SCIENTIFIC FARMING TECHNIQUE OF BRACKISHWATER CATFISH, *MYSTUS GULIO*: A STEP TOWARDS AQUACULTURE DIVERSIFICATION

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Introduction

The long whiskers catfish, *Mystus gulio* (Hamilton, 1822), belonging to the family Bagridae is a euryhaline fish and is commonly known as Nona Tengra in West Bengal. *M. gulio* (Fig 1.) is usually found in canals, lakes, rivers, estuaries (Ganges-Brahmaputra estuary), and bheris of Sunderban. It can tolerate a wide range of salinities and therefore can be farmed in both freshwater as well as brackishwater environments. The domestic market price of this fish depends on season and harvested size and it ranges from ₹ 280 - 600/kg. Important attributes such as high nutritional value, market demand, hardy nature and faster growth makes this fish a desirable candidate species for aquaculture diversification. Traditionally *M. gulio* is poly-farmed with other brackishwater fishes in traditional ponds, bheris and paddy fields. In this type of farming, wild seed of gold spot mullet, *Liza parsia*; seabass, *Lates calcarifer*; tiger shrimp, *Penaeus monodon*; bream, *Acanthopagrus* sp; tilapia, etc. are stocked together and cultured for a long duration. This type of traditional farming gives less net profit to the farmers. Therefore, to make *M. gulio* farming profitable and sustainable, Kakdwip Research Centre (KRC) of ICAR-Central Institute of Brackishwater Aquaculture (CIBA) has developed package of practices for scientific farming of *M. gulio* in a brackishwater system.

