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Breeding Performance and Seed Production of the Vietnamese Strain of Striped Snakehead (*Channa striata*) under Farm Conditions in Hyderabad, India

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Abstract

Striped snakehead, *Channa striata* (Bloch, 1793), is a high-value freshwater fish of considerable aquaculture importance in South and Southeast Asia. Commercial expansion of its culture in India is, however, constrained by the inconsistent availability of good-quality hatchery-produced seed. The present study evaluated the breeding and seed-production performance of a Vietnamese-origin stock of *C. striata* maintained under practical farm conditions in Kukatpally, Medchal–Malkajgiri District, Hyderabad, Telangana, India. Broodfish selected for breeding had an average total length of approximately 40 cm and body weight of approximately 1.2 kg. Breeding sets were maintained at a 2:1 broodstock ratio, and spawning was induced using Ovaprim. Reproductive performance was assessed using spawning response, fertilization rate and hatching rate, while post-hatch performance was evaluated from nursery survival. The broodstock exhibited an overall spawning response of 85%. Fertilization and hatching rates were 96% and 90%, respectively, demonstrating high reproductive success under the farm conditions. Nursery survival was 79%, indicating that the majority of hatchlings successfully progressed through the nursery phase. Assuming sequential application of the observed fertilization, hatching and nursery survival rates, approximately 68.3% of the initial egg cohort could potentially be retained through the nursery phase. The results demonstrate that the Vietnamese-origin *C. striata* stock can be successfully propagated using Ovaprim under Hyderabad farm conditions. Nevertheless, management during the post-hatching period remains critical because feeding, size heterogeneity and cannibalism can considerably influence final seed recovery. The findings provide practical baseline information for developing commercial seed-production systems for striped snakehead in southern India.

Keywords: *Channa striata*, striped snakehead, striped murrel, Vietnamese strain, Ovaprim, induced breeding, fertilization, hatching, nursery survival, seed production

1. Introduction

Striped snakehead, *Channa striata* (Bloch, 1793), commonly known as striped murrel in India, is an economically important freshwater food fish distributed widely throughout South and Southeast Asia. The species has attracted increasing attention for aquaculture because of its high consumer preference, market value, flesh quality and adaptability to intensive culture environments. Its accessory air-breathing organ allows it to tolerate environmental conditions that would be stressful to many conventional freshwater aquaculture species, thereby increasing its suitability for pond- and tank-based farming systems (Kumar *et al*., 2022) [6]. *C. striata* aquaculture in India has been constrained by the limited availability of dependable, uniform and good-quality seed. Traditionally, a considerable proportion of seed has been collected from natural water bodies. Wild seed availability is highly seasonal and unpredictable, while differences in age, size, physiological condition and genetic background can complicate subsequent grow-out management. Establishing reliable hatchery-based seed production is therefore essential for the development of commercial striped snakehead farming. *C. striata*. Different hormonal preparations, including human chorionic gonadotropin, carp pituitary extract, salmon gonadotropin-releasing hormone analogues and commercial GnRH-based formulations, have successfully induced spawning. Kumar *et al*. (2021) [5] demonstrated that hormonal manipulation of captive

broodstock can improve reproductive maturation and subsequent spawning performance. Their work emphasized the importance of broodstock physiological condition and appropriate hormonal management in obtaining satisfactory egg production, fertilization and hatching. Awal *et al.* (2024) [2] evaluated carp pituitary extract and buserelin for artificial propagation of *C. striata* and demonstrated clear effects of hormone type and dose on spawning response and embryonic development. These findings confirm that *C. striata* is amenable to controlled propagation, but also indicate that breeding success can vary according to broodstock maturity, induction protocol, environmental conditions and farm management.

Ovaprim is among the synthetic hormonal preparations used for induced breeding of striped murrel. Earlier studies demonstrated effective reproductive induction with Ovaprim, including high fertilization rates and relatively short hatching periods (Haniffa *et al*., 2000) [4]. Ovaprim therefore provides a practical option for hatchery and farm-scale breeding where standardized hormone administration and appropriate broodstock management are available. Induced breeding using hypophysation is an effective technique for obtaining fish seed from murrel (*Channa straitus*) under controlled conditions (Kumar *et al*., 2023) [9]. Successful spawning, however, represents only the first stage of commercial seed production. Losses during larval and nursery rearing can considerably reduce the number of marketable fry and fingerlings obtained from an otherwise successful spawning event. Early juvenile *C. striata* are predatory and exhibit pronounced cannibalistic behaviour. Size differences within a cohort can develop rapidly, enabling larger individuals to attack smaller fish. Roy *et al.* (2020) [12] demonstrated that feed type influenced growth, survival, size heterogeneity and cannibalism in juvenile striped snakehead. Management of feed availability and fish size distribution is therefore essential during seed rearing.

