



# Trout Farming in South Australia

*Aquaculture SA*

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## Distribution

Brown trout, *Salmo trutta*, are native to waters in Europe, Iceland and western Asia, while rainbow trout, *Oncorhynchus mykiss*, are naturally distributed in North American coastal rivers draining into the Pacific Ocean from Alaska to Mexico. They have now been introduced to all continents except Antarctica.

The first successful introduction of brown trout into Australia occurred in 1864 when ova (eggs) were brought to Tasmania from England. A breeding program commenced and by 1872 eggs and fry raised in Tasmania were being sent to New South Wales, Victoria and New Zealand.

Rainbow trout were first imported into Australia in 1894 when 3,000 eggs were imported from New Zealand. The first recorded release of trout in South Australia occurred during the late 1870's when John Dunn, owner of the Bridgewater flour mill, released Tasmanian trout fry into the Angas River and Cox's Creek. In the years following 1910, further trout fry for stocking SA streams were obtained from a hatchery near Ballarat in Victoria.

Trout were introduced to Australian inland waters, primarily for their sporting value. They are a cool water (4 to 19°C) species, restricted mainly to alpine and sub-alpine waters. Self maintaining populations of brown and rainbow trout occur in the higher altitude waters of New South Wales, Victoria and Tasmania.

Populations are maintained by stocking in warmer rivers and reservoirs throughout New South Wales, Victoria, south-west Western Australia and the Mt Lofty Ranges in South Australia. Although some Australian state fisheries authorities operate trout hatcheries there is no government based activity in South Australia. The River Torrens and other streams and dams within the state are stocked by a recreational group, the South Australian Fly Fishers Association, who also maintain their own hatchery.

## Life history

Although a marked difference exists in the colouration of brown and rainbow trout, there is very little other physical difference.

Brown trout can live for up to 12 years, growing to a fork length of 140cm weighing more than 20 kg. Fish from Australian populations tend to be smaller, growing to about 90 cm fork length and 14 kg. Rainbow trout live for about 8 years, growing to 110 cm in length and 18 kg. Again fish from Australian populations are smaller, growing to 90 cm and 8 kg. In Australia, it is rare for brown trout to survive beyond 9 years and rainbow trout beyond 5 years.



Growth rates of trout vary with environmental conditions. Growth is optimal at water temperatures between 7°C and 17°C and Australian populations of trout and salmon may grow more rapidly than those in the northern hemisphere due to a longer growing season here.

The average age at maturity for male brown and rainbow trout is 2 to 3 years old. Female brown and rainbow trout usually mature at 3 years of age.

Young brown trout feed on a variety of small invertebrates, such as insects, molluscs and crustaceans, while young rainbow trout feed predominantly on zooplankton. Adults of both species usually consume similar food, which includes both aquatic and terrestrial insects, molluscs, crustaceans and small fish. Trout are thought to have displaced native trout, *Galaxias spp*, from many SA streams.

Brown trout and rainbow trout also have sea dwelling populations known as 'sea trout' and 'steelhead' respectively. Sea trout occur in Tasmanian waters.

In normally well-fed trout, the flesh has a delightful pink tone which is indicative of its eating quality but where the food supply has been poor, the flesh becomes pale and loses much of its flavour qualities, particularly in muddy water. Rainbow and brown trout can co-exist but rainbow trout are more popular for both stocking and aquaculture.

Although the brown trout are hardier and therefore a better proposition for restocking streams, they have the disadvantage of being more difficult to catch than the favoured rainbow, particularly in dams. Rainbow trout grow faster than brown trout and also survive better in lakes than streams.

## **Aquaculture**

The artificial propagation of trout has been associated with angling in many European countries since the early 19th century and culturing techniques are now well established. The availability of reliable pelleted artificial feeds also led to a rapid expansion in commercial pond farming of rainbow trout in North America over the last forty years. Not only are the mechanics of trout culture well known, they are also relatively simple. There are many books available on the subject, providing all the basic information from stripping fish of eggs through to building a hatchery.