Fig 1. The long whiskers catfish, Mystus gulio harvested from a culture pond

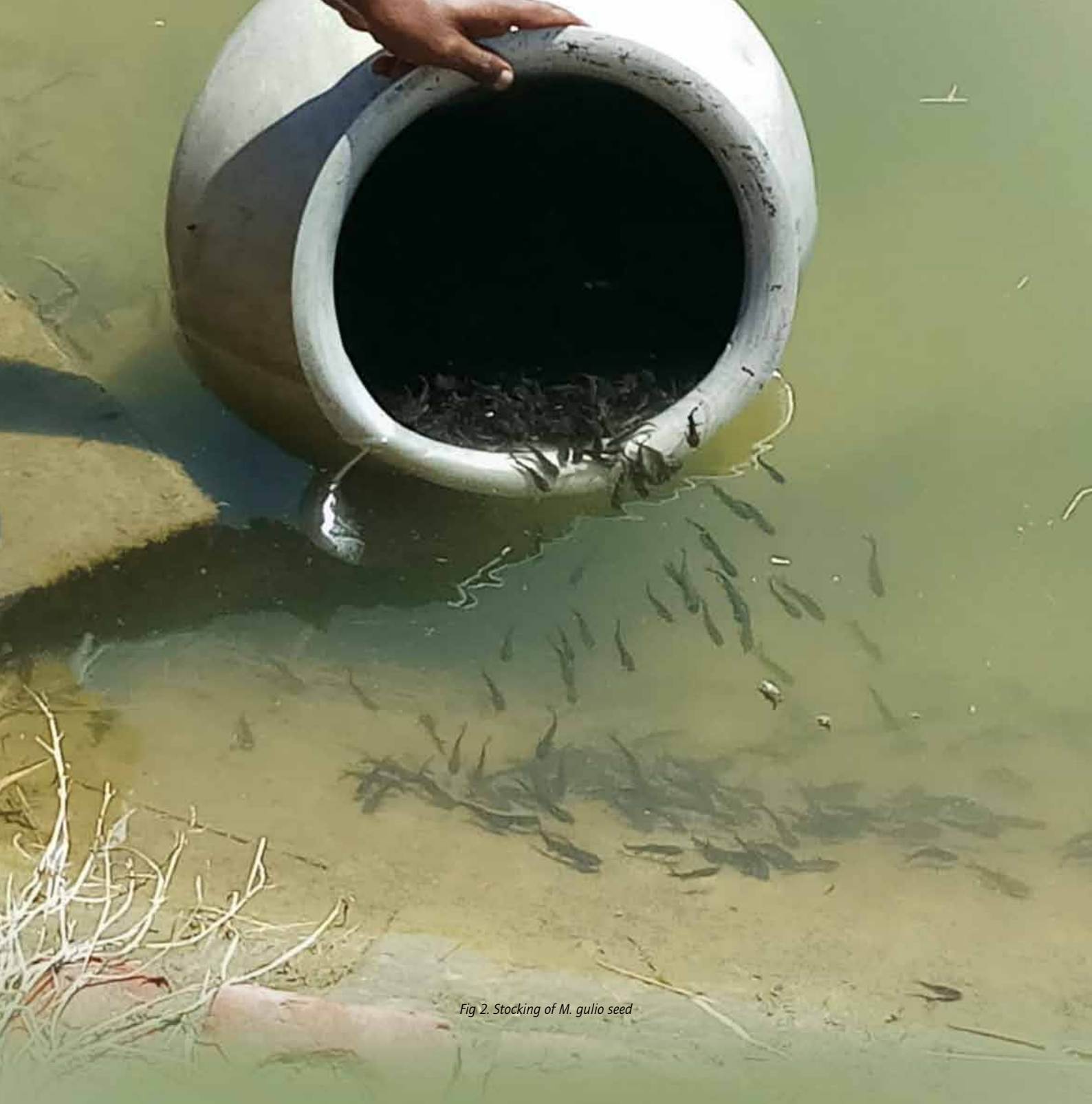

Fig 2. Stocking of M. gulio seed

Traditional farming

The traditional culture practices of *M. gulio* as described above, depends completely on the natural tidal entry of seed, feed and water exchange. Furthermore, traditional farming systems are often characterized by polyculture with fish or by rotation with paddy in *bheris* of West Bengal. In this culture system, low lying areas near brackishwater rivers and creeks are encircled by peripheral dyke and tidal water is allowed to enter the impoundment along with natural seeds of various species of shrimps, crabs and fishes. Water is retained with periodical exchanges during lunar cycles and the animals are allowed to grow. After 3 - 4 months, partial harvesting is made during each lunar cycle. In this system productivity ranges between 500 – 750 kg/ ha of which about 30% is constituted by prawns/ shrimps and 70% by fishes including *M. gulio* as one of the species. In paddy cum fish culture, after monsoon crop of paddy, the paddy field usually remain fallow due to high saline soil that are used for farming of salt tolerant rice variety and brackishwater fish especially *M. gulio* and *L. parsia*.

Scientific Farming

After viewing the culture potential of the species, ICAR-CIBA standardized the scientific farming practices of *M. gulio* as stated below.

Pre-stocking management

Drying and sludge removal: Between each crop, drying of the pond is essential. Pond drying oxidizes the decomposed organic components in the soil from the previous culture. Generally, pond bottom is allowed to dry for 7 - 10 days. After drying, the top black soil and sludge is to be removed to prevent development of anaerobic conditions during the subsequent culture. Rectangular shaped pond having area of 1000 to 2000 m^2 is ideal for the farming of *M. gulio*. Pond dike should be free from any hole or damage. Polythene lined pond is also suitable for the farming of *M. gulio*.

Water intake and disinfection: During water intake, care should be taken to avoid the entry of predator and unwanted fishes by using suitable water filter nets at the inlet point. Water has to be filled to the desired depth of 1.2 - 1.5 m for *M. gulio* farming. Bleaching powder (calcium hypochlorite) is applied @ 500 kg ha^{-1} to reduce the load of harmful pathogens and to kill the predator fishes in the water.

Liming: Liming is done only after bleaching as lime reduces the efficacy of bleaching. Generally, lime is applied a week after chlorination. Application of lime helps to maintain pond water pH, alkalinity and increase mineralization of organic matter of soil, which improve pond water productivity. Dose and type of lime to be used depends on the soil and water pH. Therefore, before application of lime checking of soil-water pH is essential. Regularly used limes for aquaculture are: quick lime (CaO), agricultural lime ($CaCO_3$) and dolomite ($CaMgCO_3$). Generally agricultural lime or dolomite is applied if soil pH is more than 5 and quick lime or hydrated lime is applied if soil pH is below 5. Calcium carbonate or dolomite (agricultural lime, lime stone powder, LSP) is recommended to be used at a dosage of 200 - 250 kg/ha for farming of *M. gulio*.