Regular size grading has consequently become an important component of snakehead nursery management. Maintaining sufficient feed availability, providing appropriately sized feed particles and avoiding prolonged feed deprivation can reduce competition and the opportunity for cannibalism. Kumar *et al.* (2022) [6] similarly identified feeding management, weaning and cannibalism control as major components of successful mass-scale seed production. Hypophysation is an effective technique for inducing breeding in *Oreochromis niloticus* (Nile tilapia) under controlled conditions ("Study on Induced Breeding," 2025) [7].

Genetic background is another consideration in snakehead aquaculture. Populations of *C. striata* from different geographical regions are not genetically homogeneous. Duong *et al.* (2019) [3] demonstrated significant population genetic structuring among wild and cultured stocks in the Lower Mekong Basin. Nguyen and Duong (2016) [8] also reported morphological and genetic variability among cultured and wild snakehead populations in Viet Nam. of particular relevance to the present study, Alam *et al.* (2022) [1] identified strain-specific mitochondrial polymorphisms capable of differentiating Bangladesh and Vietnamese *C. striata* stocks. Such findings indicate that geographic origin should be considered when introduced stocks are evaluated for aquaculture. They also emphasize the importance of documenting broodstock provenance and, where possible, confirming strain identity through molecular methods.

Vietnam has a well-established tradition of snakehead culture, and Vietnamese-origin farm stocks have attracted interest outside their original production area. Nevertheless, relatively little published information is available on the reproductive performance of Vietnamese-origin *C. striata* under commercial farm conditions in southern India. Environmental conditions in Telangana differ from those prevailing in major snakehead-producing regions of Viet Nam, and local temperature regimes, water characteristics, feeding systems and general farm management may influence reproductive performance.

The present study was therefore conducted to evaluate the breeding and seed-production performance of Vietnamese-origin *C. striata* maintained under farm conditions in Hyderabad, India. Particular emphasis was placed on broodstock characteristics, spawning response, fertilization success, hatching success and nursery survival following Ovaprim-induced breeding. The study was intended to provide practical baseline information relevant to farmers and hatchery operators interested in developing dependable striped snakehead seed production in southern India.

2. Materials and Methods

2.1 Study area and experimental approach

The breeding trial was conducted at a freshwater aquaculture farm located in Kukatpally, Medchal–Malkajgiri District, Hyderabad, Telangana, India. The work was undertaken as a practical farm-scale breeding and seed-production assessment rather than as a controlled laboratory experiment. The study evaluated the reproductive response of farm-maintained Vietnamese-origin *C. striata* following hormonal induction and subsequently followed the resulting progeny through the nursery phase. Because replicate-level raw data for individual spawning events were not available for all production variables, the study was analysed primarily as a descriptive farm trial. Accordingly, the results are reported as observed percentages rather than as reconstructed means, standard deviations or inferential statistical comparisons.

2.2 Origin and characteristics of broodstock

The broodfish were derived from stock maintained at the farm as Vietnamese-origin *Channa striata*. Identification as *C. striata* was based on the farm broodstock records and morphological characteristics of the cultured stock. Molecular confirmation of geographic origin was not undertaken as part of the present trial. Consequently, the term "Vietnamese-origin" refers to the recorded provenance of the farm stock rather than independent genetic verification. Broodfish selected for breeding had an average total length of approximately 40 cm and an average body weight of approximately 1.2 kg. Mature broodfish exhibiting satisfactory body condition and external signs of reproductive readiness were selected. Females were assessed principally from abdominal distension, softness of the abdomen and appearance of the genital opening, whereas males were selected according to general body condition and external reproductive characteristics. Breeding sets were constituted at a 2:1 broodstock ratio.

