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An Approach on Murrel Breeding

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Abstract

Murrel (*Channa* species) is a commercially significant freshwater fish known for its high nutritional value and adaptability to diverse environmental conditions. Its biology is characterized by air-breathing capabilities, tolerance to low-oxygen environments, and aggressive predatory behaviour. Murrels exhibit sexual dimorphism, with females generally larger than males, and reach sexual maturity within 1-2 years. In the wild, murrels spawn during the monsoon season, but in aquaculture, artificial breeding techniques are employed to facilitate controlled reproduction. Hormonal induction using synthetic hormones such as Ovaprim and HCG is widely used to induce spawning in captivity. After successful fertilization, eggs are incubated in controlled environments, and larvae are reared under optimal water quality conditions until they reach fingerling size. The application of artificial breeding techniques has enhanced the production of murrel, ensuring a stable supply for commercial aquaculture.

Keywords: Murrel, *Channa* species, sexual dimorphism, air-breathing fish, artificial breeding, hormonal induction, aquaculture, spawning, larval rearing.

Introduction

Murrel, also known as Snakehead fish, is a species of freshwater predatory fish mostly from the Channidae family that has received a lot of attention in the aquaculture industry due to its high market demand, good growth performance, and adaptability to a variety of environments. The Giant Snakehead (*Channa marulius*), Striped Snakehead (*Channa striata*) and Spotted snakehead (*Channa punctatus)* are the most extensively farmed species in aquaculture. They are both endemic to South Asia, Southeast Asia, and portions of China. Murrels are noted for their white, boneless, and firm flesh, which is highly regarded in many Asian countries for their taste and nutritional content, making them a prominent food industry ingredient. Murrels have a variety of biological features that make them suitable for aquaculture. One of the most striking features is their ability to breathe air. They have a unique system known as the labyrinth organ, which allows them to breathe atmospheric air and survive in oxygen-depleted environments such as stagnant ponds or swamps where most other fish would perish. This makes them exceptionally resistant to environmental fluctuations, particularly in tropical settings where water quality might vary due to seasonal shifts. Murrels' ability to withstand low dissolved oxygen concentrations gives them an edge in semi-intensive and intensive aquaculture systems where aeration might be inconsistent. Murrels are carnivorous and exhibit intense predatory activity in the wild, eating tiny fish, insects, frogs, and crabs. They can be trained to accept artificial or formulated feed in aquaculture, but their high protein requirements must still be taken into account when developing feed formulation. Despite being predatory, they have high feed conversion ratios (FCR), making them a viable species for commercial farming. One of the issues in murrel culture is the availability of fingerlings, which have traditionally been obtained by natural capture. However, recent advances in hatchery technology, particularly the use of induced breeding procedures employing recombinant hormones like Ovaprim and HCG (Human Chorionic Gonadotropin), have considerably increased the availability of high-quality murrel fingerlings. Hatcheries now utilize these hormones to encourage spawning, overriding the species' propensity towards seasonal and environmental dependency for natural reproduction. Murrels are commonly grown in earthen ponds, tanks, or cages, with stocking numbers ranging from 10,000 to 20,000 fish per acre, depending on management level and feed availability. The fish are resilient and can withstand temperatures ranging from 20°C to 40°C, which expands their potential cultivation range. Regular water exchange and good water quality control are critical for maximum growth. Murrel farming necessitates careful monitoring of water characteristics such as temperature, pH, and ammonia levels, however their air-breathing capacity provides a buffer against rapid reductions in dissolved oxygen. Murrel farming is now recognized as one of the most profitable aquaculture businesses, particularly in South Asia, where these fish cost a premium due to high demand. Their rapid growth rate enables them to reach marketable size in 6-9 months, making them a popular species among commercial growers. Murrels have potential in overseas markets, where there is a growing demand for high-quality, white-fleshed seafood.

Biology-Reproduction

Murrels, particularly species such as *Channa marulius*, *Channa striata* and *Channa punctatus* have unique reproductive biology that helps them thrive both in the wild and in aquaculture. They are seasonal breeders, with spawning often taking place during the monsoon season, when water levels rise, providing ideal circumstances for reproduction. The reproductive process begins with wooing behaviours, which involve males and females swimming in patterns before pairing. Murrels are recognized for their oviparous behaviour, in which females lay eggs that are externally fertilized by males. In a spawning episode, a single female can produce thousands of eggs, which are normally buoyant and float on the water's surface. One of the most striking elements of murrel reproduction is parental care. Both male and female murrels guard their eggs and freshly hatched fry, which boosts the offspring's survival rate. The eggs hatch in a few days, depending on water temperature, and the larvae feed first on their yolk sacs. As they mature, the fry start grazing on zooplankton and eventually switch to a carnivorous diet. Murrels achieve sexual maturity in 1-2 years, depending on environmental conditions like as temperature and food availability. Advances in aquaculture have allowed for the controlled breeding of murrels using induced spawning techniques with recombinant hormones like Ovaprim and HCG to overcome their seasonal reproductive cycles. This allows for year-round production of fingerlings in hatcheries, ensuring a consistent supply for aquaculture purposes. Their reproductive biology, combined with their adaptability to induced breeding, makes murrels an important species in aquaculture