Fertilization: The purpose of fertilization is to ensure the growth of primary producers in culture ponds, as natural food for zooplankton. This helps to maintain healthy levels of phytoplankton and zooplankton in the culture pond, which in turn act as natural food for the *M. gulio* in its early stages. Ponds are fertilized with organic and inorganic fertilizers. Mustard oil cake, urea, and single super phosphate are applied at the rate of 250, 30, and 30 kg/ha, respectively. It is also advisable to use fermented juice, made up of molasses, 8 - 10 kg; probiotic, 50 g ; wet yeast, 100 g; rice bran, 1 kg; mustard oil cake, 5 kg and water 200 L. This juice is kept for fermentation in a tank covered with polythene for about seven days. This 200 L of fermented juice is sufficient for 1300 m^2 (~1 bigha) pond area. Depending on water pH and pond productivity, fertilizers and juice are used at monthly intervals to maintain the pond productivity.

Acclimatization and stocking of hatchery produced quality seed

Good quality hatchery produced seeds of uniform size must be used for the scientific farming of *M. gulio*. Hatchery produced *M. gulio* larvae (30 dph (days post hatched)) are nursery reared for a period of 60 days in net cage hapas (2x1x1) at the ideal density of 500 numbers/hapa to produce uniform sized seeds. This uniform size makes feed management easier and more efficient in grow out ponds. Seeds are acclimatized to the pond water (mainly salinity and temperature) to minimize the stress and improve survival. Temperature acclimation is carried out by keeping the seed bag/container in pond water for around 30 - 45 minutes. Seed bags are then opened and pond water is added slowly, which will acclimatize the fish seed to pond water conditions. Once the water temperature and salinity of the pond water and the water in the seed bags are same, the fry are released into the pond at the desired stocking density. Generally, 60 days old nursery reared fingerlings (weight: 0.85 - 0.86 g; length: 40.15 - 42.50 mm) are stocked at the density of 20 numbers/m^2 (Fig. 2).

Post Stocking Management

Feed and feed management: Cost of feed accounts for about 40% to 60% of the total production cost. Feed monitoring should be done using check net trays to avoid under and over feeding. Feed is reduced during periods of low DO, plankton crash, rainfall, and during very high temperatures. Starter feed (size: 500-1000 µ, protein: 30%) is provided during the first two months

Fig 3. Harvesting of M. gulio

of rearing and then pelleted feed is applied for the rest of the culture period. Either floating or sinking feed having a protein content of 28 - 30% and lipid level of 5 - 6% is fed at the rate of 5 - 3% of the estimated total biomass. Initially, for two months feeding is done at the rate of 5% of the average body weight. Thereafter, it is reduced to 3% of the estimated total biomass. Daily ration is to be two equal meals in the morning (06:00 h) and evening (18:00 h). Feed quantity is adjusted at 15-day intervals based on estimated biomass from random sampling of 30% stocked fish, feeding rate and assumed survival.

Maintenance of pond productivity: Depending on pond productivity, ponds are fertilized at monthly intervals. To keep desirable pH level, liming is recommended at fortnightly intervals with agricultural lime powder at 200 -250 kg/ha. Periodical raking of pond bottom is recommended for better pond environment.

Water depth and its quality: During entire farming period water exchange is not essential except during emergencies. Seepage and evaporation loss of water is compensated at regular intervals during high tide to maintain the ideal water depth of 120 cm. Desired water quality for farming of *M. gulio* is given below:

Sl. No	Water quality parameters	Ideal (safe) ranges
1	Dissolved oxygen (ppm)	5 - 8
2	Salinity (PPT)	0.5 - 12
3	pH	7.5 - 8.5
4	Total hardness (ppm)	1500 - 2000
5	Alkalinity (ppm)	120 - 150
6	Temperature (0C)	28 - 32
7	Total ammonia (ppm)	<0.1

Health management: Careful visual inspection of fish for parasites, haemorrhages, discolouration, aberration of fins, and mucus quality will help to understand the health of fish. Feed supplemented with probiotics and nutraceutical will help to enhance innate immunity health status of *M. gulio*.

