

Illustrations: Sabrina Cheng/WorldFish

# Better management practices for monosex tilapia seed production: An illustrated guide



Funded by



In partnership with



RESEARCH PROGRAM ON Fish

Led by WorldFish

# Better management practices for monosex tilapia seed production: An illustrated guide

---

## Authors

Jharendu Pant,<sup>1</sup> Shwu Jiau Teoh,<sup>1</sup> Silvino Gomes,<sup>2</sup> Adriano Dani,<sup>3</sup> Lucas Soares De Jesus,<sup>2</sup> Mario Pereira<sup>2</sup> and Ram C. Bhujel<sup>4</sup>

## Authors' affiliations

<sup>1</sup> WorldFish, Penang, Malaysia

<sup>2</sup> WorldFish, Dili, Timor-Leste

<sup>3</sup> National Directorate of Aquaculture, Ministry of Agriculture and Fisheries, Dili, Timor-Leste

<sup>4</sup> Aqua-Centre, School of Environment, Resources and Development (SERD), Asian Institute of Technology (AIT), Thailand

## Citation

This publication should be cited as: Pant J, Teoh SJ, Gomes S, Dani A, De Jesus LS, Pereira M, and Bhujel RC. 2020. Better management practices for monosex tilapia seed production: An illustrated guide. Penang, Malaysia: WorldFish. Booklet: 2020-12.

## Acknowledgment

This work was undertaken as part of the [CGIAR Research Program on Fish Agri-Food Systems \(FISH\)](#) led by [WorldFish](#). The program is supported by contributors to the [CGIAR Trust Fund](#). Funding support for this work was provided by Ministry of Foreign Affairs and Trade (MFAT), New Zealand, in the framework of the Partnership for Aquaculture Development in Timor-Leste (PADTL) project.

The authors would like to acknowledge the MAF Gleno hatchery team, especially Mr Marcos de JSM and Leohitu PPP hatchery owner, Mr. Joao Da Silva, for their support in establishing and operating the GIFT hatcheries in Timor-Leste. Recognition also goes to Kate Bevitt and the WorldFish communication team for their hard work in creating this booklet.

## Contact

WorldFish Communications and Marketing Department, Jalan Batu Maung, Batu Maung, 11960 Bayan Lepas, Penang, Malaysia. Email: [worldfishcenter@cgiar.org](mailto:worldfishcenter@cgiar.org)

## Creative Commons License



Content in this publication is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License ([CC BY-NC 4.0](#)), which permits non-commercial use, including reproduction, adaptation and distribution of the publication provided the original work is properly cited.

© 2020 WorldFish.

## Illustrations

Content: Shwu Jiau Teoh/WorldFish

Artwork and graphic design: Sabrina Chong/WorldFish

# Table of contents

---

About the booklet	2
Seed production process	3
Step 1. Breeding	4
Step 2. Collecting eggs	5
Step 3. Incubating eggs in hatching jars and trays	6
Step 4. Sex reversal technology	7
Step 5. Nursing in hapas	8
Step 6. Conditioning, packing and transportation	9
Step 7. Stocking in grow-out pond	10
References	11
Hatchery layout	12

