



Benchmark®
Genetics



Atlantic salmon –
guidelines for
order and egg
delivery procedures

Delivery of the correct number of Atlantic salmon eggs of the best quality depends on effective communication and interaction between Benchmark Genetics and the customer, and ensuring that procedures, including counts and quality checks are carried out effectively and efficiently.

This guide describes good practice procedures for ensuring that eggs are dispatched, transported, delivered, checked, disinfected and transferred to hatching equipment smoothly and efficiently.

Good aquaculture practices are the procedures and protocols designed to promote adequate and responsible aquaculture production. Such practices will ensure that high levels of product quality, safety and environmental sustainability are achieved.

Disclaimer

Every attempt has been made to ensure the accuracy and relevance of the information presented in this document. Benchmark Genetics Limited however, accepts no liability for the consequences of using this information for the management of Atlantic salmon or for any other purpose.

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What we do

Benchmark Genetics has more than 40 years of experience of delivering high-quality genetic material into the global Atlantic salmon market. Benchmark Genetics is a global breeding company operating advanced breeding programmes for Atlantic salmon, tilapia and shrimp.

The company runs three nucleus programmes for Atlantic salmon in Norway, Iceland and Chile supplying the SalmoBreed, StofnFiskur and SagaChile strains to producers around the world. Atlantic salmon are selected using a balanced breeding approach for improved growth, disease resistance and efficiency.

Achieving the genetic potential depends on farming practices and the conditions in which the animals are held. Sub-optimal conditions will reduce performance. The aim of this document is to describe good practice for Atlantic salmon eggs, alevins and fry, allowing producers to develop best practice management procedures for their operation.

Information presented in this document combines data derived from internal research trials, published scientific knowledge with the

expertise, practical skills and experience of the Benchmark Genetics technical service teams, and sister companies in the Benchmark Group.

Ordering eggs

To place an order for eggs please contact the local Benchmark Genetics sales manager. To receive the best customer service please make contact as soon as possible. Changes to any order are best made as early as possible to allow the incubation centre supplying the eggs to make adjustments.

The Benchmark sales team will follow up on orders both before and after delivery. Experienced technical and sale teams are always available to assist with any logistical, quality or production related issues that may arise.



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1. Prior to shipment – order confirmation and documentation

Communication by email between the sales manager and customer should be concluded in advance by finalising a specific order confirmation agreement.

During this initial communication, the customer will provide information regarding the company name & address, hatchery details, airport that the delivery will take place, contact details, etc. The contract will include all the relevant shipment information and terms and will be shared between both parties. In the meantime, the order will be submitted by the sales manager in the Benchmark production program BreedControl. Access to BreedControl will be provided to the customer for keeping records of all the relevant shipping paperwork. BreedControl is subject to constant improvement and new features will be included in the future.

At least two weeks before each shipment communication (by email or phone) will be completed by the sales manager. The customer should confirm that the delivery date and arrangements are acceptable.

In advance of the shipment, the sales manager will share a number of documents with the customer. Including:

1. Airwaybill – if applicable.
2. Relevant health documents.
3. Invoice (including the price of the ova and the shipping cost, etc).
4. Certificate of Origin (CO) can also be issued if the receiving country authorities request it.
5. Packing list (PL).
6. Product information Report (PIR).

Customers should use the packing list to make a detailed plan prior to the egg arrival. Based on the shared paperwork, the customer will know in advance the exact number of eggs, development stage in degree-days (DD), number of boxes and size of eggs that they will receive.

The customer must ensure that all local documentation and permits are in place before the arrival of eggs. The sales managers can assist with information regarding logistics and customs to avoid any delays.

2. Egg packing and counting

24–96 hours before shipment the ova are disinfected in Buffodine solution, prepared according to manufacturer's instructions.

Eggs are sorted and counted by machine. 2 litres of eggs are distributed evenly in 0.5 litre sections in each tray. Number of eggs per tray will vary according to size stated in delivery documents.