2.3 Hormonal induction and breeding procedure

Selected broodfish were subjected to induced breeding using Ovaprim, a commercial synthetic spawning-induction preparation commonly used in freshwater aquaculture. Ovaprim was administered according to the routine breeding protocol employed at the farm. Sex-specific injection doses were not included in the production dataset available for the present analysis and were therefore not reconstructed retrospectively. Fish were observed for reproductive behaviour and subsequent egg production. Females releasing eggs were classified as successfully spawned.

Spawning response (%) = (Number of females that spawned / Number of females induced) × 100

2.4 Assessment of fertilization

Fertilized eggs were differentiated from unfertilized or non-developing eggs according to their appearance and evidence of normal embryonic development.

Fertilization rate was calculated as

Fertilization rate (%) = (Number of fertilized eggs / Total number of eggs examined) × 100

2.5 Incubation and hatching

Fertilized eggs were maintained under routine farm incubation conditions until hatching. Developing eggs were monitored periodically, and hatchlings were recorded after emergence from the egg membrane.

Hatching rate was expressed relative to the number of fertilized eggs

Hatching rate (%) = (Number of larvae hatched / Number of fertilized eggs incubated) × 100

2.6 Nursery management and survival

Routine nursery management was followed to maintain feeding, water conditions and fish health. Particular attention was given to the known vulnerability of *C. striata* larvae and fry to differences in growth and size, which can increase the risk of cannibalistic losses. The detailed feed composition, daily feeding rate, stocking density and grading interval were not available as quantitative components of the supplied dataset and were therefore not reconstructed. At the end of the recorded nursery phase, surviving seed were assessed and nursery survival was calculated as:

Nursery survival (%) = (Number of surviving seed / Number initially stocked in the nursery) × 100

2.7 Cumulative production efficiency

To provide an integrated indication of sequential seed-production efficiency, the proportional recovery through fertilization, hatching and nursery survival was calculated from the recorded percentages:

Cumulative egg-to-nursery recovery (%) = Fertilization proportion × Hatching proportion × Nursery survival proportion × 100

This calculated value represents an estimated sequential recovery and should not be interpreted as a directly counted fingerling-production value because absolute egg and larval numbers were not available.

2.8 Data analysis

The available farm data were analysed descriptively. Spawning response, fertilization, hatching and nursery survival are presented as percentages. No means ± standard deviations or significance tests were generated because individual breeding-event observations and replicate-level measurements required for valid inferential analysis were not available. This approach was adopted to avoid creating artificial replication or statistical precision unsupported by the original farm dataset.

3. Results

3.1 Broodstock characteristics

Broodfish selected for induced breeding were comparatively large and in suitable reproductive condition. The average total length of the selected stock was approximately 40 cm, while average body weight was approximately 1.2 kg. A broodstock ratio of 2:1 was maintained during the breeding operation.

Table 1: Broodstock and breeding characteristics of Vietnamese-origin *Channa striata*

Parameter	Observed value
Mean total length	Approximately 40 cm
Mean body weight	Approximately 1.2 kg
Broodstock ratio	2:1
Spawning-induction agent	Ovaprim
Culture setting	Farm conditions
Location	Kukatpally, Hyderabad, Telangana, India

3.2 Spawning response

Ovaprim successfully induced spawning in the majority of the selected broodfish. The overall spawning response was 85%, indicating that the majority of induced females successfully spawned after hormonal induction. The result demonstrates a strong reproductive response of the Vietnamese-origin stock to induced breeding under the prevailing farm conditions.

3.3 Fertilization and hatching

The recorded fertilization rate was 96%, indicating that only a small proportion of the eggs assessed failed to undergo successful fertilization or normal initial embryonic development. The hatching rate was 90% of fertilized eggs. Thus, most successfully fertilized eggs proceeded through embryonic development and produced viable hatchlings.

Table 2: Reproductive performance of Vietnamese-origin *Channa striata*

Reproductive parameter	Observed value (%)
Spawning response	85
Fertilization rate	96
Hatching rate	90

The combination of high fertilization and hatching percentages indicates that the major reproductive stages before larval rearing performed satisfactorily under the farm breeding protocol.

3.4 Nursery survival

Post-hatching performance remained comparatively high. The recorded nursery survival was 79%, demonstrating that more than three-quarters of seed entering the nursery phase survived through the recorded nursery period.