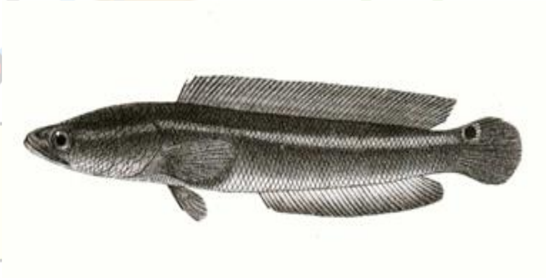
Channa striata

Source: https://animalia.bio/channa-marulius

Source: Animal diversity web

Broodstock development of Murrel

Broodstock development in murrels, particularly species such as *Channa marulius*, *Channa striata* and *Channa punctatus*, is an important phase in effective aquaculture production because it ensures the availability of healthy, mature fish for breeding. Creating high-quality broodstock entails choosing individuals with desirable characteristics such as rapid growth, illness resistance, and overall health. These carefully chosen fish are raised in controlled conditions, usually big, well-managed ponds or tanks, where water quality, diet, and health are regularly monitored. A diet high in protein, vitamins, and vital fatty acids is given to broodstock to improve their quality of eggs and sperm and to increase their reproductive potential. Because they are carnivores, murrels are usually fed tailored pellets enhanced with shrimp meal, fishmeal, and other nutrient-dense ingredients to support healthy gonadal development and optimal growth. Once the broodstock reach sexual maturity, which can take 1 to 2 years, they are induced to spawn using hormones such as Ovaprim or HCG (Human Chorionic



Channa marulius

Gonadotropin). This technique, known as induced breeding, helps overcome their seasonal reproductive tendencies, allowing hatcheries to produce fingerlings throughout the year. Healthy broodstock ensures high fecundity, with females producing thousands of viable eggs per spawning cycle, and males contributing robust sperm for successful fertilization. Proper broodstock management is essential for ensuring the sustainability of murrel aquaculture, as it directly impacts the quality and quantity of fingerlings produced for commercial farming operations.

Cannibalism Mitigation of Murrel

Cannibalism management in murrel aquaculture is a major concern since murrels, particularly species such as *Channa marulius*, *Channa striata* and *Channa punctatus* are highly carnivorous and exhibit cannibalistic behaviour, especially in their early life stages.Cannibalism, if not handled appropriately, can result in significant losses in fingerling and juvenile populations. This behavior is generally caused by size differences among fish, competition for food, or overcrowded environments. **Size grading** is one of the most successful ways for preventing murrel cannibalism. This entails regularly sorting the fish by size and separating larger individuals from smaller ones, as larger fish are more prone to prey on smaller conspecifics. **Frequent grading** at the fry and fingerling stages reduces the size discrepancies that cause cannibalism (Raizada *et al*.,2022). Another essential element in preventing cannibalism is providing enough food. Enough good food given on a regular basis lessens the chance of aggressiveness motivated by rivalry. Offering suitably sized, nutritionally balanced feed pellets or live prey can help meet murrels' dietary needs and lessen their tendency toward cannibalism. Murrels are carnivores and need a diet high in protein. Stocking density also influences cannibalism management. Overcrowding creates competition for resources and space, potentially exacerbating aggressive behaviour. Maintaining ideal stocking densities in tanks or ponds improves food distribution and minimizes stress, both of which are vital for preventing cannibalism. Furthermore, maintaining optimum environmental conditions-such as high water quality, acceptable oxygen levels, and appropriate habitat features like submerged plants or artificial shelters-can help minimize stress and aggression in murrels. By applying these management approaches, aquaculture enterprises can considerably minimize cannibalism, increase survival rates, and boost overall murrel farming production.

Setting up of natural breeding system for murrel

Establishing a natural breeding system for murrels, such *Channa striata* , *Channa marulius* and *Channa punctatus*, entails establishing surroundings that are similar to their native environment in order to promote reproduction naturally and without the use of hormones. Being a seasonal breeder, murrels usually lay their eggs when the water levels rise during the monsoon season. Breeders must build earthen or concrete ponds with enough vegetation, shallow sections, and water quality that mimics the fish's native habitat in order to mimic these characteristics in an aquaculture setting. To replicate the shallow, flooded areas that murrels like for spawning, a typical natural breeding pond design would involve establishing shallow parts in the pond where the water depth ranges from 0.5 to 1 meter. To offer cover and safety, artificial buildings or aquatic vegetation might be added.