Ova are packed in Styrofoam boxes, (33 x 33 x 36 cm), at a temperature 2–4°C (Figure 1).

Figure 1. Benchmark Genetics plastic-coated cardboard box.



Each box normally contains four trays totalling 8 litres of eggs with a single tray of ice on the top layer. For deliveries with long transport time and warm transport temperatures of >8°C, three trays of ova (6 l per box) with ice in both the top and bottom tray are used (Figure 2).

A temperature logger (Figure 3) is placed in one box of each shipment and an additional logger added for every additional million eggs. Other temperature loggers are available in the market that also fit the purpose. The boxes are numbered externally and internally. Styrofoam boxes are encased in a plastic-coated cardboard box printed with shipping conditions and delivery address.

Figure 2. Egg packaging procedure: Four trays with eggs placed in the styrofoam box with a single tray of ice placed on the top layer. Styrofoam box sealed and placed in the Benchmark Genetics labelled cardboard box.



Figure 3. Temperature logger used for monitoring temperature during transport.



3. Shipment and temperature profile

Each box is numbered externally and internally, and the box orientation is shown clearly on the outer plastic-coated cardboard box along with shipping conditions and address (Figure 4). The styrofoam inner box is sealed around the lid and a sharp tool will be required to remove this at unpacking.

At packing ova will be at a temperature of 2-4°C with ova arriving at a temperature of 2-6°C and average temperature during transport of 4°C if the temperature in the transport is controlled to 2-10°C. The boxes should not be exposed to temperature of below 0°C since this may adversely affect the eggs. For longer transport duration or if boxes are to experience ambient temperatures of > 10°C 4 litres of ice to 6 litres of ova is sufficient to maintain satisfactory temperatures.

Figure 4. Transport boxes prepared and sealed for shipment.



Figure 5. A handheld thermometer showing the temperature of eggs at arrival to the farm.



4. Transport and arrival at the farm

The logistics are agreed upon between sales manager and customer in advance of each order. The boxes should be handled with care during transport and may be collected by the customer or delivered to an agreed location or the receiving farm. In the countries that Benchmark Genetics is present, the sales manager may deliver the boxes directly to the farm. A temperature-controlled environment is an important factor during this phase of the procedure. The boxes should be held at around 2-10°C ambient external temperature during the transportation to the farm. The transport plan needs to take account of season and environmental temperature and should be agreed between the sales manager and customer. At warmer times of the year and with longer journey time more ice may be required in the transport boxes.

To ensure high biosecurity on arrival at the hatchery the outer cardboard boxes can be discarded, and the inner boxes disinfected by using a suitable disinfectant such as Buffodine prepared according to manufacturer's instructions. Only the disinfected inner boxes should be taken into the hatchery. (See Benchmark Genetics Atlantic Salmon Hatchery Manual).

5. Unpacking/disinfection

The quality and conditions of all boxes should be assessed before unpacking. Notes and pictures of any boxes that have been externally damaged should be taken and recorded in the relevant ova quality control sheet.

As standard, Benchmark Genetics disinfects the eggs with Buffodine according to manufacturer's instructions 24-96 hours prior to packing. Customers can request that this disinfection step is not carried out.

Eggs should not be re-treated with Buffodine within 48 hours of the previous treatment. More information on the disinfection protocol can be obtained from the sales manager.