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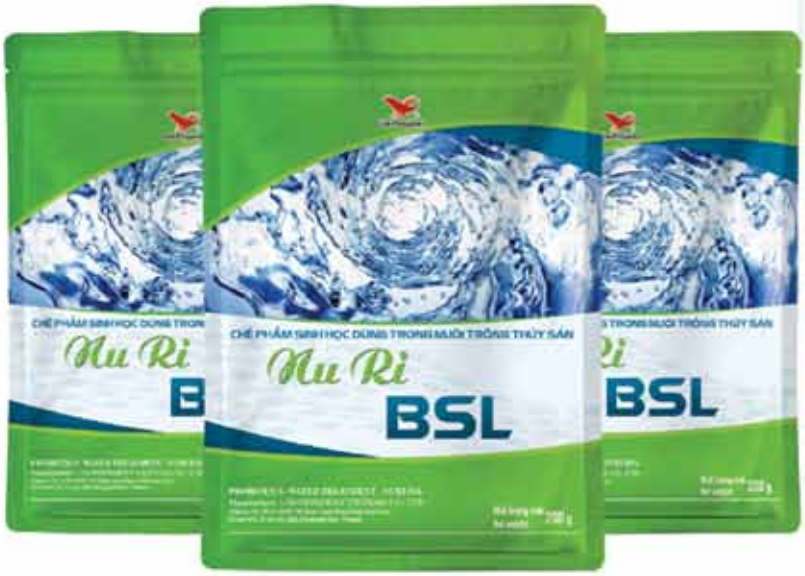
AQUACULTURE PROBIOTICS EXPERT

Nu Ri

NET 200 g **BSL**



Probiotics for water treatment

1. WATER QUALITY CONDITIONING

Best choice of Bacillus spp. that rapidly decompose uneaten feed, feces and other organic substances in pond water, keeps water quality optimal

2. HIGH ACTIVITY OF SPORES

No cultivation is needed. Easily adapt to the changes of surroundings and g row fast in freshwater or seawater culture farming, even under low oxygen environment

Inhibit the growth of Vibrio spp.

3. DECREASE AMMONIA CONTENT

Prevent the accumulationof toxic substances such as NH_3, NO_2, etc.

4. IMPROVE WATER COLOR

Improve water color regulate the algae and bacteria balance in water, turning your pond from green to clear

5. ESTABLISH BALANCED POND BACTERIA SYSTEM

Compete nutrition with vibrio and inhibit them to grow. Provide nutrition for probiotics in the pond, to establish a well-balanced farming system.

6. INCREASE AQUACULTURE PRODUCTION

Good quality of water prevents fish/prawn infections, making high profit of production

* COMPOSITION:

Bacillus spp. > 1×10^{11} cfu/kg

(Bacillus subtilis, Bacillus amyloliquefaciens, Bacillus licheniformis)

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Comparison between traditional and scientific farming of *M. gulio*

Parameters	Traditional	Scientific
Species used	Combination of species (gold spot mullet, *Liza parsia*; seabass, *Lates calcarifer*; tiger shrimp, *Penaeus monodon*; bream, *Acanthopagrus* sp; tilapia, etc.) are used (mixed culture, bheries and paddy cum fish culture)	Only *M. gulio* (monoculture)
Stocking density	Not fixed	10-20 individuals/m^2
Pond	Larger traditional ponds, backyard small ponds, bheries and paddy field are commonly used.	Medium size well-structured pond (1000 m^2)
Sanitization of pond soil and water	Nil	With bleaching powder.
Fertilization	Nil	Organic and inorganic fertilization are used as per requirement.
Food and feeding	Generally, use oil cake and wheat flour. Occasionally use commercial feed.	Formulated feed (sinking or floating).
Quality of harvest	Assorted size of different species.	Uniform size of single species
Net profit	Less profitable	More profitable

CIBA initiative to promote the *M. gulio* scientific farming

For the first time, the KRC of ICAR-CIBA successfully demonstrated semi-intensive culture of *M. gulio* in brackishwater ponds using hatchery produced seeds. In this trial, 60-days old hatchery produced good quality seeds (size range: 40.15 - 42.50 mm: 0.85 - 0.86 g) were stocked at a stocking density of 1, 2, 10 and 20 individuals/m^2 and fed with formulated feed developed by KRC of CIBA @ 5 - 3% of biomass. In seven months of rearing including three months during winter, the fish attained the size of about 40 - 60 g with production of 1.5 to 2.0 t per ha (Fig 3. and Fig 4.) at stocking density of 20/m^2. The total cost of production was around ₹ 90 - 120/kg and it had a ready market of ₹ 250 - 300/kg, which is economically profitable.