## About the booklet

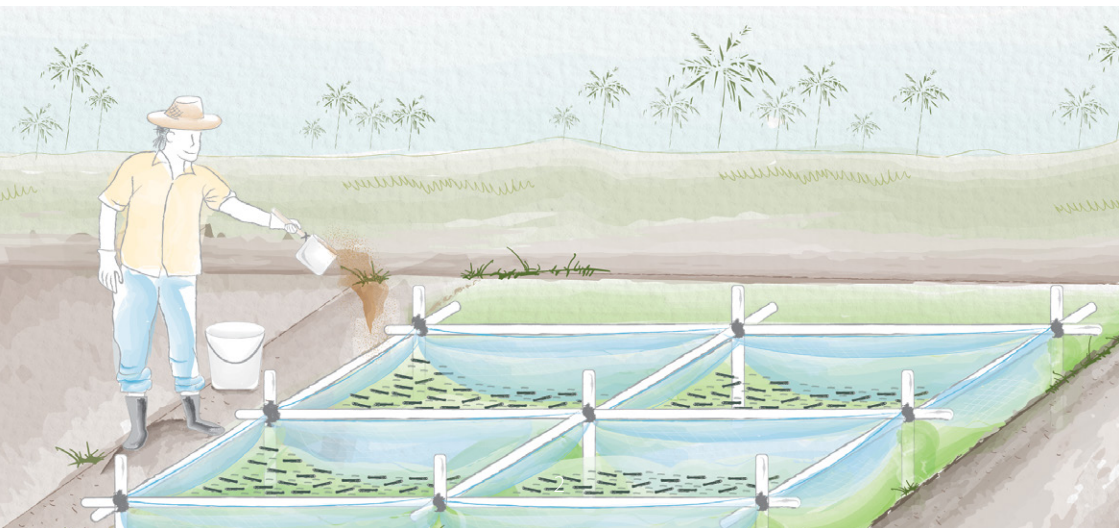
---

This booklet explains the better management practices (BMP) for producing high-quality genetically improved farmed tilapia (GIFT) monosex seed.

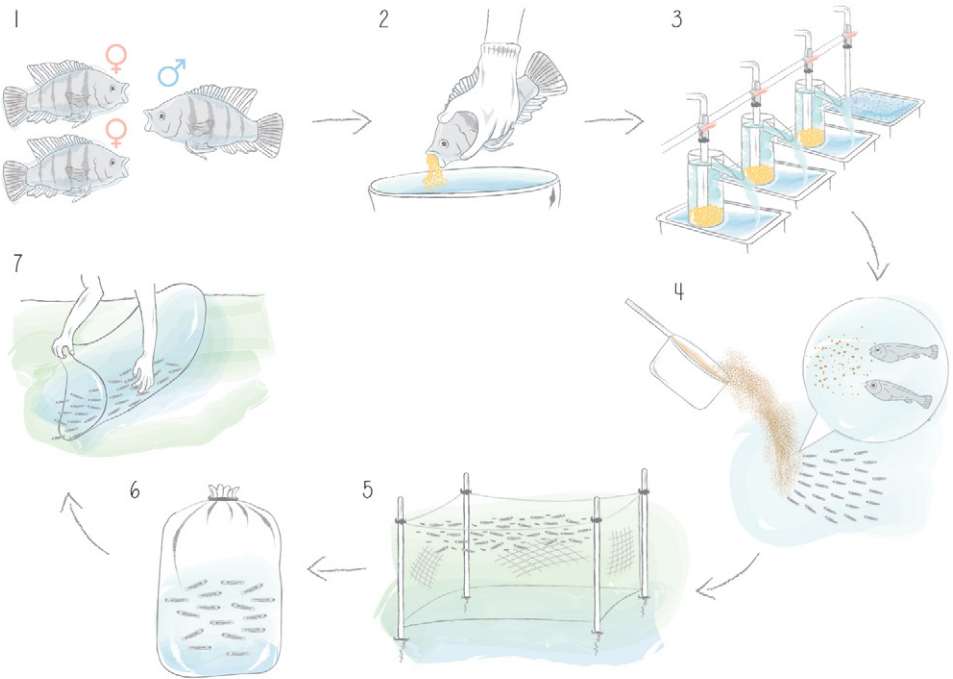
These simple and low-cost methods have been tested and proven over five years of research and development in Timor-Leste. The goal is to support the scaling of fish farming to contribute to food and nutrition security. The booklet is intended as a resource for governments, I/NGOs and private sectors involved in tilapia seed production and grow-out systems in the tropics across the Asia-Pacific region. Note, these practices may need some adjustments to adapt to the local agro-ecological and environmental contexts.

It is mandatory for the hatchery to comply with all biosecurity requirements throughout the seed production process, including hatchery staff wearing protective clothing and masks; following adequate safety and precautionary measures when storing and handling 17-alpha methyl testosterone (MT hormone), alcohol, and other chemicals; and properly managing wastewater and other effluents from the hatchery.

The CGIAR Research Program on Fish Agri-Food System, led by WorldFish, is developing BMP guidelines at the global level and contextualizing BMP resources at the country level to support sustainable GIFT farming in WorldFish focal and scaling countries. This booklet is produced as part of this approach and there is also a plan to produce a detailed BMP on GIFT hatchery and nursery management.