In Tasmania, rainbow trout are also raised in sea cages in sheltered bays along the south and west coasts. They are reared in freshwater hatcheries until they weigh between 70 and 100 grams and then gradually acclimatised to salt water over a period of 5 to 7 days, before being transferred to floating cages at sea. The marine environment along the Australian mainland coastline is thought to be unsuitable for this type of culture.

Individuals investigating the possibility of trout culture either for recreation or on a commercial scale, should first consider the selection of a site in conjunction with the environmental requirements of the fish. An additional requirement for potential commercial operators is to conduct a complete market analysis and to identify areas of distribution so that investment does not exceed potential market.

In SA there have been very few attempts at farming rainbow trout on a commercial scale and the numbers have dwindled even further during recent years. SA farmers have limited access to suitable sites and lack a competitive advantage over their counterparts in the eastern states, where the climate is cooler, there is an abundance of good quality water and trout can be produced more economically with less environmentally related problems.

There are certain critical conditions that must be met to achieve optimum growth and production. The single most important factor limiting the annual production of a trout farm is the quantity of water available. The quality of water, with regard to temperature, is also critical to the survival of the fish and the success of the enterprise. It can not be over emphasised that intensive trout farming requires a very large rate of supply of cool, high quality water.

The possibility of recirculating water and reusing it as a means of operating in regions where large volumes of water are not available has many pitfalls. Various degrees of reducing water usage are possible, from gravity feed of water between raceways in series to total reuse, involving complex auxiliary water treatment plants. Such complex systems appear not to be economically viable for commercial trout farms elsewhere in the world and only reliable with highly skilled, technical management.

Given adequate reoxygenation (to greater than 5 mg/L of oxygen), direct recirculation without any other treatment is ultimately limited by build up of dissolved ammonia waste from the fish. Ammonia is extremely toxic to fish at very low concentrations. Sublethal effects are loss of appetite and lowered resistance to disease and high water temperatures.

The water temperature should always be between 12°C and 20°C. Trout feed best at 15°C. Unfortunately in SA the hot extended summers create problems as water temperatures regularly exceed 20°C during these periods and trout stop feeding.

Deaths occur when water temperatures exceed 26°C, or in natural conditions where the fish seeking out deeper water in dams and river pools to escape surface heat, encounter low oxygen levels. Unlike most other countries, trout in SA grow and survive best during the winter season. Most mortalities occur during the long hot dry summers.

The most reliable and economically viable system of water supply is the gravity feed single-pass method, where there is no reliance on or cost of pumping water and no recirculation or reuse of the water that has passed through the ponds. Such a system should be the primary objective for water supply for at least most of the year in terms of economic viability and reliability of operation. There are few sites where this can be done in SA. Without all these conditions there is little hope of establishing large scale commercial aquaculture of trout.

Intending trout farmers are strongly recommended to visit existing farming operations, investigating management methods and speaking to people experienced in the industry before embarking on their own enterprise.

### ***Commercial growout operations***

Trout farming requires the same farming intensity and market structure as conventional agriculture. The same skills that make a good 'traditional' farmer are essential to a successful fish farmer.

Only rainbow trout are cultured commercially in Australia, although brown trout and fry and fingerlings are produced by hatcheries for sale for stocking dams for recreational fishing.

The two basic designs of systems for intensive trout production are raceways and circular ponds. Circular ponds create more uniform flow and water quality conditions than do raceways, causing the fish to distribute more evenly within each pond.

Common to both types are built-in design features encouraging some degree of continual self-cleaning of settled fish and food wastes and facilitating routine manual cleaning. Most of the wastes are in the form of soluble or suspended solids and are removed by water movement throughout.

Raceway ponds are long and narrow in shape with a water inlet and outlet at opposite ends. Water quality is highest at the inlet and usually tends to decline through the length of the pond. Therefore, fish tend to favour the inlet area and any increased tendency in this regard warns the experienced manager of water quality problems.