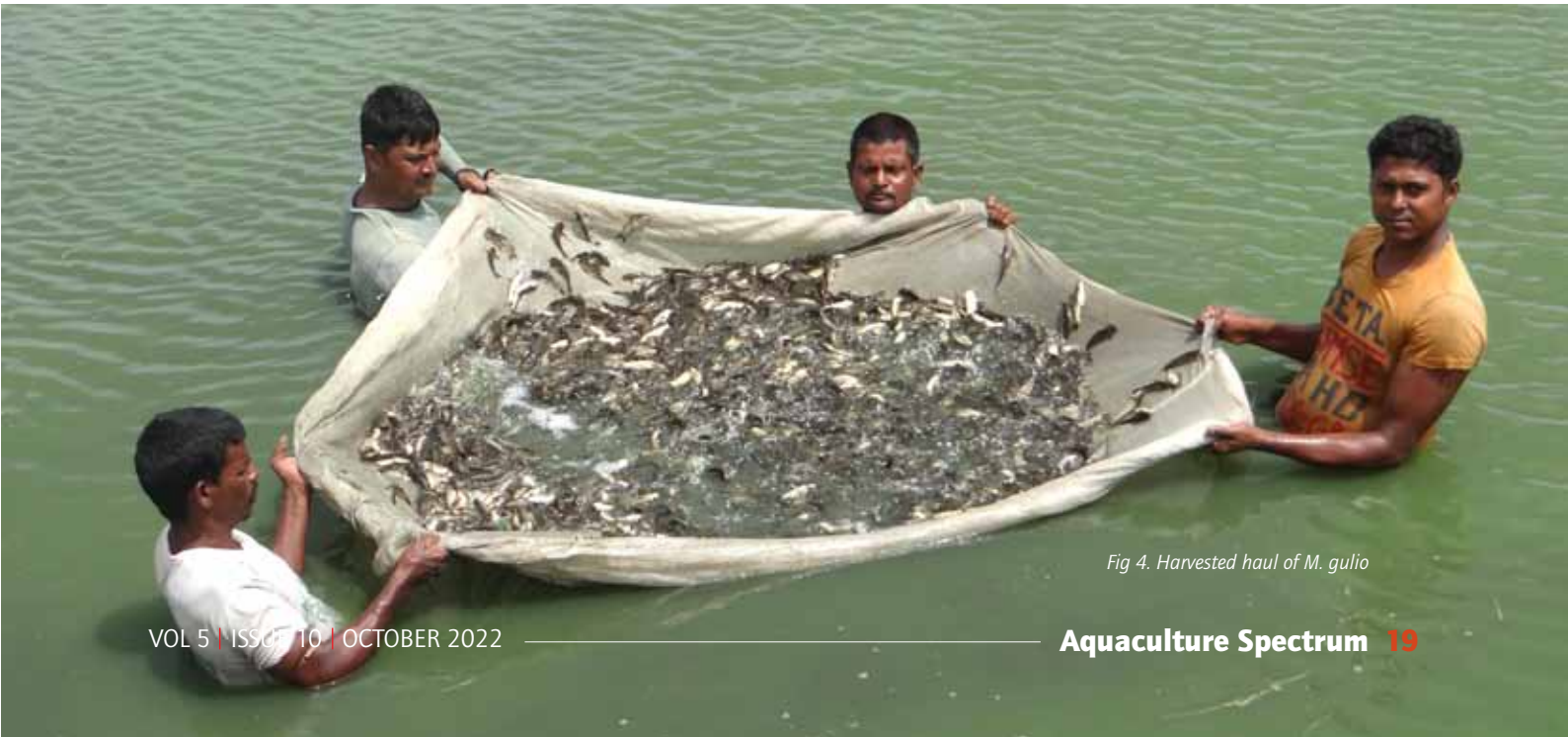

Fig 4. Harvested haul of M. gulio

Fig 5. The culture demonstration and harvest carried out under CIBA guidance

Conclusion

As demonstrated by CIBA, *M. gulio* is a highly potential and suitable species for farming (Fig 5.) in both brackishwater and freshwater environment. Intensive farming with improved management practices such as: use of aeration, feed supplements, and probiotics will help to improve the production further. *M. gulio* can also be farmed at high densities in polythene lined ponds and recirculatory aquaculture systems (RAS). This fish is also highly suitable to be farmed along with crabs (box culture) in a two-tier farming system. This fish has huge potential for farming in the coastal states like West Bengal, Odisha and Andhra Pradesh where this species is naturally available and locally acceptable as a table fish.

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Biodiversity, Epidemiology and Therapeutics of Fish Lice (*Argulus* sp.)

- Page 41

Scientific farming technique of brackishwater catfish, mystus gulio: A step towards aquaculture diversification

Page 12

Nanotechnology and its significance in fisheries and aquaculture

Page 27

Dr. Cheran's Column - Shrimp Aquaculture - Industry Review

Page 55

Ornamental Fish- The Mbuna Cichlids

Page 60