



Benchmark®
Genetics Shrimp

**SHRIMP
BROODSTOCK
ACCLIMATISATION
PROCEDURES**



Shrimp broodstock are often transported long distances from breeding companies to hatcheries. To optimise the recovery of shrimp from the stresses of transport, to minimize mortality during acclimatisation and maximise the number of eggs and larvae produced the broodstock need to be placed in a favourable environment.

This manual describes the optimum conditions and best-practice management procedures for acclimatisation of shrimp broodstock.

Who we are

Benchmark Genetics Shrimp is part of Benchmark Holdings plc., a leading provider of solutions in aquaculture genetics, health and specialist nutrition.

The company operates a world-leading breeding programme for Whiteleg Shrimp, *Litopenaeus vannamei* using the latest genomic tools in a pedigree breeding programme with over 20 years of selection for improved performance.

Specific Pathogen Free (SPF) strains are distributed worldwide from strategically placed, biosecure multiplication centres.

What we do

Benchmark Genetics Shrimp develops and globally distributes genetically improved, high performing SPR/SPF shrimp strains with the highest adaptability to local environmental conditions and genetically improved disease resistance, yield, health and welfare.

The company is committed to developing broodstock with a high level of resistance to the major diseases affecting the shrimp industry worldwide, such as WSSV and AHPND.



PREPARATION FOR ARRIVAL

Objective: Pre-conditioning the water and preparing reception tanks and facilities before arrival of the broodstock will ensure a quick recovery from transport stress. The water quality of the reception tank is adjusted to match that of the transport water on arrival.

24 hours prior to arrival

- Clean and disinfect the tanks using commercial detergent and disinfectants prepared according to manufacturer's instructions. Appropriate personal protective equipment should be worn during cleaning and when using detergents and disinfectants.
- Shrimp can be transferred to production tanks or quarantine/acclimatisation tanks depending on facilities;
 - Ensure that sufficient disinfected and conditioned seawater is available;
 - Disinfect the reception tanks;
 - Flush drainage and floor surface with a solution of 50-80 ppm active chlorine prepared using manufacturer's instructions then rinse with clean, fresh water (not sea water);
 - Install new airstones, or if airstones have been used previously immerse in acid solution of pH <2 for at least 12 hours;
 - After ensuring that no residual chlorine solution remains, wash tank surface with an acid solution (muriatic acid solution, pH <2) then rinse with clean, fresh water (not sea water);
 - Wash tank surface with INVE Sanocare PUR 1% solution at a usage rate of 0.2 l/m² of tank surface or a commercial iodine and detergent solution using a scrub sponge;
 - Rinse with clean, fresh water;
 - Allow the tank surface to dry.

12 hours prior to arrival

- Part-fill the tanks with treated water;
 - Fill the tanks up to 50% of the volume, using a 1 micron filter bag to remove particles. Tanks should remain at 50% volume until shrimp have been transferred from the transport bags.
 - Depending on water quality, the chelating agent EDTA is often added at 15 ppm and mixed using aeration to bind toxic heavy metal ions.

6 hours prior to arrival

- Disinfect the water;
 - Disinfect water using a specialist aquaculture disinfectant such as INVE Sanocare PUR (dose rate 1 ppm) and aerate or chlorine solution at concentration of 10–30 ppm followed by dechlorination with aquaculture sodium thiosulphate according to manufacturer's instructions;
 - Check calibration of pH pens using pH 4 and 5 calibration buffer solutions or other pH meters using manufacturer's procedures.

3 hours prior to arrival

- Adjust water quality to match transport water;
 - Check water quality parameters;
 - Stop aeration and start to adjust the pH of the water;
 - The expected pH of the shipment water as function of transport duration is shown in table 1;
 - The pH in the reception tanks needs to be adjusted to the value in table 1 according to transport duration;

- To reduce the pH, lab grade quality acids such as acetic, muriatic, hydrochloric or ascorbic (vitamin C) acid can be used;
- The amount of acid required depends on the acid used and the pH and other characteristics of the local water source. A titration test using a 10 litre bucket can be used to estimate the amount of acid used to achieve the required change in pH;
- Aeration increases pH and so should be turned off during the titration test and pH adjustment until the tank is at full volume. A submersible pump should be used to mix the water in the tank;
- After pH adjustment check the pH for 1 hour, at 15 minute intervals with pH pens or other suitable pH meters at different points in the tank to ensure adequate mixing;
- If pH is not achieved in the tank repeat the titration test and adjust the pH as necessary;
- When the desired pH is achieved, record:
 - Salinity (needs to be within 5 ppt of the salinity of the source farm confirmed by supplier)
 - Temperature
 - Dissolved oxygen % (DO)
 - Alkalinity
 - pH.