Table 3: Seed-production performance of Vietnamese-origin *Channa striata*

Parameter	Value
Fertilized eggs, proportional to eggs examined	96%
Hatchlings, proportional to fertilized eggs	90%
Nursery survival	79%
Calculated cumulative egg-to-nursery recovery*	68.3%

*Calculated as 0.96 × 0.90 × 0.79 × 100. The value is a proportional estimate and not an absolute fingerling count.

The calculated sequential recovery indicates that, assuming all three percentages relate to successive stages of the same production cohort, approximately 68.3% of the original eggs could theoretically be represented by surviving nursery seed.

4. Discussion

The present farm study demonstrates successful induced breeding and seed production of Vietnamese-origin *Channa striata* under Hyderabad conditions. The combination of an 85% spawning response, 96% fertilization, 90% hatching and 79% nursery survival indicates that the broodstock were capable of completing the major reproductive and early seed-production stages following Ovaprim induction.

4.1 Broodstock response and Ovaprim-induced spawning

The 85% spawning response observed in the present study demonstrates a high degree of responsiveness of the broodstock to hormonal induction. Controlled reproduction of *C. striata* can be difficult when broodfish are inadequately conditioned or are induced outside an appropriate stage of gonadal maturation. Broodstock selection therefore remains an important determinant of breeding success.

Kumar *et al*. (2021) [5] reported that hormonal manipulation and broodstock management can improve reproductive maturation, egg production, fertilization and hatching in captive *C. striata*. The successful response obtained in the present farm trial similarly indicates that broodfish maintained under culture conditions can retain strong reproductive potential when appropriately selected and induced.

Ovaprim was the hormonal preparation used in the present trial. Its effectiveness for striped murrel breeding has been demonstrated previously. Haniffa *et al*. (2000) [4] compared several inducing agents and found particularly favourable fertilization performance following Ovaprim administration. The present spawning response therefore supports the practical application of Ovaprim for farm-scale propagation of striped snakehead. However, because hormone dose was not available in the supplied farm record, the study cannot determine whether the observed performance represents an optimum dose-response relationship. Future work should report sex-specific Ovaprim dosage precisely to improve experimental repeatability.

4.2 Fertilization performance

The 96% fertilization rate was one of the strongest outcomes of the trial. This value indicates effective gamete release and successful fertilization following hormone-induced spawning. The result is consistent with earlier observations that very high fertilization can be achieved in Ovaprim-induced striped murrel. Haniffa *et al*. (2000) [4] reported fertilization in the range of approximately 95–98% under favourable Ovaprim treatment, placing the 96% recorded in the present farm trial within a biologically credible range. High fertilization may reflect several interacting factors, including broodstock maturity, gamete quality, appropriate timing of spawning, adequate male participation and suitable environmental conditions. Because the present trial was conducted under practical farm conditions, these variables operated simultaneously and their individual contributions cannot be separated. The result is nevertheless important commercially. Poor fertilization immediately reduces hatchery output regardless of subsequent incubation and nursery management. A fertilization rate approaching 100% therefore provides a strong biological foundation for seed production.

