



Food and Agriculture  
Organization of the  
United Nations

# GENETICALLY IMPROVED FARMED TILAPIA: THE GIFT THAT KEEPS ON GIVING

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*After 28 years of selective breeding, WorldFish's genetically improved farmed tilapia (GIFT) is now producing its twenty-third generation and is being used by 17 governments around the world.*

In 1988, to address poor productivity of tilapia farms, deteriorating tilapia performance and inadequate tilapia seed supply, WorldFish (then known as the International Center for Living Aquatic Resources Management or ICLARM) and collaborating partners from the Philippines and Norway began the genetically improved farmed tilapia (GIFT) project to produce a faster growing strain of Nile tilapia (*Oreochromis niloticus*), suitable for both small-scale and commercial aquaculture.

WorldFish has conducted 28 years of selective GIFT breeding. Six selective breeding generations were produced in the Philippines and 17 more generations have been produced since the 2001 move of the GIFT selective breeding programme to Malaysia, so the WorldFish GIFT project is now producing its twenty-third generation (WorldFish, 2021).





**Nile tilapia have many traits, which make them good candidates for aquaculture and for a selective breeding programme. These include:**



being omnivorous and growing on lower quality diets with reduced quantities of fishmeal



tolerance to variable water quality, including a wide range of salinity – from freshwater to brackishwater – and wide temperature and oxygen ranges



being relatively hardy and resistant to disease



being inexpensive for small-scale farmers to raise for nutrition and income



breeding after six months and having a generation time of less than a year



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Cage culture of Nile tilapia in Thailand

# TECHNIQUE AND APPROACH USED

Under the GIFT project, WorldFish pioneered a systematic breeding protocol with the breeding of full sibling families (brother and sister seed from the same parents) that were grown in separate cloth net cages until big enough to individually tag with microchips, before stocking seed from other parents into a communal pond, with the performance of all fish being monitored individually. Fish from the best-performing families were selected as parents of the next GIFT generation.



Broodstock Nile tilapia (*Oreochromis niloticus*)

The selective breeding method developed under the GIFT project has also been successfully applied to Nile tilapia in Egypt and Ghana, and to other tilapia species – *O. shiranus* in Malawi and *O. andersonii* in Zambia. It has also been applied to Indian major carps – catla (*Catla catla*) and roho labeo (*Labeo rohita*) – and Chinese carp, namely silver carp (*Hypophthalmichthys molitrix*).

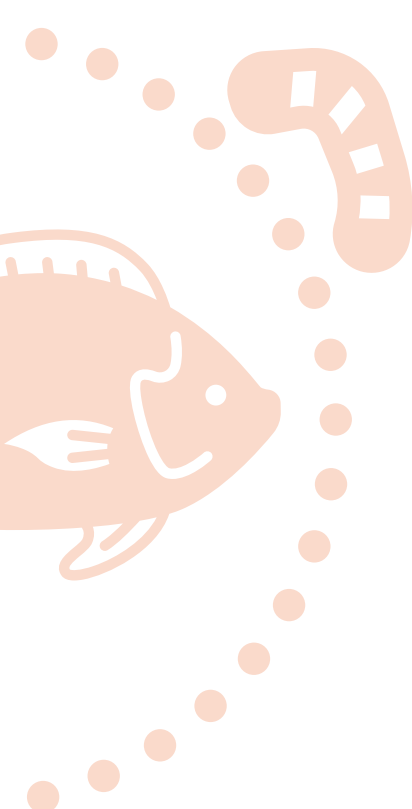
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## SCOPE AND SCALE OF APPLICATION

Following internationally accepted guidelines for introductions and transfers,<sup>1</sup> WorldFish has disseminated the improved GIFT strain to 17 countries and their research organizations, namely: Bangladesh, Brazil, China, Costa Rica, Fiji, Ghana, India, Indonesia, Malaysia, Myanmar, Papua New Guinea, the Philippines, Sri Lanka, Thailand, Timor-Leste, the United States of America and Viet Nam.