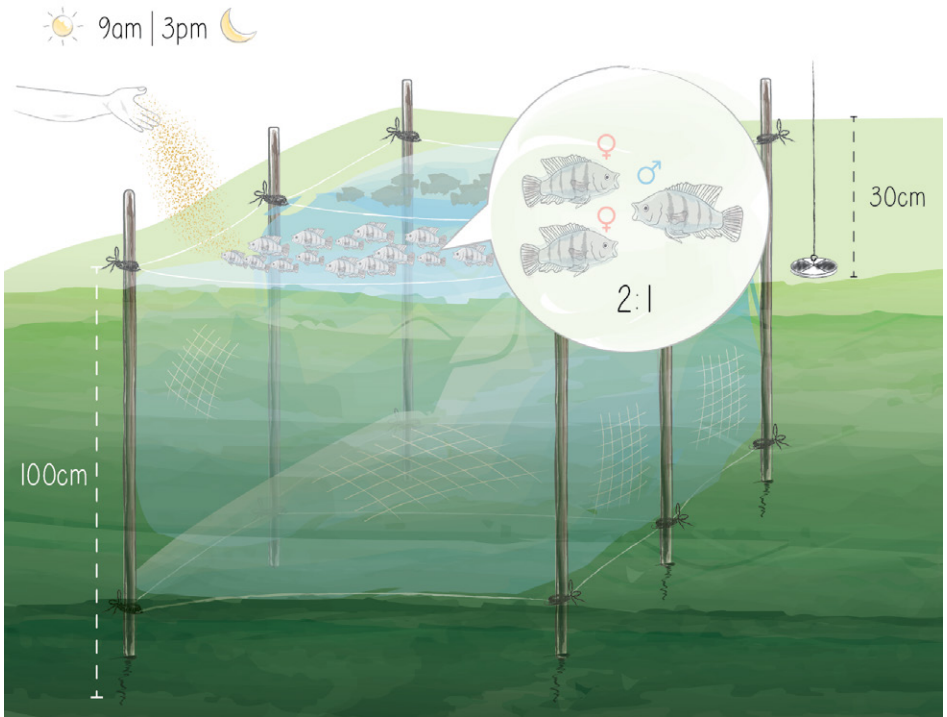
# Seed production process



Producing quality fish seed involves seven steps:

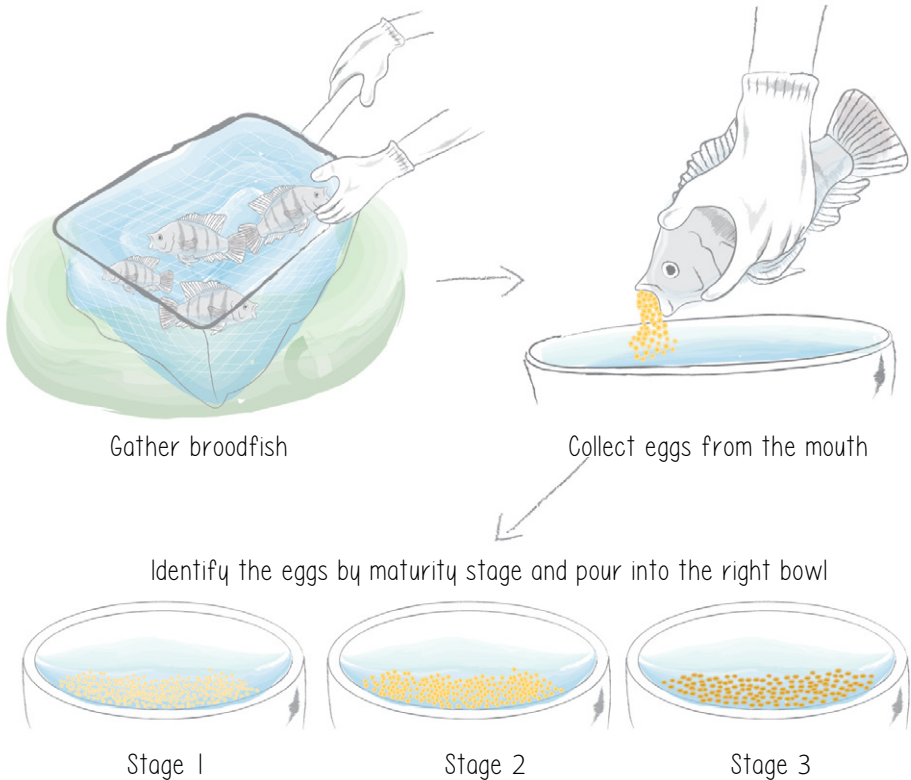
1. Breeding in hapas
2. Collecting eggs
3. Incubating eggs in hatching jars (3–4 days) and larval rearing in trays (5–7 days)
4. Applying sex reversal technology (21 days)
5. Nursing in hapas (30–45 days)
6. Conditioning and transportation of fingerlings
7. Stocking in growout ponds