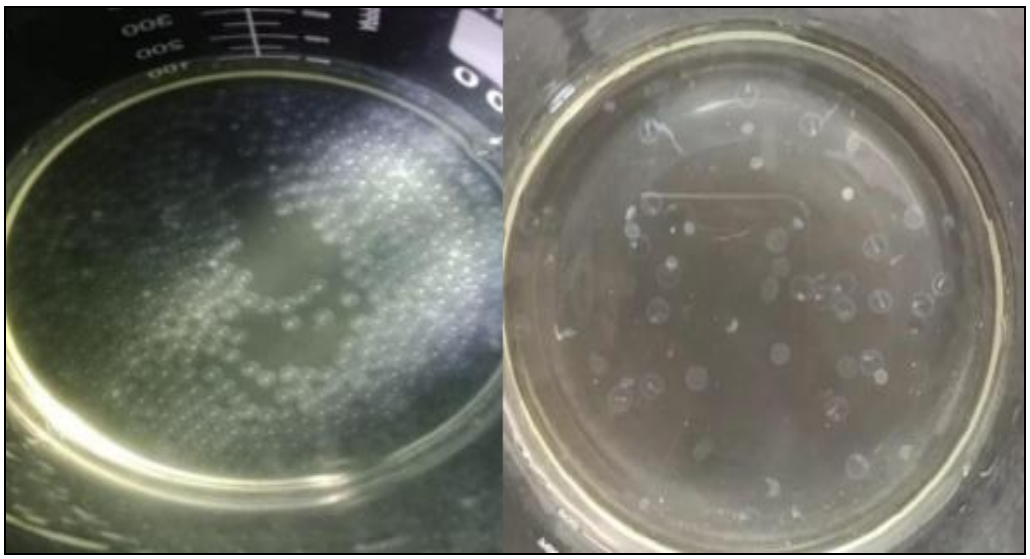

Fig 1: Fertilized and unfertilized eggs

4.3 Hatching performance

The recorded 90% hatching rate also indicates satisfactory egg and embryo quality. Published information for *C. striata* demonstrates that successful hatching depends on egg quality, incubation conditions, water temperature and the effectiveness of the hormonal protocol (Kumar *et al*., 2021; Awal *et al*., 2024) [5, 2]. Awal *et al*. (2024) [2] demonstrated that hormonal treatment and dose can significantly influence reproductive and embryonic outcomes in striped snakehead. Although their study examined carp pituitary extract and buserelin rather than Ovaprim, their findings reinforce the principle that reproductive induction must be matched to broodstock maturity and environmental conditions. The combination of 96% fertilization and 90% hatching in the present study indicates that embryo losses after fertilization were relatively limited. These results compare favourably with commonly reported hatchery performance in striped murrel and demonstrate the feasibility of maintaining high egg viability under farm rather than laboratory conditions.

4.4 Nursery performance and seed recovery

The 79% nursery survival recorded in the present study is particularly relevant from a farmer's perspective. Reproductive indices such as fertilization and hatching are important biologically, but commercial viability ultimately depends on the quantity of viable seed surviving beyond the highly vulnerable larval stages. The proportional combination of fertilization, hatching and nursery survival suggests an estimated cumulative recovery of approximately 68.3 nursery survivors per 100 initial eggs, provided that the reported percentages are sequential and apply to the same cohort. This calculated value illustrates the progressive nature of production losses and highlights why final seed survival should be considered together with reproductive performance. A nursery survival of 79% indicates that early seed management was generally effective. Nevertheless, the decline between hatching and the end of nursery rearing shows that the post-hatch stage continues to represent an important production bottleneck.

4.5 Cannibalism and size variation

Cannibalism is one of the principal biological challenges in seed production of *C. striata*. The species becomes strongly predatory early in development, and rapidly developing size variation can allow larger individuals to consume smaller siblings. Roy *et al*. (2020) [12] demonstrated that feeding strategy affects growth, survival and cannibalism in early juvenile striped snakehead. Live zooplankton supported high growth and survival but could also increase size heterogeneity and cannibalistic interactions. Their findings illustrate that maximizing growth alone does not necessarily maximize final seed recovery. Kumar *et al*. (2022) [6] likewise identified feeding management, weaning and cannibalism control as major priorities for commercial-scale striped murrel seed production. Feed should therefore be offered at an appropriate size and frequency, and all fish should have adequate access to food. Regular grading is especially important. Individuals that grow rapidly can become "shooters" and obtain a substantial size advantage over the remainder of the cohort. Separating these fish reduces direct predation on smaller individuals and decreases competition. The 79% nursery survival observed in the present study suggests that the farm management system was able to retain a relatively large proportion of seed. More detailed future monitoring should distinguish mortality caused by cannibalism from losses attributable to handling, feed inadequacy, water quality or other causes.

4.6 Broodstock size and practical farm relevance

The broodfish used in this trial averaged approximately 40 cm in total length and 1.2 kg in body weight. Successful spawning of fish of this size demonstrates that relatively large broodfish can remain reproductively effective under managed culture conditions. Broodstock size alone does not determine reproductive success. Nutritional condition, gonadal development, age, previous spawning history, environmental conditions and stress during handling can all influence reproductive performance. Nevertheless, documenting broodstock size is important because larger mature females may have greater absolute egg-production capacity. Absolute and relative fecundity were not available in the present farm dataset. Future trials should therefore quantify total egg output per female and eggs produced per kilogram of female body weight. These measures would allow direct assessment of whether the relatively large broodfish used in the present trial provide a commercial advantage through increased egg production.