- Adjust temperature to 21°C using a water chiller to match temperature of transport water and increase DO. Ice contained in sealed, disinfected, heavy duty plastic bags can be used instead of a chiller. Water from the ice bags should not leak into the tank because of possible contamination. Ice bags should be disinfected before use by soaking or spraying with 15 ppm INVE Sanocare PUR or 200 ppm commercial iodine disinfectant solution.

Key Points:

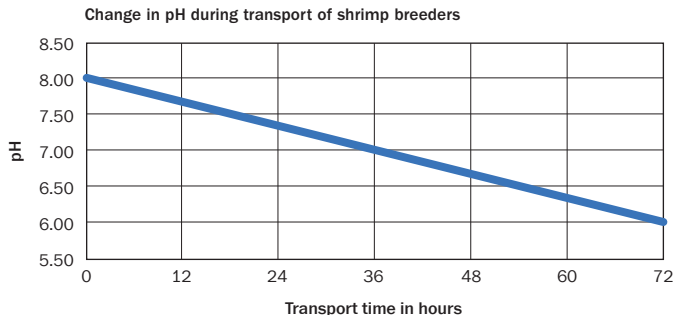
- Preparation in the 24 hours before arrival will speed up recovery from transport and increase broodstock performance;
- Reception tanks need to be cleaned and disinfected;
- Preparation of water in reception tanks involves creating similar water quality and temperature to that in the transportation bags to prevent stress after transfer;
- Tanks should be filled to 50% capacity and remain with this volume until shrimp are transferred from transport bags;
- Aeration of tanks will alter pH and should not be switched on until the shrimp are transferred and tanks are at full volume, unless DO is too low.

1 Hour prior to arrival

- Adjust water quality and temperature;
- Check pH — adjust if needed — use pump to mix;

Table 1. Predicted pH of transport water after different transport durations

Transportation time (hours)	pH
0	8.00
12	7.66
24	7.33
36	7.00
48	6.66
60	6.33
72	6.00



SHIPMENT ARRIVAL & ACCLIMATISATION

Objective: Minimise stress, ensure fast recovery from transport and improve reproductive capacity by efficient transfer of the shrimp broodstock from transportation bags to tanks with minimum difference in water quality. After broodstock are transferred to reception tanks gradually change the water quality to that of the receiving facility.



Caution:

- ✗ Sudden changes in water quality will result in stress to the shrimp and delay recovery from transport stress.
- ✗ Do not add air or oxygen to the transport bags because pH will increase, resulting in stress to the shrimp.

Unpacking

- Disinfect an area of floor for removing and sorting transport bags using 15 ppm INVE Sanocare PUR or 200 ppm commercial iodine disinfectant solution;
- Remove the transport bags from the boxes in the disinfected floor area, spray or dip with 15 ppm INVE Sanocare PUR or 200 ppm commercial iodine disinfectant solution, sort and place the bags gently on the water surface of reception tanks — see photograph;
- Air or oxygen should not be added to the transport bags because the resulting change in pH and increase in ammonia toxicity will result in stress to the shrimp;
- Check documentation;
- Each tank should receive the number of bags to achieve a density of 6 to 8 shrimp per m². Sexes can be mixed or kept separate depending on management preferences;
- Occasionally transport bags are deflated. These should be placed in the tank to acclimatise and priority given to these when opening.



Transportation bags are placed on water surface to allow water temperature to equalise with reception tank.

Check shrimp condition and water quality

- The condition of shrimp and transport water at arrival should be assessed by initially opening only three bags of males and females at random and recording:
 - Temperature;
 - pH;
 - DO;
 - Salinity;
 - Alkalinity
- Mortality: gill condition, soft, presence and location of any necrosis;
- Other observations e.g. turbidity, smell.