# Step 1. Breeding



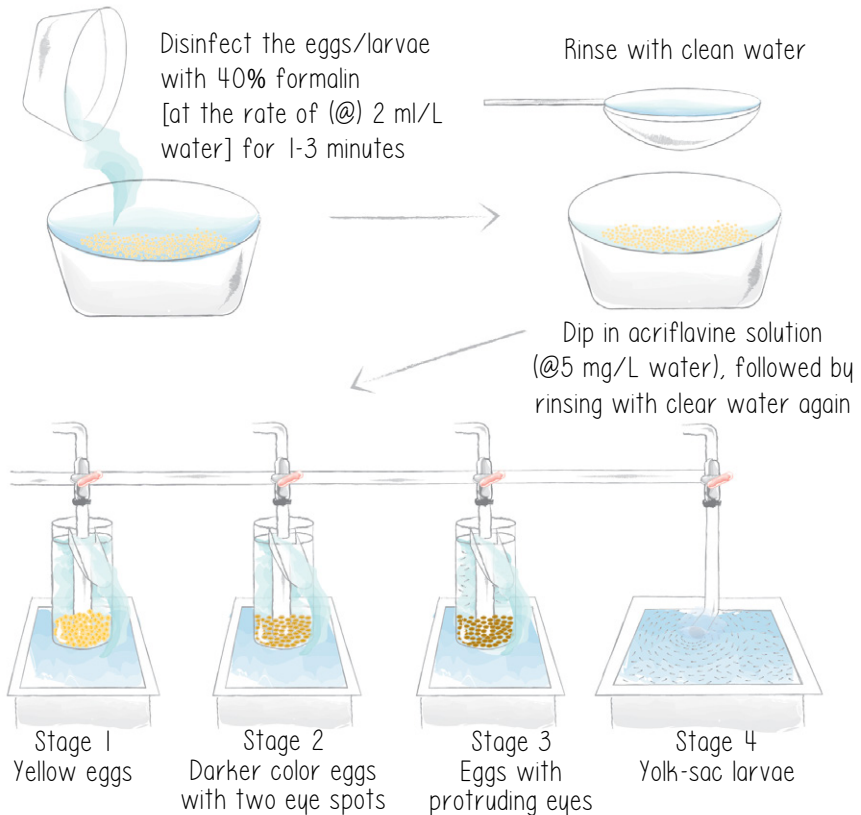
- Fertilize the pond when necessary and maintain green water. Light green water (secchi disk depth of 30 cm) helps breeding and produces good quality eggs. Stock mature female (150 g size) and male (200 g size) broodfish in hapas at a 2:1 ratio with a stocking density of 6 broodfish per m<sup>2</sup>.
- Feed broodfish with good quality commercial pellets or locally-made feed twice daily at 9 am and 3 pm.
- Tilapia breed naturally if males and females are kept together. Around 15–30% of females produce eggs each week.
- Replace the broodfish in 1.5 to 2 year intervals when they grow to over 500 g in size.

## Step 2. Collecting eggs



- Start harvesting the seed one week after mixing the males and females. Harvest the seed weekly on the same day thereafter.
- To harvest seed, gather the broodfish at a corner of a hapa. Check the mouth of every fish for eggs/larvae. If there are no eggs/larvae in the mouth, gently release the fish back into the hapa.
- If a female has eggs/larvae in her mouth, collect them in a bowl with some water and gently release the fish back into the hapa. Identify the eggs by their maturity stage and pour into the right bowl by stage. The lighter color indicates less mature eggs (stage 1), the darker colored are more mature eggs (stages 2 and 3).

