



Food and Agriculture  
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# RABBITFISH FARMING IN ASIA

*Rabbitfish have considerable potential for small-scale sustainable aquaculture across Southeast Asia: They are relatively easy to grow, have high local demand and are herbivorous, feeding on a variety of freely available feeds.*

Rabbitfish (*Siganus* spp.) are medium-sized herbivorous fish native to the Indo-Pacific region. There are 28 species of rabbitfish (FAO, 2021a). They thrive in coastal areas; some species live on coral reefs while others prefer brackishwater mangrove habitats. Rabbitfish are popular food fish in the Indo-Pacific region and in some African and Near Eastern countries.

Most rabbitfish consumed currently come from capture fisheries. Indonesia and the Philippines are the main suppliers of rabbitfish, with annual landings of around 76 000 tonnes and 25 000 tonnes respectively (FAO, 2021b). The demand is very high in Southeast Asia and other markets like Hawaii. The high demand for these species is causing overfishing and a decline in their numbers in the wild. Besides overexploitation, these wild populations are under further pressure from other damage such as climate change impacts to their favoured habitats – coral reefs, mangroves and seagrass meadows. For these reasons, developing ways to culture the species is becoming more urgent.

A research team at the Bureau of Fisheries and Aquatic Resources (BFAR) in the Philippines, led by Dr Westly Rosario, successfully cultured two of the most commercially interesting candidates, the goldlined spinefoot or golden rabbitfish (*Siganus guttatus*) and the vermiculated spinefoot or maze rabbitfish (*Siganus vermiculatus*). Both species are popular food fish, growing to about 50 cm in length, with a maximum weight of 1 kg for the goldlined spinefoot rabbitfish and 2 kg for the vermiculated spinefoot rabbitfish. In the Philippines, fresh rabbitfish fetch around USD 6.20/kg at the farm gate and USD 7.20/kg at retail. The average wholesale prices for whole gutted rabbitfish and live rabbitfish in China, Hong Kong SAR are over USD 10/kg and USD 15/kg, respectively (FIS, 2022).



# TECHNIQUE AND APPROACH USED

The BFAR hatchery produces fry from eggs in 45 days. The fry are then transferred to nursery ponds and reach fingerling size in approximately 90 days. Fingerlings are stocked in brackishwater ponds, pens or floating sea cages for grow-out. When these fish are cultured at low densities, they can be fed with filamentous algae, seaweed and seagrass – which are naturally available in brackishwater ponds. However, for large culture volumes and high densities, the use of a high-quality plant-based pelleted feed is recommended to ensure good growth and survival rates. Fish are usually cultured from fingerling to harvest size of 250 g in five or six months.

The non-aggressive and herbivorous nature of rabbitfish makes them an ideal species to be grown in polyculture pond systems with milkfish, mud crab or shrimp. They have also been cultured with grouper, with small numbers of rabbitfish added to grouper cages to keep the floating nets relatively free of algae and seaweeds.

To improve growth and survival rates, Dr Rosario successfully developed a hybrid between the golden rabbitfish and the maze rabbitfish. The major challenge was the spawning schedule, because *S. guttatus* spawns during the first quarter of the lunar calendar, while *S. vermiculatus* spawns during the last quarter (hybrids spawn during a new moon). These findings on lunar cycles will enable rabbitfish hatcheries to maximize production year-round. The hybrids grow better than the parent species, have more vigour and show stronger disease resistance, while they are sold for the same price at fresh fish markets. However, some questions remain on the potential of these hybrids escaping and reproducing in the wild.

Villanueva *et al.* (2021) conducted a study on *Siganus guttatus* to further improve existing hatchery protocols. To mitigate the high mortality rate in hatcheries, they examined whether stocking densities had a marked impact on survival rates and whether survival rates could be improved by using different feed types. They achieved a maximum survival rate of 12 percent for fingerlings (a significant increase compared to the 5 percent survival rate achieved previously by BFAR), and the researchers found that the larvae and fry did not seem adversely affected by an increase in stocking density, which accorded with the findings of Syah *et al.* (2020). On high protein feed the rabbitfish grew faster, but using fish meal in feeds would reduce the sustainability of farming operations of these fish – as they are selected for their herbivorous nature. Thus, alternatives like feeds with a high level of plant-based protein should be developed further.

