RESPONSIBLE
SOURCING

Production process

FISH – FARMED ATLANTIC SALMON

RSPCA

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Animal welfare considerations

- By-catch
- Handling methods for farmed fish
- Husbandry and management practices for farmed fish
- Killing/slaughter method during commercial harvesting
- Killing/slaughter method for farmed fish
- Water quality and environment for farmed fish

Definitions

Sac fry/Alevin – Recently hatched fish (larvae) who have a sac containing the remainder of the yolk. Allowing the larvae to feed off the yolk for a few days whilst staying protected in substrate.

Fry – Hatched fish who has finished its yolk sac and now feeding on plankton.

Parr – A juvenile fish who feeds on small invertebrates and are camouflaged with spots and bars.

Smolt – When parr move from freshwater to saltwater they undergo a physiological process (smolt) that allows them to survive the change in water. Their scales also change to silver in colour.

Post-smolt – When the fish have matured sufficiently and now are able to live in saltwater.

Broodstock – sexually mature fish who are used for collection of eggs or 'milt' (sperm).

Neo-males – female fish who have undergone sex reversal. When neo-males are crossed with normal females, only female offspring are produced.

Triploid – Triploid salmon are produced by applying thermal or pressure shocks to the egg and sperm mix at fertilisation to create sterile fish.

Salmon are social, intelligent, and sentient animals. These unique creatures are predatory fish who migrate across oceans in the wild to spawn. Salmon are an anadromous species who can change their physiology to move from fresh water to salt water. A salmon's natural lifespan can be up to 7 years, but when raised for consumption they will live till around 3 years of age.

Current scientific evidence demonstrates that fish are sentient animals, capable of experiencing pain and suffering. Salmon have a natural lifespan of between 3 to 8 years. Born in freshwater and living their adult lives at sea, but then returning to their freshwater birthplace to spawn. In commercial salmon production fish will be slaughtered at 3 years of age.

Aquaculture (fish farming) can occur on land in large tanks or ponds, or at sea in large sea pens. The production of Atlantic salmon in Tasmania is a combination of land-based and sea-based farming systems.

Farming of Atlantic salmon begins on land at the breeding farm where 'broodstock' (sexually mature fish) are held in large freshwater ponds or tanks.

In Tasmania, salmon farmers use only female fish in the grow-out phase because the relatively warm seawater temperatures can result in rapid sexual development in male fish which, in turn, results in greater disease susceptibility and poor meat quality. Therefore, a common practice in aquaculture, is sex reversal of some female broodstock resulting in 'neo-males'. When these neo-males are then crossed with normal females, only female offspring are produced.

Once a year, usually in autumn, individual broodstock are anaesthetised by submerging the fish in a water bath containing an anaesthetic agent. While anaesthetised, eggs and 'milt' (sperm) are removed from female and neo-male fish, respectively. While some female fish are allowed to recover from the anaesthetic and are released back into the ponds or tanks, the method of milt removal from neo-males requires the fish to be euthanised.

Eggs and milt from selected broodstock are mixed together to produce fertilised eggs.

The fertilised eggs are then placed in purpose-built incubators at specialised hatcheries. Eggs are incubated at the hatchery in an environment that aims to mimic egg incubation in the wild, for example, by providing substrate in which eggs can nestle and clean water flow providing plenty of oxygen for the eggs to grow. As the small pea-sized eggs develop, the eyes of the salmon can be seen as a black dot on the orange egg. The incubation period is measured in 'degree days' and is usually 450 degree days. This means that if, for example, the water temperature during incubation is 8 degrees, the incubation period is around 56 days.

After hatching, the hatchlings (called 'alevins') absorb nutrients from a yolk sac attached to their bodies and they remain in the hatching environment for another month or so at which time they are able to feed independently.

Triploid salmon are produced by applying thermal or pressure shocks to the egg and sperm mix at fertilisation to create sterile fish. Thermal or pressure shock results in the fertilised egg having three sets of chromosomes (one from the father and two from the mother) rather than the normal two sets (one from each parent). Triploid salmon are used in salmon aquaculture for their lack of sexual maturation, which is considered an undesired trait. Triploids are more easily stressed, more sensitive to warmer sea temperatures and low oxygen concentration, and have a high rate of deformities and mortalities than normal diploid salmon (salmon with only two sets of chromosomes).