It is very important that the inlet water supply, flows into the pond across the whole width of the pond and that the flow is then fairly uniform over the width to the outlet, which should also span the width.

The circular pond differs from the raceway in providing near uniform water quality and flow conditions over the whole pond so fish are usually distributed quite uniformly at high densities. This feature has been said to be a disadvantage for management if water quality deteriorates, in contrast to the raceway. The circular pond has a central outlet hole for both self-cleaning and manual cleaning.

Pelleted, specially formulated trout feed is available from stockfeed manufacturers. Chicken and other types of stock pellets are unsuitable. Feeding can be carried out manually, by an automatic programmed feeder or by a demand feeder. Detailed feeding tables for trout, which take into account the effect of fish size and water temperature on consumption (food as a percentage of body weight or fish per day), are available from pellet manufacturers.

### ***Fish-out ponds***

Successful fish-out operators try to maintain ideal conditions for fish culture while maintaining conditions that will attract and hold the public. Water conditions must be ideal as the trout are usually stocked in higher densities than commercial grow-out operations. An inventory of fish numbers is continuously monitored to maintain peak fishing efficiency. When the catch rate begins to decline, more fish are added to the system. Anglers are charged for fish caught, either according to weight or length.

The more successful fish-out farms are located within easy access to major population centres, on a main highway or in a large tourism orientated town and designed in such a way that they attract and provide a sense of satisfaction to recreational anglers. This includes providing refreshments, toilets, picnic areas and other facilities for the non-fishing members of the family. The primary objective of this type of operation is to accommodate the customer's total needs and promote return visits. Operators must enjoy dealing with the public and take necessary measures to protect their own interests. This includes liability insurance, prevention of theft and maintaining a safe environment for visitors.

### ***Farm dams***

Trout may be trained to hand feeding in small farm dams as a novelty, however, use of farm dams to produce trout reliably in large quantities, and of a size and high quality acceptable to the restaurant and retail fish market is impractical. Harvesting fish by net is difficult and net-damaged fish are unacceptable for sale. Fish size will be variable with excessive flesh fattiness and perhaps off-odours present.

Hand feeding of higher densities of fish in these still waters without or very little flushing or water throughput, will lead to rapid deterioration in water quality from fish and food wastes. For this reason the seemingly attractive proposition of producing commercial volumes of trout in floating cages in such dams is highly impractical. Experiments using this method in Australia have produced severe pollution of even very large dams.

## **Disease**

Fortunately Australia is free of serious trout diseases. However skin and gill parasites can occur unexpectedly and cause heavy losses at times when fish stocks are greatly stressed by summer conditions. These protozoans are not specific to trout and occur on various freshwater aquarium and ornamental fish which should be excluded from the fish farm and its water supply.

## **Regulations**

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

Primary Industries and Resources SA (Fisheries) 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 bought 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 and Industries and Resources SA (Fisheries) by request on (08) 8226 2312.

The Water Resources Group of the Department of Environment and Natural 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.

### ***Obtaining Fingerlings***

Trout fingerlings can be obtained from the following establishments;

1. Tooperang Trout Farm  
Cleland Gully Rd  
Mt Compass  
Ph: (08) 8556 9048
2. Salisbury Country Trout Farm  
Lot 12 Diment Rd  
Salisbury Nth  
Ph: (08) 8280 8520
3. SA Fly Fishers' Association  
Ph: (08) 8389 2293

### **Further reading**

As trout have been cultured for more than one hundred years, the methodology is now well understood and techniques refined. Consequently, there are now a vast array of excellent publications and handbooks available on trout farming describing every facet of commercial production. Technical material of this nature is not always readily accessible, however a collection of the better publications are held at the SA Aquatic Sciences Centre Library. The library is open to the public and an appointment may be arranged by telephoning the library (08) 8200 2423.

One of the most relevant publications for SA conditions is 'A Guide for Trout Farming in Western Australia' published by the Fisheries Department of WA.