Coral trout *Plectropomus leopardus* aquaculture research and fingerling production in Indonesia

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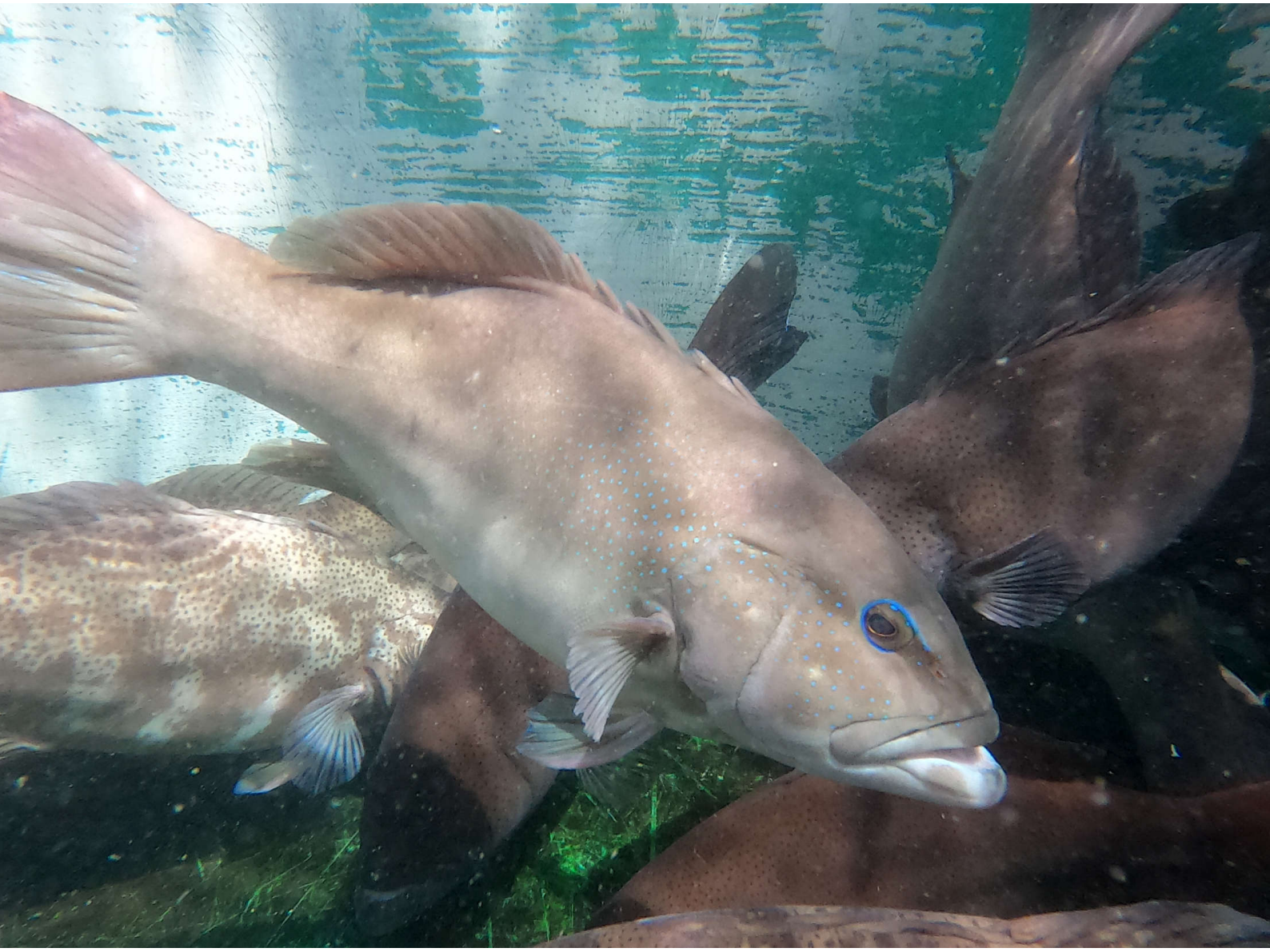
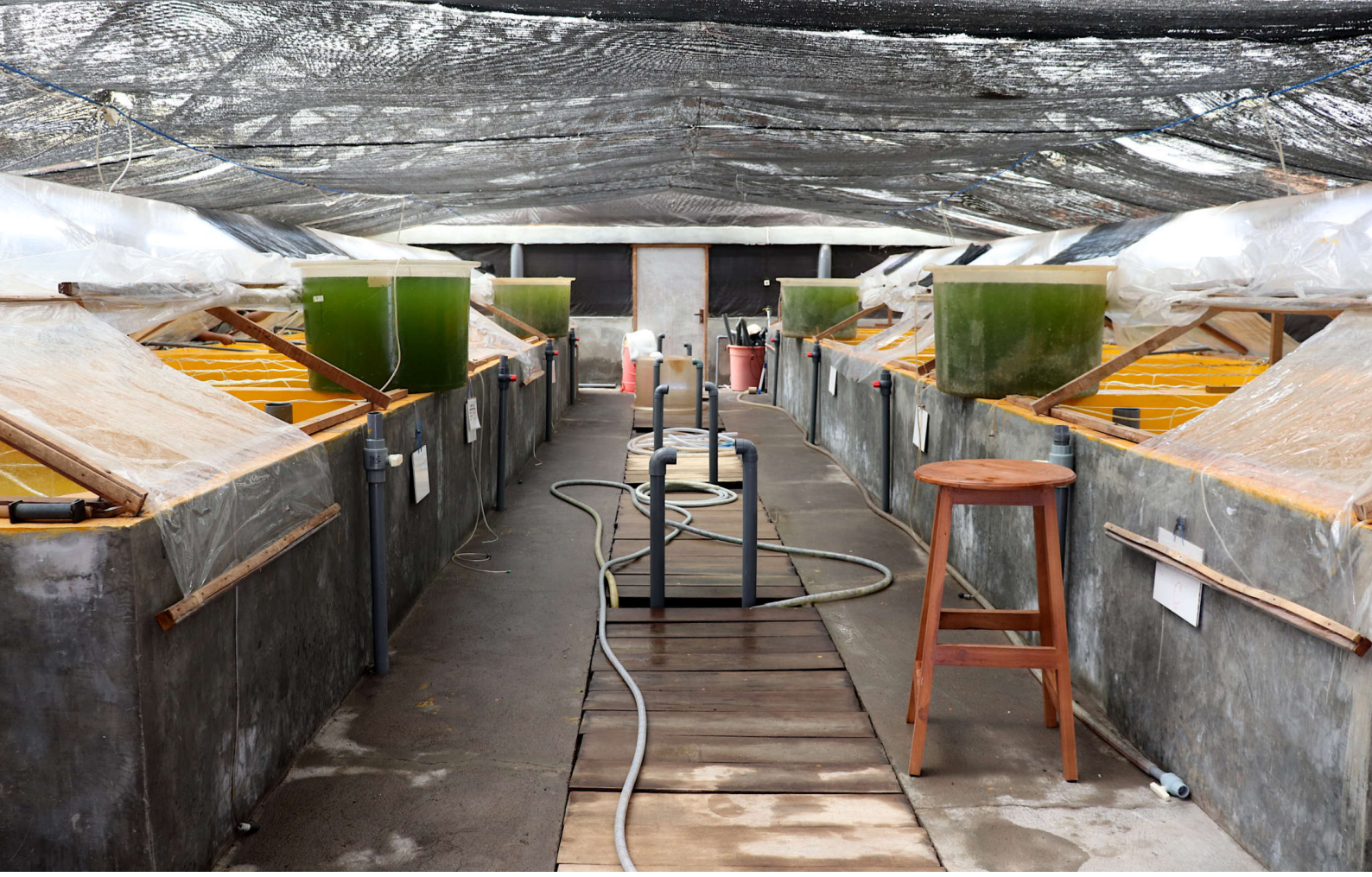