In salmon aquaculture systems, fish spend 10 to 16 months on land growing in fresh water tanks and then 14 to 18 months in the sea pens before they are ready for harvest.

Once the hatchlings are able to feed independently, they are referred to as 'fry' and are transferred to small freshwater tanks in the hatchery.

Whilst in the hatchery, the fish are vaccinated against common diseases that they may be exposed to later in life. As the fish grow, they are transferred to bigger tanks and, at around one-year-old, they are referred to as 'parr'. Distinct vertical markings appear on the fish which in the wild act as camouflage for the fish. After about a year growing out in large tanks at the hatchery, the vertical markings on the fish are replaced by a silvery sheen and the edges of the fins darken. At the same time, a physiological change occurs internally which allows the Atlantic salmon to survive in seawater. This process is called 'smoltification' and the fish are referred to as 'smolts' at this stage. After smoltification, fish are able to be transferred into sea pens.

In sea pens, the enclosure nets are kept clean to prevent build-up ('biofouling') of algae and microorganisms that impede the flow of water which supplies oxygen and removes waste products and other organic matter from the sea pens. A reduction in oxygen supply causes stress levels (and susceptibility to disease) to rise. Copper and zinc-based antifoulants are no longer used on nets thus eliminating the potential for these metals to contaminate the environment. Instead, nets are regularly cleaned in situ to prevent biofoul build-up on the nets affecting oxygen supply to the fish.

When farmed Atlantic salmon are able to be transferred to sea, they are pumped out of their hatchery tanks through water-filled pipes and transported in large water-filled tanks to the sea shore.

From here, they may be transferred via pipes directly into their marine pens or to water-filled tanks in purpose-built boats (called 'wellboats') that then take the fish to their marine pens where they will grow out for the next year and a half or so. The marine pens are large, netted enclosures, which not only prevent the fish escaping but also protect them from predators such as seals. The stocking density in marine pens is about the equivalent of three fish per cubic meter of water. Fish grow out to an average weight of around 5kg by which time they are ready to be harvested.

Good water quality and water flow is not only important for the health and survival of the farmed Atlantic salmon but also for the ecology and biodiversity of the farm's surrounding environment.

Both the fresh water and sea water stages of Atlantic salmon farming are subject to government regulation and licensing conditions that incorporate production aspects such as the location of the farming lease, the size of the lease, potentially polluting activities and waste management. As part of their license conditions, farms are required to ensure that there is no significant visual impact 35 metres beyond the edge of the lease. Remedial action is required if license conditions are breached. Salmon farms are subject to ongoing monitoring of the water and sea bed underneath and around the sea pens. Any environmental impact of farms can be reduced by preventing feed wastage, by promptly removing dead or moribund fish from the sea pens and by fallowing sea pens regularly.

There are two main methods of harvesting Atlantic salmon. Fish can be removed from their sea pens through large pipes and transferred to special harvesting boats that sit alongside the pen. Alternatively, the whole pen is slowly towed towards shore where fish are transferred to a holding pen and then to the slaughter plant.

Before slaughter, fish may be fasted for a few days in order to reduce the oxygen demand required to digest their food. By reducing this oxygen demand the fish are better able to cope with the harvest process. During the harvest and slaughter process, fish are kept in water for as long as possible. Fish are most commonly stunned through automated stunning systems that administer a percussive blow to the head rendering the fish unconscious. The unconscious fish are then bled to ensure death and immersed in an ice slurry for transport to the processing plant. At the processing plant, they are gutted, washed and processed into fresh, frozen or smoked product.

The orange-pink flesh colour of Atlantic salmon is a result of a carotenoid pigment called ‘astaxanthin’ which salmon in the wild would digest when eating plants, microbes, crustaceans and other foods it would naturally eat.

In farmed Atlantic salmon, synthetic carotenoids are added to feed to provide fish with the same anti-oxidant properties (preventing cell damage) and resulting health benefits such as disease resistance that carotenoids would provide in the wild.

For more information, including on commercial fishing, visit the RSPCA’s Knowledgebase kb.rspca.org.au