Suggested Procedure for egg disinfection (Figure 6):

1. Remove tape and lid.
2. Carefully lift out top tray of ice and discard residual ice. Note if there is no ice present.
3. Replace top tray.
4. Clamp top tray to outer box either by pins or spring clamp to prevent the trays floating when the disinfectant is added.
5. Ensure that eggs, Buffodine and water for rinsing are at the same temperature to avoid temperature shock to the eggs (Figure 5).
6. Slowly fill the box with 10 litres of diluted Buffodine prepared according to manufacturer's instructions allowing air to escape. Leave eggs in the Buffodine solution for 10 minutes, unless otherwise specified for your delivery.
7. Lightly press down on top tray and remove clamps/pins.
8. Slowly lift out trays by lifting evenly from the centre.
9. Place trays onto a raised mesh and gently rinse off disinfectant using fresh water.
10. Pour remaining disinfectant through a sieve to retain any ova and add to tray.
11. Once comfortable with the procedure, start each box at 5-minute intervals.
12. Replace Buffodine solution according to manufacturer's instructions.
13. For longer transport or if eggs seems a bit dry at arrival, see information in chapter 9. Extended duration transit (page 15).

Figure 6. Unpacking and egg disinfection procedure on arrival at the farm. **A.** Styrofoam boxes placed in the disinfection area. **B.** Lid removed revealing the first egg tray. **C.** Ideal condition of eggs during unpacking on site. **D.** Disinfectant is added to the styrofoam boxes. **E.** Egg trays placed onto a raised mesh following disinfection. **F.** Gently rinse using fresh water.

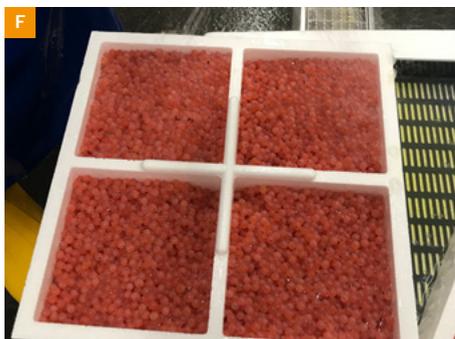
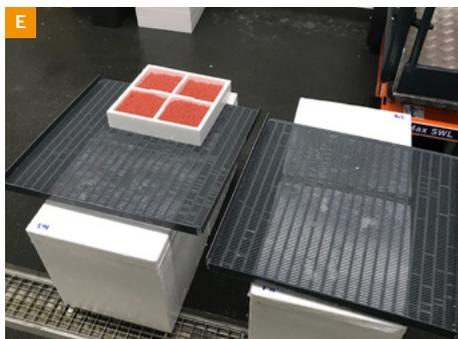
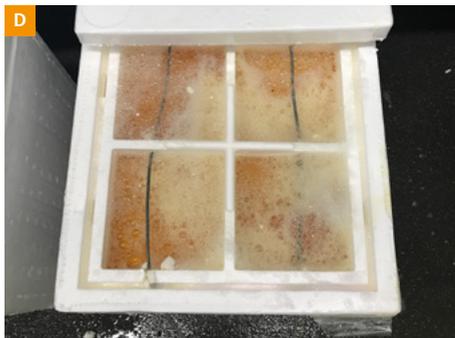
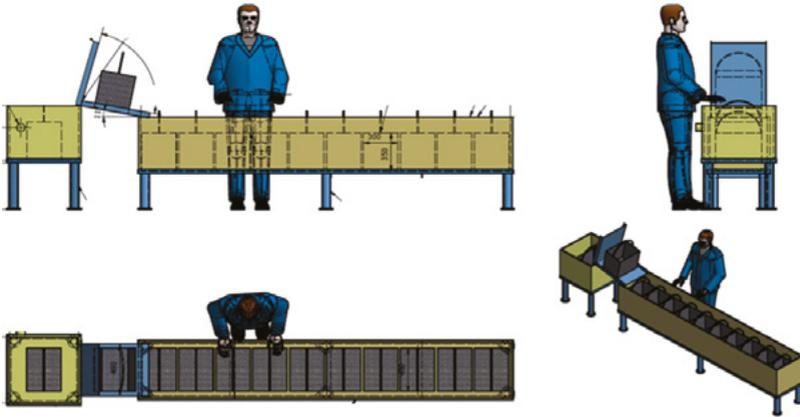


Figure 7. An example of an effective unpacking system.



