIRSA Aquaculture SA reserves the right to have all fish on the site destroyed and/or to place the proposed facility in quarantine until it is satisfied that any significant risk of disease transmission or escapement has been negated.
21. An annual report is to be forwarded to the Manager Aquaculture clearly indicating the number of fish, origin, survival rates for all batches of barramundi imported into South Australia. To be supplied 30 June annually.

Protocol for the hatchery certification and supply of barramundi fingerlings to farms within South Australia

This protocol is designed to minimise the risk of introducing or transferring lymphocystis virus or the Barramundi Nodavirus or other diseases or parasites related with barramundi into or within South Australia.

Note: Throughout the following policy, larvae are young which are dependent on their yolk-sac, fry are considered to be juvenile fish less than 21 days old or less than 10 mm in length; the time at which metamorphosis occurs. Fish older than 21 days or greater than 10 mm are termed fingerlings.

1. This protocol relates to any hatchery or supplier of fingerlings from which a farming operation in South Australia may access stock.

2. To allow time for any mortalities caused by the picorna-like virus to be expressed, and to obtain the results of the certification testing required by the protocol, PIRSA Aquaculture SA has determined that no barramundi fingerlings less than 6 weeks (42 days) of age or certification of clearance will be permitted to leave a South Australian hatchery for a farming operation in South Australia.
3. Any barramundi fingerlings entering or being transferred within South Australia under this protocol must be transported directly to a fish farmer holding a current permit to farm barramundi.

Hygiene requirements (Sanitation Protocol)

4. All other animals, other than licensed fish stocks, must be excluded from the quarantine facility within the hatchery.
5. The hatchery will be secure and capable of being locked up.
6. Access to the quarantine area of the hatchery is restricted to authorised staff. Access to the quarantine area and between different parts of the hatchery will be through foot baths containing fresh 2% formalin solution (200 ml commercial grade formalin per 10 litres of water) or hypochlorite solution (or equivalent). An iodophor hand rinse (or equivalent) will be required before entering the quarantine area.
7. Each rearing tank will have its own set of non-transferable equipment which is disinfected daily using an iodophor sodium containing 50 to 100 mg/L free iodine (or equivalent).
8. The hatchery may be inspected for compliance of the Sanitation Protocol, by an authorised officer at any time.

Recording and Sampling Protocol

9. A daily log is to be kept for each rearing tank. It will include details of the number of fry/larvae, feeding regimes, water quality parameters and any mortalities, as well as any other relevant information.
10. This log will be retained by the hatchery and the log or copies of the log will be available for inspection by a PIRSA Aquaculture SA or an authorised representative at any time. A summary of the completed log, recording details of water and fish samples and other relevant information will be signed by the owner/manager and attached to a Declaration of Origin.
11. The level of detection required will be a 2% prevalence with 95% confidence, assuming a 50% sensitivity. Each rearing tank will be sampled, larvae/fry preserved in 10% sea water (or fresh water depending on age of fish) formalin (100 ml laboratory grade formalin and 900 ml sea water/fresh water) following the schedule.
12. A sample of 400 fry per batch of hatchlings at three weeks of age, from which at least 300 CNS sections taken.
13. All samples will be collected randomly (by pooling at least four beaker or dip net subsamples taken from different sites in the rearing tank when the larvae/fry are distributed evenly throughout the water column) unless abnormal or diseased larvae/fry are present, in which case these larvae/fry will be selectively sampled.
14. Samples must immediately be forwarded to either:
 - PIRSA authorised provider; or
 - The State Fish Pathologist.

Subsequent reports should be sent to Vetlab and PIRSA, Director of Aquaculture SA and must include information such as source of supply, mortalities to date, general observations and batch number. If requested, further samples must be supplied from specified batches and in a specified manner to the above or any other person as directed by PIRSA Aquaculture SA for further laboratory testing.

Laboratory Examination Protocol

15. All samples must be processed routinely for histology and examined microscopically for lesions, protozoa, metazoa, fungi and bacteria.
16. If any lesions are presumptively associated with viruses, samples must be examined under the electron microscope.
17. Copies of Pathology Reports for each batch must be attached to the Veterinary Examination Certificate.

Selection Criteria

18. As the sensitivity of histological testing is comparatively low, and there is still an incomplete knowledge on the diseases of barramundi, the following criteria will be used to evaluate a batch's suitability for health certification.
 - Are there any lesions present eg nervous system vacuolation, or focal necrosis, which when seen by light microscopy indicate the presence of a virus?
 - Are there any protozoans or metazoan parasites present; or fungal or internal bacterial infections associated with an inflammatory or degenerative lesion present; or an organism in these groups which is known to cause disease in other fish species present?
 - The presence of any bacteria associated with an internal lesion?

If the answer to all of these questions is 'NO', then the batch may be certified as free of disease under the terms of this protocol. If the answer to any of these questions is 'YES', then the batch must be either successfully treated to effect a cure, or the batch must be rejected. Any rejections must be immediately reported to PIRSA Aquaculture.

Protocol for the hatchery certification and supply of barramundi eggs and larvae to farms within South Australia

In addition to the relevant policies and protocols previously outlined:

1. No broodstock fish with gross skin, fin, tail, eye or gill lesions except those directly attributed to physical damage will be used for breeding.
2. No broodstock showing signs of disease or illness at the time of stripping milt or ova will be used for breeding.
3. Fertilised eggs are to be removed from the spawning tank or fertilisation container and exposed to an iodophore wash within 10 hours of fertilisation and before placing in clean rearing tanks. The egg disinfection will consist of exposing eggs to a 100mg active iodine (PVP-1) per litre solution for 30 seconds in a 100 litre plastic bin, then rinsing in seawater which has been sterilised by chlorination or iodine or has been boiled.
4. Eggs and early larvae which will be leaving the facilities must be kept in isolation from all other fish stock, water supplies and equipment until dispatched.

Further Information

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