In such a setting, the male and female murrels are permitted to pair spontaneously. The female produces hundreds of eggs, which float and remain near the water surface, while the male fertilizes them externally. After fertilization, the eggs are permitted to grow in the shallow, safe areas, and both parents show excellent parental care by watching over the eggs and fry until they can swim freely and take care of themselves. If the environmental circumstances are carefully maintained and in line with the natural breeding behaviour of the species, the murrel aquaculture industry can benefit greatly from this natural breeding strategy.

Artificial Breeding of murrel

Artificial breeding system requires a number of essential processes. Initially, broodstock is chosen, with females often weighing between 500g and 1.5 kg and males between 300g and 700g. To make sure the broodstock is in good enough health for breeding, they are conditioned separately for two to three weeks. Following conditioning, ovulation and spermiation are stimulated by hormonal induction, typically using synthetic analogs like Ovaprim or recombinant hormones. When a female murrelet releases her eggs, the eggs are gathered and fertilized using male sperm. After fertilization, the eggs are incubated in specifically made hatchery systems with regulated water parameters to promote ideal hatching circumstances. During incubation, proper aeration and water quality maintenance are crucial. After hatching, the larvae are placed in nursery systems and raised there until they reach fingerling size. At that time, they are either sold to farmers for additional culture or relocated to grow-out ponds. The utilization of artificial breeding techniques contributes to a dependable and enduring murrel supply for aquaculture operations.

Recent advances in murrel (*Channa striata*) breeding have resulted in more effective hormone induction procedures and controlled spawning systems. Synthetic hormones such as Ovaprim and HCG are commonly used to encourage breeding, resulting in increased fertilization and hatching success rates. The utilization of hatchery systems with optimal water conditions leads to improved egg incubation and larval survival. Recent studies have also concentrated on improving broodstock management and larval rearing to boost production efficiency, with emphasis on achieving year-round breeding and scalable seed production for commercial aquaculture (Paray *et al*.,2013).

Importance of Murrel breeding in Aquaculture

Murrel breeding, particularly of species such as the Striped murrel (*Channa striata*), is important in aquaculture due to its high market value both locally and internationally. These fish are known for their exceptional taste and nutritional content, making them a popular commodity among consumers. Murrel breeding contributes to aquaculture's sustainability by providing a consistent source of stock to meet rising demand, hence minimizing impact on wild populations. Breeding programs also help to increase genetic features, including as growth rates, illness resistance, and overall fish health. This not only provides a steady supply, but it also increases the economic viability of aquaculture businesses, which benefits local economies and contributes to food security.

Murrel breeding also helps to diversify aquaculture species, which is important for minimizing reliance on a few key fish species and mitigating the risks associated with disease outbreaks and market swings. Aquaculture systems that raise murrels can capitalize on new market opportunities and supply alternative protein sources, which are critical for food security in many countries. Furthermore, developments in murrel breeding techniques, including as selective breeding and controlled spawning, have the potential to improve management practices and increase production efficiency. These innovations not only improve the long-term viability of murrel aquaculture, but also promote industrial innovation. Overall, murrel breeding contributes significantly to biodiversity conservation, economic development, and sustainable aquaculture techniques.

Conclusion

Murrel breeding in aquaculture has become an important part of sustainable fish farming due to the species' high market demand and distinct biological characteristics. Aquaculture systems can circumvent natural murrel reproduction constraints by employing artificial breeding techniques like as hormone induction, controlled spawning, and sophisticated larval rearing technologies. These measures enable year-round production, increase survival rates, and contribute to increased yields, making murrel farming a profitable and scalable industry. Murrel aquaculture, with adequate broodstock management, water quality control, and effective feeding tactics, has the potential to significantly improve food security and economic growth in areas where this species is in high demand.

Reference

Kumar, R., Gokulakrishnan, M., Debbarma, J. and Damle, D.K., 2022. Advances in captive breeding and seed rearing of striped murrel *Channa striata*, a high value food fish of Asia. *Animal Reproduction Science*, *238*, p.106957.

Paray, B.A., Ma, H., Manikandaraja, D. and Milton, M.J., 2013. Breeding behavior and parental care of the induced bred striped murrel *Channa striatus* under captive conditions. *Turkish Journal of Fisheries and Aquatic Sciences*, *13*(4).

Prasad, L., Dwivedi, A.K., Dubey, V.K. and Serajuddin, M., 2011. Reproductive biology of freshwater murrel, *Channa punctatus* (Bloch, 1793) from river Varuna (A tributary of Ganga River) in India. *Journal of Ecophysiology & Occupational Health*, *11*(1and2), pp.69-80.

Raizada, S., Rawat, A., Srivastava, P.P. and Lal, K.K., 2022. Cannibalism mitigation in striped murrel, *Channa striata*, with hatchery seed weaned on pellet diet: A review. *Reviews in Aquaculture*, *14*(3), pp.1213-1233.