6. Input of eggs – transfer to hatching equipment

Ensure that water temperature, pH and nitrogen /total gases are in the acceptable range (see Benchmark Genetics Atlantic Salmon Hatchery Manual – Section 1. Environmental parameters) before egg transfer. Avoiding temperature shock of eggs is particularly important.

After rinsing, transfer the required number of eggs to each hatching unit. To increase accuracy and simplicity Benchmark Genetics have designed blanking plates that fit neatly over the individual egg trays and allow ova to be poured out into the hatching units in 0.5 litre batches (Figure 8 and 9). Alternatively, an empty tray can be cut into the same profile to achieve a similar result. Smooth out the ova evenly as each tray is filled.

Place the temperature logger into the hatching system for 30 minutes to monitor the water temperature before and after transfer. Stop the temperature logger by pressing the stop button for 10 seconds until both lights blink.

Figure 8. Benchmark Genetics designed blanking plates that fit neatly over the individual egg trays.



Figure 9. Eggs transferred into a CompHatch hatching unit.



7. Quality check and count verification

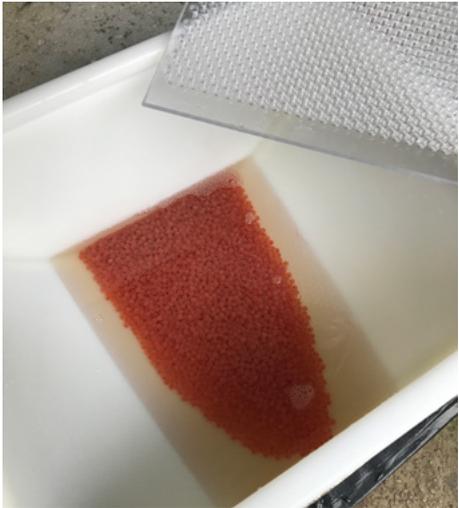
7.1 Count verification

It is important to ensure that there is an accurate count of eggs at delivery.

Suggested procedure for egg counting (Figure 10):

1. Disinfect and thoroughly rinse counting bath and counting plate.
2. Add 2 litres of fresh water to the counting bath.
3. Add 5 litres of water in an empty egg box or clean suitable container to receive the counted ova.
4. Select a box and note box, cylinder number and amount of eggs per litre from Packing List, to keep track of traceability.
5. Add a 2 litres tray of ova to the counting bath.
6. Gently sweep the counting plate through the water keeping the end you are not holding against the curved surface. The counting tray has a chamfered edge to assist with this and prevent damage to the ova.
7. Bring counting plate up to a horizontal position allowing excess ova to fall off the plate and back into the bath. Add ova to any holes not filled. A complete plate contains 500 ova.
8. Insert the plate into the water in the receiving container upside down and lift it gently upwards against the water surface until the eggs fall off. If some eggs are stuck tap the plate gently to remove them.
9. Repeat the process until no ova are left in the bath.
10. It may be useful to use a small net to remove and count the last few hundred ova.
11. Compare counting control with Packing List.
12. It is important to know the eggs are not 100% evenly distributed in each section of the tray. Therefore, count one full tray (2 litres) from a box and repeat across a minimum of three randomly selected boxes.

Figure 10. Egg counting procedure.



7.2 Quality check

During the quality check the customer will assess that the eggs that Benchmark Genetics supplies are high quality ova with low levels of eggs that do not meet quality standards.

A quality control sheet will be shared in advance by the relevant sales manager. Examine a minimum of 500 ova (1 counting plate) for any variation in quality (Figure 11). Register box and cylinder number for traceability. Register this information in the ova quality control sheet. If multiple plates are examined these should be taken at random from trays across the shipment.

Variability in egg size can be recorded using a digital photograph of 100 eggs using the measuring size diagram for fry.