Coral trout broodstock.

Coral trout *Plectropomus leopardus* is an emerging exported grouper commodity in Indonesia. The demand for coral trout fingerlings has been increasing considerably in recent years, particularly from the central area for grouper hatcheries in Bali, even during the current pandemic situation. Mostly, coral trout fingerlings are exported to Taiwan Province of China or locally distributed to Eastern Indonesia for grow-out culture in sea cages. However, fingerling production as the main key for sustainable aquaculture has not been well established compared to production of fingerlings for other grouper species and hybrids.

The value of coral trout is acknowledged to be the highest among grouper commodities. The price of hatchery-produced coral trout fingerlings is around 4-5 times higher than that of hybrid grouper. The total length of fingerlings determines their price, which ranges (per centimetre) from IDR 1,800 to 2,000 in the hatchery. The market size of fingerlings for nursery segmentation starts from 3 to 5 cm, meaning for a 3 cm fingerling the price can be as high as IDR 6,000. The limited availability of fingerlings contributes to their high price, but it is also due to the longer duration required to produce fingerlings from eggs. It takes approximately 65 days to produce a 3 cm fingerling, whereas for hybrid grouper it only takes 45 days.



Grouper hatchery.

Developing coral trout fingerling production technology will benefit the marine aquaculture sector. The Institute for Mariculture Research and Fisheries Extension (IMRAFE), formerly known as the Gondol Research Institute for Mariculture, has been researching this species. The results of fingerling production are quite promising, as shown by the increasing number of fingerlings produced as well as the survival rate from larval rearing. In 2019, IMRAFE produced 107,000 coral trout fingerlings with total lengths of 2.3-2.7 cm, 50 days after hatching, which took approximately two weeks more to reach market size of 3 cm. By continuously improving the larval rearing technique, particularly with regard to water and feeding management, survival increased from 2% in 2017 to 12% in 2020. As far as the authors are aware, this is the highest survival reported for mass-scale coral trout larval rearing.

D50 coral trout fingerlings gathered in containers for grading.

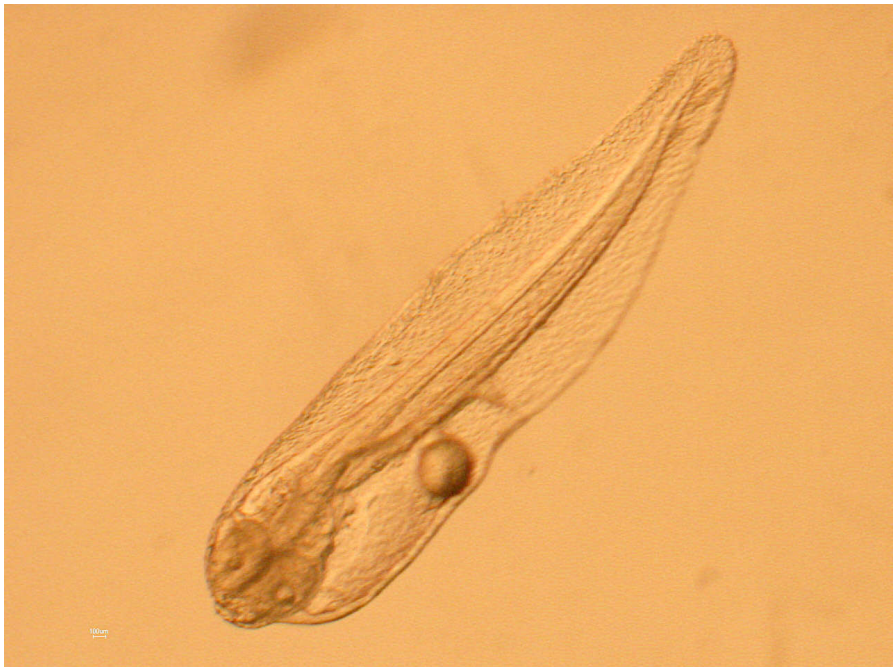
Research topics for developing the technology were mostly focused on feeding and environmental management, particularly in enhancing live feed and water quality. The protocol of larval rearing is quite similar to the standard protocol for grouper fingerling production. However, the rearing of coral trout larvae is notoriously more 'difficult' than that of other groupers, since coral trout larvae are more easily stressed than tiger or hybrid grouper. As a comparison, the total length of coral trout day 1 is 1.92-2.17 mm, which is smaller than 'cantik' hybrid grouper (*E. fuscoguttatus* x *E. polyphekadion*) at 2.49-2.56 mm. Also, the mouth gap for first feeding of coral trout is relatively small at 103.19 ± 35.77 µm compared to 'cantik' hybrid grouper at 125 µm.

Grading.

Larval rearing protocol

At IMRAFE, eggs are obtained from natural spawning of coral trout brood stock confined in round concrete tanks. For fingerling production, eggs are stocked in concrete tanks with rounded corners and a yellow colour with a density of 10 eggs/litre in a closed hatchery. The volume of tanks is approximately 6,000 litres with 1 metre depth. Seawater is sand filtered and sterilised with UV light prior to stocking of eggs and water exchange. To increase light intensity and photoperiod to 15 hours light : 9 hours dark, fluorescent lights are installed above the tanks.