4.7 Importance of Vietnamese stock origin

The geographical origin of the broodstock is relevant when interpreting the present results. Genetic studies have demonstrated meaningful differentiation among *C. striata* populations. Duong *et al*. (2019) [3] identified genetic structuring among wild and cultured striped snakehead populations in the Lower Mekong Basin. Nguyen and Duong (2016) [8] similarly demonstrated morphological and genetic variation among cultured and wild *C. striata* populations in Viet Nam. More specifically, Alam *et al*. (2022) [1] identified mitochondrial COI polymorphisms capable of differentiating Vietnamese and Bangladesh strains. These findings indicate that geographically distinct farm stocks may possess identifiable genetic characteristics. The broodstock evaluated in the present study were maintained and recorded by the farm as Vietnamese-origin fish. Molecular verification was not included in the available dataset. Accordingly, the results demonstrate the performance of a farm-maintained Vietnamese-origin stock, but they should not be interpreted as demonstrating genetically determined superiority of the Vietnamese strain over Indian populations. Future strain-comparison trials should use molecularly confirmed broodstock and rear Vietnamese and Indian stocks under identical conditions. Such studies should compare growth, age at maturity, fecundity, spawning response, fertilization, hatching, nursery survival, feed efficiency, disease resistance and economic performance.

4.8 Implications for commercial seed production

From a practical perspective, the combination of 85% spawning response, 96% fertilization, 90% hatching and 79% nursery survival indicates substantial potential for developing farm-scale seed production of this stock in Telangana. A reliable local hatchery system would reduce

dependence on seasonal wild seed collection and allow farmers to plan stocking schedules more effectively. It could also improve seed uniformity and facilitate selective broodstock management. However, commercial success should not be evaluated from hatching percentage alone. Production costs associated with broodstock maintenance, hormone administration, incubation, live or formulated feed, grading, water management, labour and nursery infrastructure must be considered together with the number and market value of fingerlings ultimately produced. Economic evaluation should therefore accompany subsequent production trials.

4.9 Study limitations

The present study provides useful farm-level data but has several limitations.

First, the available dataset contained summary breeding and nursery percentages rather than replicate-level observations. Inferential statistical analysis and estimation of variation among individual breeding events were therefore not appropriate.

Second, absolute fecundity, relative fecundity, latency period and the absolute number of hatchlings and fingerlings were not available. These variables would allow more detailed evaluation of reproductive efficiency.

Third, the actual sex-specific Ovaprim dose used in the farm protocol was not included in the supplied production record. Future trials should document hormone dose precisely.

Fourth, detailed quantitative records of nursery stocking density, feed input, grading frequency, water temperature, dissolved oxygen, pH and nitrogenous metabolites were not available.

Finally, Vietnamese origin was based on farm provenance rather than molecular confirmation. Genetic characterization using COI-based or other appropriate markers would strengthen future strain-specific evaluations.

Despite these limitations, the trial provides a useful practical demonstration of successful induced spawning and seed production of Vietnamese-origin *C. striata* under commercial farm conditions in Hyderabad.

5. Conclusion

The Vietnamese-origin *Channa striata* stock evaluated in the present study demonstrated strong reproductive and nursery performance under farm conditions in Hyderabad, Telangana, India. Broodfish averaging approximately 40 cm total length and 1.2 kg body weight responded successfully to Ovaprim-induced breeding at a 2:1 broodstock ratio. The trial produced an 85% spawning response, 96% fertilization rate and 90% hatching rate. Nursery survival reached 79%, demonstrating satisfactory post-hatching seed performance. When fertilization, hatching and nursery survival were considered sequentially, the observed percentages corresponded to a calculated potential recovery of approximately 68.3% from the initial egg cohort to nursery survivors, although this derived value should be confirmed in future trials using direct numerical egg and seed counts. The results demonstrate that Vietnamese-origin striped snakehead can be successfully propagated under Hyderabad farm conditions and support the development of local hatchery-based seed production. Future studies should include larger and replicated breeding trials, precise documentation of Ovaprim dosage, fecundity and latency measurements, continuous water-quality monitoring, detailed nursery feeding and grading records, absolute fingerling recovery, economic analysis and molecular confirmation of broodstock origin. Direct comparison between genetically verified Vietnamese and Indian *C. striata* stocks under identical culture conditions is particularly recommended before conclusions are made regarding strain superiority.