Register all the above information and the ova counts along with other parameters in the ova quality control sheet and forward to the sales manager.

Figure 11. Quality check. **A:** White egg. **B&C:** Early hatched alevin with yolk sac. **D:** non-fertilized egg. **E:** Micropthalmic egg. **F:** Quality check on numerous eggs upon arrival to the farm, one individual egg separated due to damage during transport.

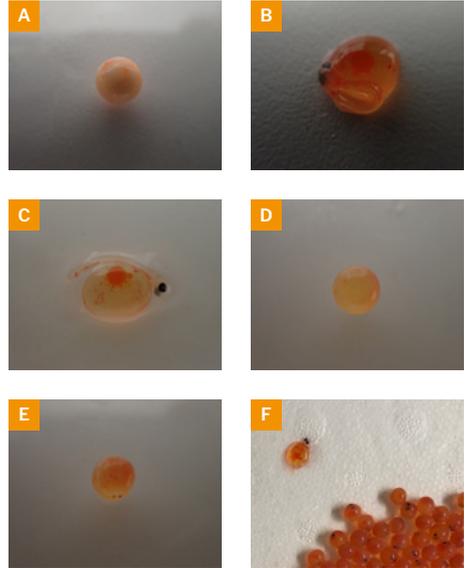


Figure 12. Removal of abnormal eggs with the use of a handheld pipet.



8. When things go wrong

Occasionally problems may be experienced with an egg delivery due to events out of Benchmark Genetics control.

In the case of quality or handling related issue please notify the sales manager as soon as possible, at least within 72 hours from it being identified. All deviations need to be documented in case of an insurance claim. Problems might include but are not restricted to:

- Items lost in transit
- Damage to the delivery
- No ice in boxes upon arrival or internal box temperature exceeding 8°C
- Low temperature – freezing temperature or internal box temperature below 2°C
- Suboptimal ova quality
- Boxes arriving upside down

The relevant ova quality control sheet should be completed as soon as possible. Photos and documentation should be collated and shared with the sales manager and suitable solutions reviewed and agreed.

9. Extended duration transit

A transit duration exceeding 90 hours may result in dehydration of the ova, even if provided with sufficient ice. Dehydrated ova may rupture when exposed to Buffodine due to the abrupt change in osmotic potential causing an elevated level of prehatch mortality.

In such a situation the following steps can be taken to rehydrate the eggs before disinfection:

1. Remove the remaining ice from the top tray and then secure the empty tray in place using pins or clamps to prevent floating.
2. Fill the box with fresh water from the hatchery avoiding heat shock and allow the ova to soak for up to 15-20 minutes.
3. Pour out the water and refill the box with a Buffodine solution, prepared according to manufacturer's instructions and allow to soak for 10 minutes.
4. Remove trays and rinse in accordance with the unpacking/ disinfection protocol in section 6.

10. Further information

- Hatchery manual
- Benchmark Genetics input and import information
- Measuring size diagram for fry document
- Ova quality control sheet



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Non-endorsement: This document contains statements about use of recognised chemicals and reagents used to clean and disinfect facilities and equipment for handling and incubating salmon eggs. Cleaning and disinfection can be achieved using a variety of chemicals and reagents and a range of equipment is available for egg handling. Manufacturer's instructions should always be adhered to when using reagents and chemicals for cleaning and disinfecting equipment and using egg handling equipment. Local health and safety procedures and regulations should be followed when working with reagents and chemicals and personal protective equipment should be used where appropriate. Nothing in this document should be construed or interpreted as i) an endorsement, recommendation or advice on the use of any particular chemical or product, or ii) any claim, warranty or guarantee on the use or effectiveness of any particular chemical or product. Benchmark Genetics Limited or any of their affiliates, accepts no liability, claim or action for the direct or indirect consequences of the use of any information contained in this document, whether that be explicit or implicit, for the preparation of facilities and equipment or for any other purpose.

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