

# First commercial scale production of snakeheads (murrels) using extruded feed in India

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## Snakehead fish aquaculture around the world

Snakeheads are members of the freshwater perciform fish family Channidae, native to parts of Africa and Asia. There are more than fifty different species of snakeheads around the world, out of which only a few are valuable for commercial aquaculture. Historically, the Chinese have practised snakehead commercial farming for more than thirty years. Marketing selection and culture practices have made three species commercially viable out of ten snakehead species, reported in China. The prevalent farming trends favour *Channa maculata*, *Channa argus* and a hybrid of the former two species (*Channa maculata* ♀ x *Channa argus* ♂) on a large scale. Nevertheless, a small population of *Channa asiatica*, a variety of snakehead species is farmed in some local regions. The ever expanding domestic market in China boasts of a production of up to more than 400,000 metric tons snakehead fish annually. This marked increase is because of the obvious properties like fast growth, high survival rate, intensive stocking availability and easy weaning to extruded feed etc. Presently, in terms of production, in China, the hybrid snakehead fish (*C. maculata* ♀ x *C. argus* ♂) comprises more than 50% of total snakeheads.

Indigenous to many tropical countries, the striped snakehead (*Channa striata*) a warm, freshwater species is both carnivorous and an obligate air-breather. Best-known for the important economic role in the aquaculture industry throughout the Asia Pacific region, the striped snakehead is also a valuable source of protein. In Thailand, Cambodia and Laos, the tropical striped snakehead, *Channa striata* is usually grown using trash fish. In Vietnam, the major species of snakeheads are the natural variant of *Channa striata* (Square head) and the hybrid (Sharp head). In the last few years, the breeding and culture of snakehead has received a major boost, primarily due to two practices - successful induced breeding and weaning to extruded

feed. Today Vietnam produces totally around 100,000 tons of snakeheads for its domestic consumption. Even in Myanmar, culture of *Channa striata* using extruded feed has proven successful in the last 4-5 years, albeit on a smaller scale.

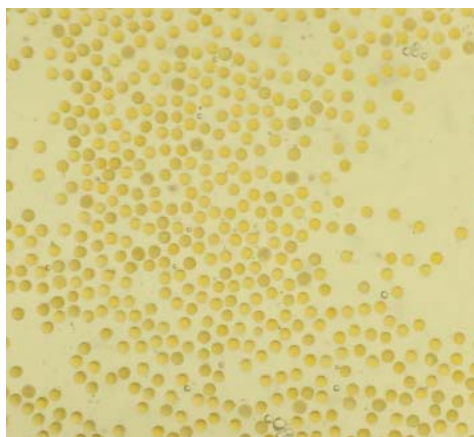
## Snakeheads in India

The air-breathing *Channa striata*, a high-value food fish, commonly known as the striped murrel in India, is one of the most sought-after freshwater fishes. Regardless of various species of murrel belonging to the genus *Channa* (syn. *Ophiocephalus*) only four types are available as food fish in India, these are the giant murrel (*C. micropeltes*), bullseye murrel (*C. marulius*), spotted murrel (*C. punctatus*) and striped murrel (*C. striatus*). As the result of long term overfishing, habitat degradation and absence of aquaculture technology, the population of giant murrel *C. micropeltes* is critically endangered. The above mentioned factors are likely to bring about a decline in the population of the other varieties as well, i.e., bullseye murrel (*Channa marulius*), spotted murrel (*Channa punctatus*) and striped murrel (*Channa striata*). Nevertheless it is the popularity of the striped Murrel (called *Korrameenu* in Telugu) that has led to a growing demand for this species in several states of India, including Andhra Pradesh, West Bengal, Telangana, Tamil Nadu, Karnataka etc.

