



Atlantic salmon aquaculture in South Australia

- The Atlantic salmon aquaculture industry in South Australia began in the south east of the state in 1996.
- Cold water upwellings in the region allow for the production of excellent quality fish.
- Early production results indicate there is significant potential for the expanded production of Atlantic Salmon in this region.

Production

- Salmon eggs are purchased certified disease free from a hatchery in NSW.
- Larvae are transferred to and kept in fresh water raceways for approximately 20 days.
- At 40mm, the fry are moved into large freshwater ponds.
- At one year (approximately 55g), the smolts are transferred to cages in the sea.
- The salmon are fed an artificial diet, specifically prepared to maximise growth.
- Salmon are harvested after two years at approximately 3 to 4 kg.
- Salmon are sold onto the domestic market, predominantly as value added product (ie. Smoked).

Value

- Australian Atlantic Salmon is recognised as being amongst the highest quality salmon produced across the world.
- The international market for Atlantic Salmon is huge, with annual global production of approximately 555,543 tonnes, valued at \$US 1.8 billion.
- The industry in Tasmania has been established for only 13 years and now produces approximately 9000 tonnes annually, valued at 90 million.
- Considerable community benefits arise from successful aquaculture activities. The salmon industry in Tasmania has created a significant number of jobs directly in the industry, and in support areas such as transport, processing, manufacturing and business services. One company alone employs approximately 380 workers.

Biology of Atlantic Salmon

Table 1 : A review of the biology of Atlantic salmon
(Sources ; Sedgewick, 1982; Clements, 1988; Shepherd and Bromage, 1988).

Common name	Atlantic Salmon
Species name	<i>Salmo salar</i>
Close relatives	It is a member of the family Salmonidae which includes rainbow trout (<i>Oncorhynchus mykiss</i>), chinook salmon (<i>Oncorhynchus tshawytscha</i>) brook trout (<i>Salvelinus fontinalis</i>) and brown trout (<i>Salmo trutta</i>).
Distribution and farm supplies	Exotic to Australia successfully introduced from the Copequid Fish Culture Station, Phillip River, Nova Scotia, Canada into NSW in about 1963-5. No self-perpetuating populations occur in Australia, all stocks are maintained through serial releases of fry by government hatcheries or by private groups in NSW and Tasmania. Eggs from NSW have since been imported into Western Australia, Tasmania, Victoria and South Australia, however currently only Tasmania and South Australia have seafarming operations. Hatcheries are now operating in NSW, Vic and Tasmania. Seafarming operations in WA failed.
Life cycle	Anadromous, born in fresh water (the larvae are called 'alevins') where they stay for 6 to 24 months (called 'parr') before migrating down the rivers and into the sea ('smolt'). Here the salmon grow to maturity before returning as 'grilse' (1 sea winter fish) or salmon (1+ sea winter fish) to spawn in the rivers and streams generally where they were born. They can live around 6 years. Land-locked populations also occur.
Environmental requirements	The optimal water temperature range for culture is 8 to 18° C, depending on the life stage with the best growth around 12 to 16° C. They will tolerate 0 to 21° C ANZECC (in press) recommend that alkalinity > 100mg/L, PH 6 to 9, Salinity >15mg/L, suspended solids < 25mg/L and ammonia <0.01mg/L
Growth rates	Growth rates are dependent on water temperatures and salinity. These are generally faster than rainbow trout in seawater. Has been recorded up to 45kg in Norway, however in Australia under culture conditions the fish are generally up to 12kg (as broodstock), although there is a market preference for 3 to 4kg (2 to 3 years old) fish. Under ideal conditions 1yr animals can weigh between 50 to 200g (fresh water), 2yr>1.5kg (seawater), 3yrs >4kg (seawater).
Diet	Carnivorous eating larger zooplankton, small crustaceans and pelagic fish in the wild; under culture situations they are fed artificial pelleted diets. Prey size increases with fish size.

Reproduction	Spawns once a year in freshwater, the age at first spawn can be 1 (precocious males) to 2 (males and females) years and can extend for another 2 to 5 years. The female can lay up to 1800 eggs/kg of body weight. The spawning time is May – early June and can occur over 2 to 3 days, but usually the eggs are striped on one day. At fertilisation the eggs are approximately 4 to 6mm in diameter. The eggs hatch 40 to 80 days later, however this depends on water temperature (the optimal temperature is 8 to 12° C). The yolk-sac fry stage continues for about 20 to 35 days after which the fry begin feeding on zooplankton in the wild; in hatcheries they are fed specially formulated powders (starter diets).
Smoltification	In the wild, toward the end of the smoltification process, the salmon swim from freshwater to the sea. Under culture situations, this process is carefully managed to ensure that the young fish (50 to 200g) are acclimatised to seawater by slowly increasing the salinity of their tank water over a couple of weeks (not done in Tasmania) or adding salt to the feed. Some farms do not use any transfer treatments. During this time the fish undergo changes in their physiology, their chloride cells become activated, and develop growth hormone and osmoregulatory enzymes in their gills which allows them to survive in seawater. Smoltification is a process which takes about 6 months under ambient light, from initiation to smolt exposure to seawater.
Culture status	Small numbers of fingerlings are released into NSW reservoirs and waterways for recreational fishing, and one Victorian freshwater farm is producing 2 to 3kg individuals in commercial quantities. A \$90m pa seacage farming industry in Tasmania and a pilot sea cage farm has been established in South Australia. Interest in sea cage farming has been expressed in both Victoria and Western Australia although trials to date have not been successful, mostly due to mortalities from high water temperatures.
Market size	This depends on the buyer requirements but usually fish over 3kg (whole weight) are harvested for fresh, frozen or smoked products; markets range from about 2.5kg upwards for head on gilled and gutted fish.
Market price	Atlantic Salmon are considered excellent eating fish and enjoy good market acceptability. The price varies with the product type, however the wholesale value is usually in excess of \$12/kg. (Note: farm production costs are around \$5 to 7 per kg).

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