6. References

1. Alam MS, Projna F, Zafrin MS, Das R, Khan MGQ. Assessment of genetic diversity, detection of strain-specific single nucleotide polymorphisms and identification of the Bangladesh and Vietnam strain of *Channa striata* by PCR-RFLP analysis of the mitochondrial COI gene fragment. Aquaculture and Fisheries. 2022;7:287-295. doi:10.1016/j.aaf.2020.12.006.
2. Awal MR, Pervin R, Rahman MA, Bhadra A, Mahmud Y, Tanu MB, *et al*. Effect of hormonal treatment on artificial propagation, spawning performance and embryonic development of striped snakehead *Channa striata* (Bloch, 1793). Animal Reproduction Science. 2024;267:107521. doi:10.1016/j.anireprosci.2024.107521.
3. Duong TY, Uy S, Chheng P, So N, Tran TTH, Nguyen NTT, *et al*. Genetic diversity and structure of striped snakehead (*Channa striata*) in the Lower Mekong Basin: implications for aquaculture and fisheries management. Fisheries Research. 2019;218:166-173. doi:10.1016/j.fishres.2019.05.014.
4. Haniffa MA, Merlin RT, Mohamed JS. Induced spawning of the striped murrel *Channa striatus* using pituitary extracts, human chorionic gonadotropin, luteinizing hormone-releasing hormone analogue and Ovaprim. Acta Ichthyologica et Piscatoria. 2000;30:53-60. doi:10.3750/AIP2000.30.1.04.
5. Kumar R, Mohanty UL, Pillai BR. Effect of hormonal stimulation on captive broodstock maturation, induced breeding and spawning performance of striped snakehead, *Channa striata* (Bloch, 1793). Animal Reproduction Science. 2021;224:106650. doi:10.1016/j.anireprosci.2020.106650.
6. Kumar R, Gokulakrishnan M, Debbarma J, Damle DK. Advances in captive breeding and seed rearing of striped murrel *Channa striata*, a high value food fish of Asia. Animal Reproduction Science. 2022;238:106957. doi:10.1016/j.anireprosci.2022.106957.
7. Study on induced breeding in *Oreochromis niloticus* (*Nile tilapia*) through hypophysation technique. International Journal of Oceanography and Aquaculture. 2025;7(4):1-4. doi:10.23880/ijoac-16000270.
8. Nguyen NTT, Duong TY. Morphological and genetic differences between cultured and wild populations of *Channa striata* in Viet Nam and its phylogenetic relationship with other *Channa* species. Songklanakarin Journal of Science and Technology. 2016;38:427-434. doi:10.14456/sjst-psu.2016.56.
9. Kumar BG, Kumar DR, Saikumar B. Induced breeding (hypophysation) in murrel *Channa straitus*.

International Journal for Multidisciplinary Research. 2023;5(4). doi:10.36948/ijfmr.2023.v05i04.5835.
10. Rawat A, Raizada S, Yadav KC, Sahu V. Induced spawning and embryonic development of striped murrel *Channa striata* (Bloch, 1793) under indoor conditions using salmon gonadotropin releasing hormone analogue. Indian Journal of Fisheries. 2020;67:52-61. doi:10.21077/ijf.2020.67.3.97091-06.
11. Sathvika M, Kumar KP, Padmavathi P, Thirumala M. Small-scale breeding and early fry culture of *Betta splendens* using *Artemia* nauplii: a case study from Government Arts & Science College (A), Kamareddy, Telangana, India. Asian Journal of Fisheries and Aquatic Research. 2026;28(9):104-112. doi:10.9734/ajfar/2026/v28i91148.
12. Roy P, Chandan CSS, Roy NC, Islam I. Feed types affect the growth, survival and cannibalism in early juvenile of striped snakehead (*Channa striata* Bloch). Egyptian Journal of Aquatic Research. 2020;46:377-382. doi:10.1016/j.ejar.2020.08.009.
13. Thirumala M, Kumar KP, Vanaja K, Manasa C. Hypophysation: an induced breeding technique in *Cyprinus carpio*. International Journal of Creative Research Thoughts. 2024;12(8):758-764.