This is due to the optimal nutrition, taste, and nearly boneless flesh as well as the various medicinal and wound healing properties, in the snakehead as a species, especially, the striped Murrel which is highly sought-after all over India. Live snakehead fish fetch a stable high price between ₹ 400-500/kg (US\$ 6-8/kg) in different retail markets. Because of the highly edible nature and its medicinal value, Murrel has been officially declared as "state fish" for the state of Telangana in 2016, which







. Fig 1: Eggs of *Channa striata*



Fig 2: 60-hours old *C. striata* larvae after fertilisation



. Fig 3: *C. striata* fry (2 days post first feeding)



. Fig 4: *C. striata* fry (10 days post first feeding)



. Fig 5: *C. striata* fry (25 days post first feeding)



. Fig 6: *C. striata* juveniles (15-20 gms)

aimed at the promotion of murrel farming and conserving the indigenous aquatic diversity in the water bodies in Telangana.

In India, snakehead fingerlings are believed to have medicinal value; hence they are used on the eve of *Mrigasira Karthi* day to treat asthma patients. A special herbal medicine is inserted into the mouth of small live snakehead fingerlings and then the patients are made to swallow the live fish together with the medicine.

#### Partnership for Snakehead farming in India

Currently, commercial snakeheads farming by using extruded feed has not been demonstrated successfully in India. Although induced breeding of snakeheads has been successful by various institutions and individuals, farming/ growout has been restricted to stocking a few fingerlings in extensive carp ponds to control weed fish. Moreover, murrels in such ponds are harvested only once every two to four years when the carp ponds are dried.

The success of breeding attempts to raise commercial quantities of fry is highly debatable due to two main factors: one being that snakehead is fearfully cannibalistic, and the second is that lack of availability of nutritionally balanced diet. All previous attempts at rearing this species have

focused on using either live fingerlings, or trash fish as feed. Using trash fish mixed with pelleted feed, or mash feeds made from powdered dry fish to rear murrels has serious consequences, by way of a deteriorated water quality and pond bottom. It is usually in these conditions which lead to the dreaded EUS (Epizootic ulcerative syndrome) which a fast spreading, deadly disease to which this species is particularly vulnerable.

Considering the need to bring a much more high value species into aquaculture in India, UNO feeds – one of India's largest extruded fish feed manufacturers has entered into a strategic agreement with Guangzhou Nutriera, China to introduce the technology for domestication and grow out of *Channa striatus*. Prior to entering India, Nutriera, one of the biggest aqua feed premix & additives enterprises in China, has made a rapid headway in extruded snakehead feed in Vietnam and Myanmar, and in hybrid snakehead fish farming in China.

In 2015 a hatchery and research facility for breeding snakehead, *Channa striatus* was established in Bhimavaram, Andhra Pradesh by UNO feeds in partnership with Nutriera. Subsequently, in the same year, good quality parent stock was collected from wild. They were then carefully weaned to eating trash fish. In 2016, the first commercial scale

Table 1: Farming and harvest results

Item	Tank 1	Tank 2	Tank 3	Tank 4	Tank 5
Pond area (ha)	1.2	1.5	1.2	0.8	0.4
Water depth (m)	1.2	1.2	1.2	1.2	2.1
Stocking size(g/pc)	50	40	50	30	30
Stocking density(pcs/m <sup>2</sup> )	3.5	2.5	3.0	3.5	2.0
Stocking quantity(pcs)	40000	38000	36000	28000	8000
Stocking date	23/8/2016	28/9/2016	28/9/2016	13/12/2016	28/9/2016
Harvesting date	16/6/2017	21/7/2017	23/8/2017	1/9/2017	10/8/2017
Harvest size(g/pcs)	773	801	750	637	788
Fish production(kg)	29374	29830	26730	15600	5900
Feed consumption(kg)	46410	42665	37730	22780	8870
Survival rate	95%	98%	99%	98%	93%
FCR	1.58	1.43	1.41	1.46	1.50

artificial breeding of *Channa striatus* was successfully carried out at this facility and the fry were gradually weaned to specially formulated extruded snakehead feed that was produced under the guidance of Nutriera experts. Grow-out phase of these weaned fry was also carried out in a new farming base spread over 60 acres. Through these practices in 2016/2017, the UNO technical team has accumulated a great deal of valuable experience on induced breeding, commercial farming and extruded snakehead feed production.