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## ACCESSIBILITY

An illustration on the left side of the page shows a stylized orange fish swimming upwards, leaving a trail of small orange circles. Above the fish is a larger orange shape resembling a seedling or a young plant with three small white squares on its stem.

Governments and their research institutes as well as competent authorities for aquaculture have, under guidance from WorldFish, maintained the imported GIFT stocks and bred and distributed seed to both small-scale and commercial-scale aquaculture farmers alike.

<sup>1</sup> ICES Code of Practice on the Introductions and Transfers of Marine Organisms, Copenhagen, 1994.

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# THE OUTCOME AND BENEFITS

In 1997, the sixth GIFT generation was growing 85 percent faster than the first GIFT generation. The GIFT strain has improved by nearly 10 percent in growth performance per generation.

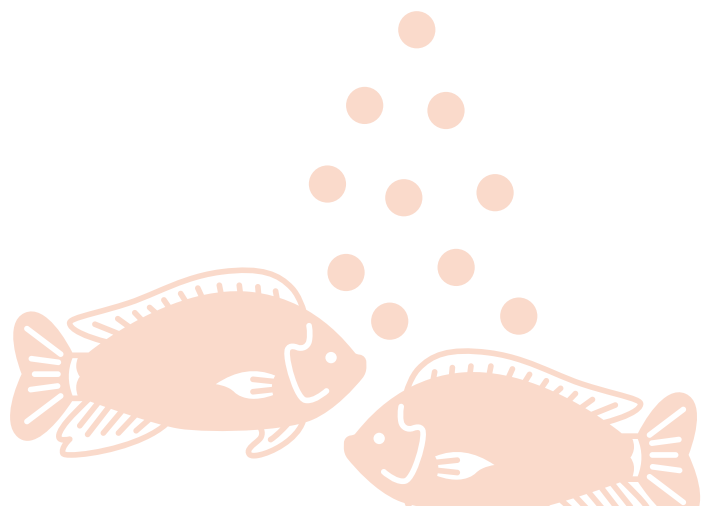
In 2003, an Asian Development Bank study found that GIFT and GIFT-derived strains accounted for 68 percent, 46 percent and 17 percent of tilapia production in the Philippines, Thailand and Viet Nam, respectively. A survey conducted in Bangladesh in 2010 found that 75 percent of hatcheries producing monosex tilapia were using GIFT broodstock. In an on-farm performance assessment study with a stratified random sample of 213 GIFT and 256 non-GIFT farmers in Bangladesh, Tran *et al.* (2021) found that the GIFT strain grew 27 percent and 36 percent faster than non-GIFT tilapia in monoculture and polyculture, respectively. GIFT yields were significantly higher than non-GIFT yields and GIFT species were more profitable and cost-effective than non-GIFT species (WorldFish, 2017).

WorldFish has also developed the Abbassa Nile tilapia breeding programme, which it launched in 2002 in Egypt. In its ninth generation this outperformed other local strains by 12 percent in growth rate and 48 percent in profitability because of improved, lower food conversion ratios (Ibrahim, Nasr-Allah and Charo-Karisa, 2019).

WorldFish has demonstrated that selective breeding is a feasible, cost-effective and sustainable approach to the genetic improvement of tilapia.

More recently the organization has commenced selecting GIFT for resilience against pathogens including tilapia lake virus (TiLV), for improved feed conversion efficiency and better growth under low oxygen conditions, using DNA-based approaches and genomic tools.

Today, tilapia is the second most cultured fish species in the world and WorldFish is committed to making improved, faster growing and resilient GIFT seed available to farmers to reduce poverty and hunger.



## REFERENCES

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# ACKNOWLEDGEMENTS

This brief was prepared by Don Griffiths (FAO consultant) and Trong Quoc Trinh (WorldFish GIFT geneticist).

Required citation: FAO. 2022. *Genetically improved farmed tilapia: the GIFT that keeps on giving*. Bangkok.

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