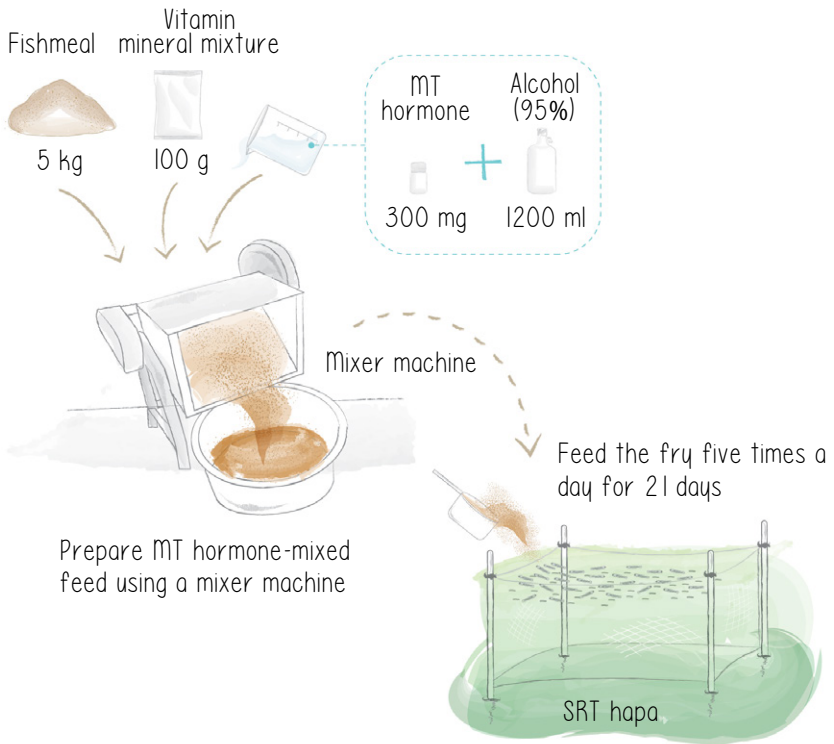
### Step 3. Incubating eggs in hatching jars and trays



- Transfer the eggs and yolk-sac larvae into a bowl filled with water, shaking the bowl gently. Wash the eggs/larvae with clean water several times. Pass them through a fine mesh sieve to separate the sand particles.
- Disinfect the eggs/larvae with 40% formalin (@2 ml/L water) for 1-3 minutes, then rinse with clean water. Dip the eggs/larvae in acriflavine solution (@5 mg/L water), then rinse again for 30 seconds.
- Weigh the eggs/larvae by stage and keep records for each batch.
- Place the eggs/larvae into jars that are supplied with filtered water. Maintain a constant water flow to churn the eggs/larvae gently. After hatching, transfer them into trays for larval rearing.