- Using observation of transport conditions make any final adjustment to reception tank water quality;
 - Adjust pH — if transport and acclimation water pH differ by >0.5;
 - Using procedures used before arrival and mix to ensure homogeneity of the pH throughout the tank;
 - Adding air or oxygen will result in rapid increase in pH. Aeration should remain off after adding the acid until the tank is at its full volume and acclimatisation is complete unless DO drops to dangerous levels ie below 5 ppm.
 - Adjust temperature — if transport and acclimation water temperature differ by >3°C;
 - Bags should be allowed to float until the temperature difference is less than 1°C.
 - Adjust salinity — if transport and acclimation water salinity differ by >5 ppt;
 - Adjustments to salinity are rarely required.
- Add a probiotic such as INVE PRO-W (5 ppm based on 50% water volume) to control bacterial levels;
- Occasionally, more active shrimp can be seen feeding on weaker animal's appendages. Feeding small amounts (1-2% of biomass) of biosecure broodstock feed such as INVE BREED-S will reduce this behaviour. Feeding should be managed by observation of shrimp behaviour using small amounts of feed.
- Start aeration only after tank has achieved 100% volume, unless aeration was needed to maintain DO above 5 ppm.

Tank monitoring

- Extra attention should be given to weak animals, typically swimming on their side;
 - Adding a temporary, net cage with extra air stones for these animals aids recovery and avoids cannibalism.
- Check tanks hourly for 24 hours, removing any dead animals immediately and recording sex and cause of mortality (e.g. soft, gills, necrosis, cannibalism).

Transfer of shrimp to tanks

- When water quality of transport and tank water is equivalent, open the bags and scoop the animals into the tank with a net, discarding the shipping water – see photograph. Shipping water should not be used due to high levels of metabolic waste which can have built up during transport;
 - Start water flow as a trickle into the reception tank aiming to achieve 100% volume over 5 hours;
 - Extra attention should be given to weak animals, typically swimming on their side;
 - Adding a temporary, net cage for these animals aids recovery and avoids cannibalism. Extra air stones should be added to this pen when the tank reaches full volume;
 - Addition of 5 ppm vitamin C (based on 50% water volume) is common practice to boost antioxidant capacity of the shrimp and help recovery from stress;
 - Check DO at 30 min intervals. If DO drops below 5 ppm start aeration;

Key Points:

- Gradual changes in water quality will prevent stress to the shrimp;
- Transfer the shrimp from the transport bags to receiving tanks when water quality and temperature are similar;
- Transport water should be discarded.



Transfer the shrimp from bags to tanks using a hand-net and discard the transport water.

ENVIRONMENTAL PARAMETERS

High levels of performance and good health and welfare are experienced when broodstock are kept in their comfort zone defined by a number of water quality parameters.



Caution:

X Care should be taken when adding acid or alkali to the tanks. Use appropriate personal protective equipment and follow local health and safety procedures.

pH

pH — a measure of water acidity — is one of the most important water quality parameters. Ocean pH is around 8.2 and shrimp are comfortable from 7.6. Water pH will decrease during transport through accumulation of CO₂ and may reduce to levels of pH 6.0–6.5 resulting in increasingly high stress levels. Water pH in the tanks can be lowered by adding acetic acid (vinegar) or other acids (muriatic acid; hydrochloric acid or CO₂). Laboratory grade acid is preferred. Water pH will normalise with aeration.

Temperature

The optimum temperature range for reproduction is 27 to 28 °C.

Salinity

Shrimp broodstock are comfortable in a range of marine salt concentrations from 30 to 34 ppt. Spawn and hatching efficiencies can be improved by lowering the salinity 2 to 3 ppt from the normal salinity.

Alkalinity

Alkalinity is a measure of the concentration of alkaline molecules such as bicarbonate and hydroxides in solution. Shrimp broodstock should be kept at an alkalinity of 140–150 ppm. During spawning or hatching it can be beneficial to increase alkalinity to 150–160 ppm. Alkalinity can be increased by adding calcium bicarbonate or sodium bicarbonate.

Dissolved Oxygen (DO)

Shrimp broodstock should be kept in water with at least 5 ppm dissolved oxygen (DO) using aeration or oxygen addition where required to maintain adequate levels.

Table 2. Water quality parameters for shrimp broodstock

Parameter	Min	Max
pH	7.6	8.2
Temperature °C	27	28
Salinity ppt	30	34
Alkalinity ppm	140	150
Dissolved Oxygen ppm	5	



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