#### Broodstock collection

In 2015, utilising the local expertise of UNO, Nutriera experts designed a special hatchery for snakehead and carried out broodstock rearing. The broodstock was mainly collected from wild. It is a usual practice to catch snakeheads by traps in the "Kolleru lake", i.e., Godavari river and its tributaries. However, these traps cause injuries to the body of the fish and most of the caught fish were not suitable as brooders. Due to ever dwindling wild population, it has taken a lot of effort to collect about 2000 adult fish in good condition. These were raised on a special diet up to breeding season.

#### Induced breeding

Induced breeding was carried out between April and September 2016. Altogether, successful breeding was carried out in four batches during this period. Around 2 million murrel fry were produced in total which resulted in 0.2 million 10g-size juvenile striped murrels for grow-out stage. The average spawning, fertilisation and hatching rate was around 90%, 60% and 80% respectively. Within 45 days post hatching, the murrels body weight reached 15~20g. The Uno technical team assisted and guided by the

Nutriera team for the last two years is finally successful in their endeavour, in artificial breeding of striped snakehead *C. striata*.

#### Fed Exclusively with extruded feed

The Snakehead species, being a typically carnivorous feeder, requires higher level of dietary protein(38%-50%) and fat (6%-12%) for the different life stages. Currently, no additional feeding is practised when snakeheads are farmed in low density along with Indian Major Carps. The lack of specially formulated feed for snakehead has been a major constraint for development of snakehead commercial culture for a long time in India.

In June 2016, after the first success of induced breeding at UNO snakehead hatchery center, a specially produced extruded feed was produced for striped snakehead *Channa striatus* by using local raw materials and a special premix for snakehead imported from Nutriera, China. This snakehead feed is also now available commercially under the brand UNOMEI. Functional supplements were also used at various stages to improve digestion and immunity of the fish. Snakeheads were exclusively fed with

#### Intensive monoculture techniques

It is advisable to undertake intensive monoculture of snakehead in small ponds of 0.2 to 0.8 hectares. Due to the high stocking density and long term high protein diet feeding, large quantity eutrophic wastes were released into the water body during the growth of fish. Therefore it is necessary to undertake periodic water exchange, water quality control and bottom improvement during snakehead commercial farming.









Table 1 (pre-page) shows the results of the first year's growout of the snakehead. The stocking density ranged from 25,000 juveniles/ha to 35,000 juveniles/ha, survival rate was above 95% from 10g juvenile stocking to harvest. The FCR ranged from 1.4 to 1.6. The feed cost for snakehead production is around ₹ 120-140/kg, which accounts for 75% of the total snakehead fish production cost. The final FCR is slightly higher than what is seen in China and Vietnam. A lot has been achieved but there remains space for further improvement in snakehead fish farming performance in the next year.

However, through the practices in artificial breeding and commercial culture in India, we have explored different methods to adapt to local conditions in each fry breeding batch and have accumulated valuable experiences for production in the following year.

#### Future plans for the snakehead in India

Breeding experience with *Channa striatus* culture show that this fish can be grown in a high density and that it can reach marketable size of 500-800g in about 7 months of culture period, at a FCR around 1.1-1.3 in Vietnam, and 0.8-1kg in about 10-12 months culture period in Myanmar at a FCR about 1.3-1.5. Our experience has proved that the same conditions hold true even in India, but one must keep in mind the principle difference between countries like Vietnam and India, which is of limited water availability, which in itself is indicative of the restrictions on stocking density.

Hardy biological traits, fast growth and good market potential make the snakeheads an alternative species for aquaculture, alongside carps and catfish in India. To meet the market demand for snakehead fish and develop intensive commercial farming in India, there are plans to further increase fingerling production in 2017/2018. Within a period of two years there should be enough fingerlings for sale to farmers and it is very likely that striped snakehead will establish itself as an important aquaculture species in India.

UNO feeds along with the support of Nutriera will continue its efforts to work with this species and also try to select and evaluate the faster growing Bullseye snakehead *C.maurilius* or Giant snakehead *C.micropeltes* and will also look at possible cross hybrids between *C. striatus* and *C. maurilius*.