## Step 4. Sex reversal technology (SRT)

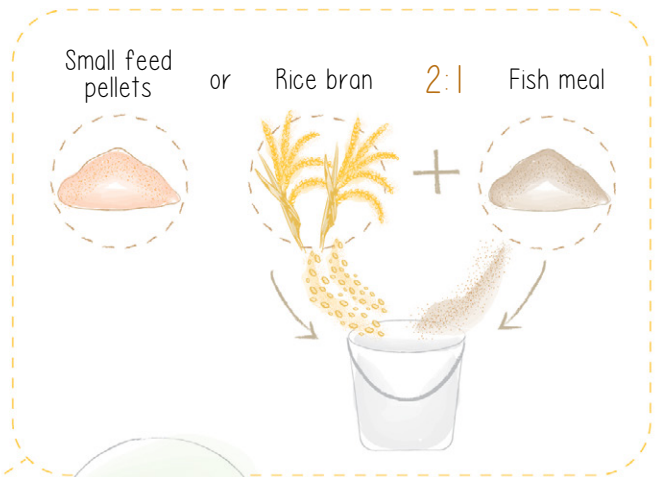


- The sex reversal of tilapia fry is done using 17-alpha methyl testosterone (MT hormone). Prepare the feed by dissolving 300 mg of hormone in 1200 ml of alcohol (95%), then mix it gradually into 5 kg of fishmeal and add 100 g of vitamin-mineral mixture. Keep the hormone-mixed feed spread thinly under an open or ventilated area overnight for the alcohol to get evaporated.
- Stock swim-up fry in 6 m<sup>2</sup> hapas at the stocking density of 3000-5000 fry/m<sup>2</sup>. Feed the fry five times a day with hormone-mixed feed for 21 days.
- Sex determination takes place around 12 to 15 days after hatching. If MT hormone feeding begins late, or when they are older than 15 days, sex reversal may not be possible. Follow the feeding time and schedule to produce over 99% male fry.

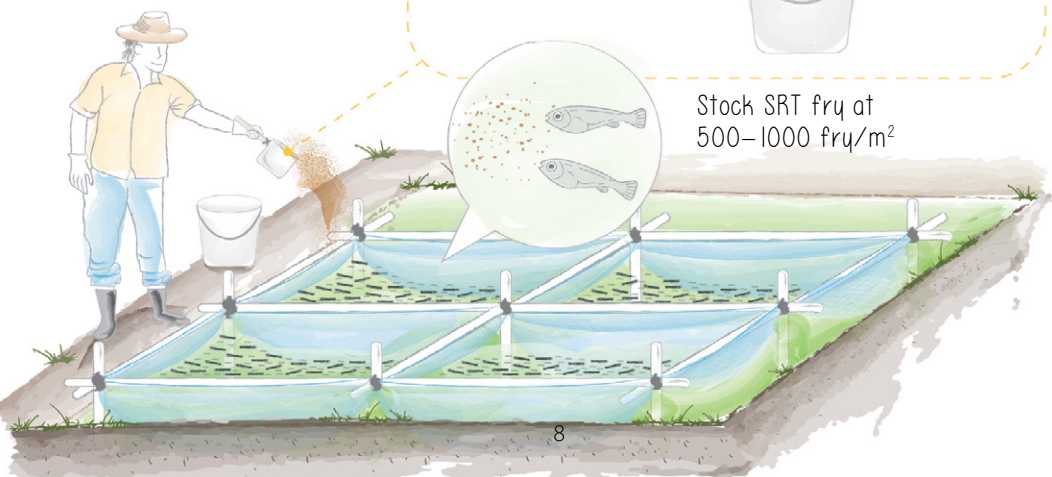
## Step 5. Nursing in hapas

- Install hapas (10–20 m<sup>2</sup>) in a pond prepared by draining, drying for a week and applying lime. A week before SRT fry stocking, fertilize the pond with urea and triple super phosphate (TSP). Cover hapas with strong nets to avoid predation from birds.
- Stock the SRT fry for nursing at 500–1,000 fry/m<sup>2</sup> in hapa.
- Feed the fry with floating feed pellets or with a mixture of rice bran and fish meal (2:1), two to four times a day at about 5–10% of biomass or up to satiation.
- Nurse the fry for about a month or until they are at least 1 g in size. Fry can also be further nursed to 5 g, which is a more suitable sized fingerling to stock in the grow-out pond.

Feed small floating feed pellets or mixture of rice bran and fish meal, two to four times a day