Nannochloropsis sp. are added in the rearing water as green water and live feed consists of rotifers, copepod nauplii, artemia nauplii, and mysids. Formulated diet is incorporated into feeding on the same day as the first siphoning. Water quality parameters, particularly dissolved oxygen (DO) and temperature are regularly monitored to adjust aeration rate and air circulation should it be required. The level of DO and temperature should be maintained above 5 ppm or 80% saturation and 27.5-30 °C. To maintain water quality, water exchange is started from 5% on D5 and increased gradually to 15% on D12 and to >25-100% from D22 onwards. Siphoning is conducted daily from D12. Feeding and water exchange management are illustrated in the accompanying tables.

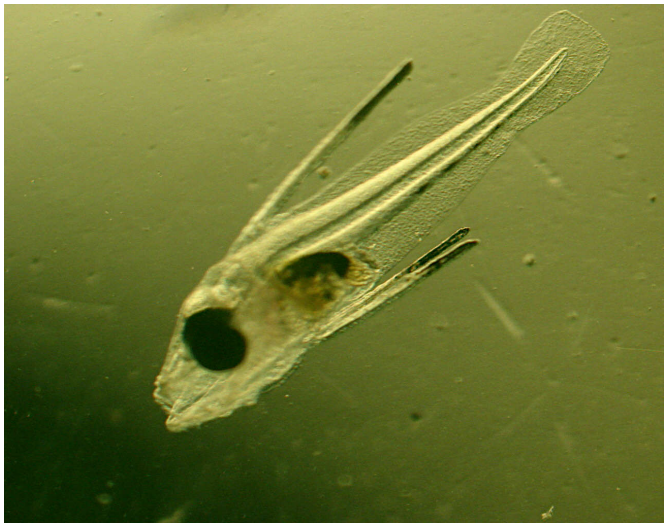


Coral trout larvae D1.

Coral trout larvae D6.

Feed management	Larvae age (days)																	
	2	3	4	7	9	10	11	12	13	14	15	16	17	20	25	30	40	50
Nannochloropsis	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		
Rotifers	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		
Copepod nauplii			■	■	■	■	■	■	■	■	■	■	■	■	■	■		
Formulated diet								■	■	■	■	■	■	■	■	■	■	■
Artemia nauplii														■	■	■	■	■
Mysids																■	■	■

Water exchange	Larvae age (days)																	
	1	3	5	7	9	10	11	12	13	14	15	16	17	20	22	30	40	50
5-10 %			■	■	■	■	■											
10-25 %								■	■	■	■	■	■	■	■			
>25 % gradually to 100%																■	■	■
Siphoning								■	■	■	■	■	■	■	■	■	■	■



Coral trout larvae D12.

Coral trout larvae D25.

First grading is conducted on D50 when most of the larvae have fully metamorphosed into fingerlings. Prior to grading, rearing water should have been flowed thoroughly for at least 2 days. Grading is performed manually by grouping fingerlings based on their length and removing deformed individuals, which are rarely found in fingerlings of less than 5 cm.

Smartphone app improving smallholder shrimp farming practices in Bangladesh

Winrock International is implementing a five-year project in Bangladesh to improve production and trade of farmed marine shrimp and freshwater prawns, with 250,000 farmers and other industry businesses targeted.

Winrock is a USA Not-for-Profit development organisation and the Bangladesh project - called “Safe Aqua Farming for Economic and Trade Improvement (SAFETI)” - is funded by the United States Department of Agriculture.

SAFETI is introducing improved farming methods to the country’s shrimp and prawn farmers and has developed a mobile phone app as one way to support them. The Shrimp Farming BD App contains information on improved technologies - from pond preparation through to harvest - and has a calculator that farmers can use to work out the quantities of chemicals, feeds and other inputs they need for their pond. Also incorporated is a Frequently Asked Questions (FAQ) page where users can find answers to common questions with a single click: and they can send specific technical questions to SAFETI specialists online and receive an answer back within hours. The app can also be used to post news messages, and a link to market prices is planned.

The app can be downloaded from the Google Play Store and then used online or offline. It is only available in Bengali language, but already has 14,000 users, including some in the neighboring Indian State of West Bengal. Under the COVID-19 conditions this year, it has been particularly valuable as a support to Bangladeshi smallholder shrimp and prawn farmers, and will serve them as a remote learning resource well into the future.