Syah *et al.* (2020) found that in the grow-out stage, stocking densities affect the fish, with lower stocking densities (100 fingerlings/m<sup>3</sup>) resulting in better growth, a higher survival rate and a better feed conversion ratio compared to a higher stocking density (150 fingerlings/m<sup>3</sup> to 200 fingerlings/m<sup>3</sup>). Rabbitfish can tolerate changes in temperature and salinity, and have non-aggressive behaviour, making culture of the species easier than most other marine finfish.



Juvenile rabbitfish bred at a hatchery in Palawan, the Philippines

## SCOPE AND SCALE OF APPLICATION

The Philippines is at the forefront of closed-cycle aquaculture of rabbitfish. Aquaculture production of rabbitfish in the Philippines was 246 tonnes in 2019 (OECD, 2021), representing the bulk of global production. Rabbitfish are also cultured in Egypt, India, Indonesia and Saudi Arabia (FAO, 2021a).

Villanueva *et al.* (2021) concluded that, despite the high mortality rates in the hatchery, it could still be commercially viable to farm juvenile rabbitfish using a simple nursery setup consisting of a series of small round bowls until the fish are ready for grow-out. Small bowls can be easily managed and do not need a significant investment, making this technique practical and adaptable for small-scale operators with the potential to provide a livelihood for women and youth. However, for large-scale facilities, the use of large tanks stocked at a higher density should be tested.



Wild-caught broodstock of goldlined spinefoot rabbitfish (*Siganus guttatus*)

## ACCESSIBILITY

Currently, there are very few hatcheries producing rabbitfish fingerlings and therefore the sustainable production of these species is in its infancy. The establishment of a rabbitfish industry in an area requires a central hatchery, which needs infrastructure and technology, similar to other marine finfish species. Broodstock can be sourced from other hatcheries or in the first instance from the wild.

Once a hatchery is established, this can serve as a hub to produce rabbitfish locally in a sustainable manner. Required investments for growers include construction of ponds or floating marine cages, and fingerlings and feed for the first batch. With the earnings from the first harvest, farmers should be able to buy new fingerlings and feed for the next batch.

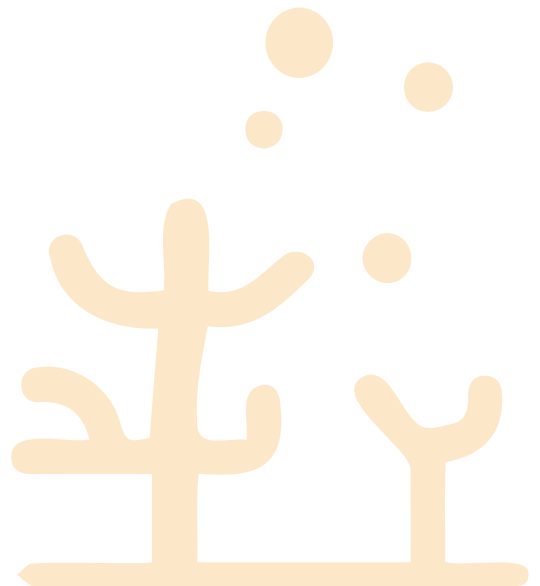
In areas where aquaculture is established and existing infrastructure is in place, it is easier to adopt the culture of rabbitfish.

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# OUTCOME AND BENEFITS

Investors are usually mostly interested in the culture of carnivorous marine finfish and crustaceans – with species groups like seabass, salmon and shrimp showing double-digit growth rates. These species are in high demand, especially with western and Chinese customers, and fetch relatively high prices. However, culturing these species can come with significant environmental impacts. Large amounts of fish meal are typically used in feeds for such species, and it is estimated that, at present, a quarter of all fish landed globally – 21 million tonnes annually – are destined for the fish meal industry and inclusion in pelleted terrestrial and aquatic animal feeds. With the world facing a global environmental crisis, improving the sustainability of farming methods is critical. Besides implementing more efficient ways of farming fish, a large part of the solution is to critically consider just which species we should be farming.

Culturing marine herbivores such as rabbitfish, which feed low in the food chain, is crucial for ensuring food security in developing countries surrounded by vast amounts of seawater – like Indonesia, the Philippines and Timor-Leste. Grow-out and marketing of rabbitfish can also provide an alternative livelihood option for coastal communities.



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