Stock SRT fry at 500–1000 fry/m<sup>2</sup>

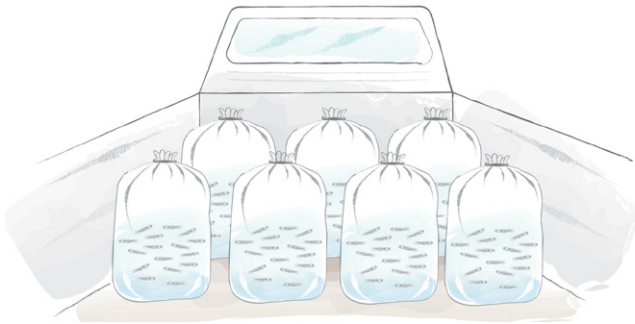


## Step 6. Conditioning, packing and transportation

---



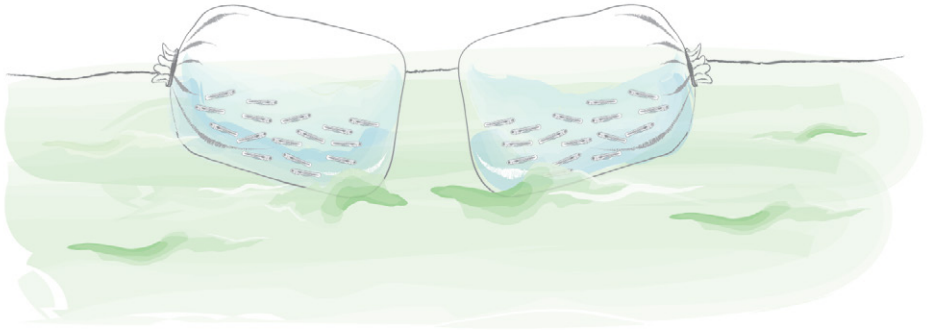
Pack uniform size monosex fingerlings



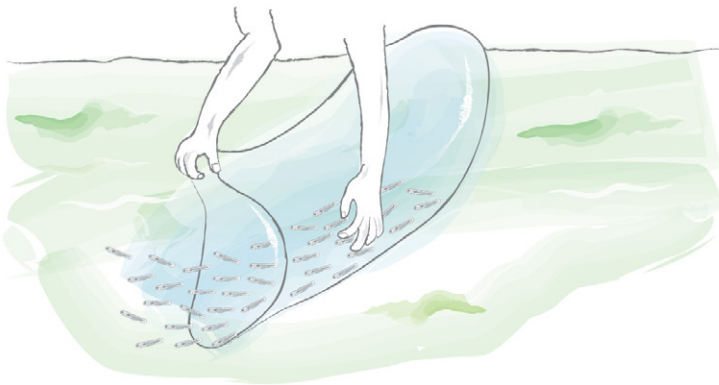
- Fingerlings should be conditioned for a day without feeding. They may die during transportation if they have not been conditioned. This is mainly due to high ammonia production from their own excreta coupled with low oxygen, high temperature and stress caused by rough handling or jerking.
- Before moving fingerlings to conditioning tank, dip fingerlings in salt (@5 g/L water) or acriflavine (@1 g/200 L water) solution to kill any external pathogens before placing into conditioning tanks supplied with clear water. Don't feed the fingerlings overnight (at least 12 hours) so they empty their stomachs.
- Grade the fingerlings by size (small, medium, large and extra-large) and put 300-500 healthy fingerlings (depending on size and distance to travel) into a plastic bag (60 cm x 40 cm size). Fill around one-third of the bag with water and the remaining two-thirds with oxygen and tie it shut.
- Fingerlings in bags can be transported for up to 20 hours' drive. Reduce fingerlings to 300 per bag if the transport time is longer than 12 hours.

## Step 7. Stocking in grow-out pond

---



Float the fingerling bags for 20–30 minutes



Release fingerlings into a green water pond

- The fingerling bags should not be opened immediately. The fingerlings must be conditioned before being released into the grow-out pond.
- Float the bags in the pond for 20–30 minutes to ensure the water temperature equalizes. After this, the fingerlings can be released into the pond.

## References

---

[AIT] Asian Institute of Technology. 1994. Partners in Development: The Promotion of Sustainable Aquaculture. AIT, Bangkok, Thailand, 98 p.

Bhujel RC. 2014. A Manual for Tilapia Business Management. CABI Publishing, Wallingford, UK. ISBN (10): 1780641362, 216 p.

Macintosh DJ and Little DC. 1995. Nile tilapia (*Oreochromis niloticus*) In Broodstock management and egg and larval quality, Bromage NR and Roberts RJ. eds. Blackwell Science, 424 p.

# Hatchery layout



## **About WorldFish**

WorldFish is an international, not-for-profit research organization that works to reduce hunger and poverty by improving fisheries and aquaculture. It collaborates with numerous international, regional and national partners to deliver transformational impacts to millions of people who depend on fish for food, nutrition and income in the developing world. Headquartered in Penang, Malaysia and with regional offices across Africa, Asia and the Pacific, WorldFish is a member of CGIAR, the world's largest global partnership on agriculture research and innovation for a food secure future.

For more information, please visit [www.worldfishcenter.org](http://www.worldfishcenter.org)