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Empowering Local Fish Farmers Through Hormonal-Based Induced Spawning of Climbing Perch (*Anabas testudineus*) for Sustainable Aquaculture Production

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ABSTRACT

Background: Climbing perch (Anabas testudineus) is a primary commodity in Ogan Ilir Regency, South Sumatra, with high market demand. However, wild populations are declining due to overfishing, and farmers face a chronic shortage of high-quality fry due to seasonal spawning limitations.

Purpose: This community service program aims to empower local fish farmers through hormonal-based induced spawning technology and participatory training to increase fry production capacity and improve farmers' competence.

Methods: The program used a Participatory Action Research (PAR) approach with three phases: planning (FGDs), implementation (hormone injection, spawning, larval rearing), and evaluation (pre/post-test). Participants were 15 farmers from Pokdakan Balai Makmur. Spawning used 0.25 mL/kg Ovaprim and 0.90 mL/kg hCG. Parameters measured included fecundity (F), fertilization rate (FR), hatching rate (HR), survival rate (SR), and farmer competence.

Results: Fecundity reached 6,326 eggs per female. FR was 98.6% (SD ±0.81), HR was 96.3% (SD ±1.20), and SR was 99.1% (SD ±0.51). Water quality remained optimal (pH 6.5–8.8, temperature 25.8–29.4°C, DO 5.0–5.5 mg/L). Farmer competence improved from 25.8% (SD ±8.2) to 60.5% (SD ±7.4), a significant increase of 34.7 percentage points (paired t-test, $p < 0.001$). A community-managed "Seed Fund" was established for hormone procurement.

Keywords
Climbing Perch; HCG (Human Chorionic Gonadotropin); Ovaprim; Spawning

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Introduction

Sustainable aquaculture development in rural areas requires more than just technical intervention; it demands a robust model of community empowerment to ensure long-term independence. Community empowerment plays a pivotal role in fostering an independent civil society and balancing relationships among the community, the government, and the academic stakeholders. An independent community is better positioned to engage with external parties on equal terms, particularly to enhance its bargaining power in the local economy (Sulistiyani *et al.,* 2016). In the context of Ogan Ilir Regency, particularly in Tanjung Raya, the climbing perch (*Anabas testudineus*) has become a primary commodity due to high market demand (Figure 1). However, the wild population is declining due to overfishing, and the aquaculture sector faces a chronic shortage of high-quality fry, which typically only spawn seasonally in the wild (Dahril *et al.,* 2017; Junaidi *et al.,* 2021).

Previous community engagement models in aquaculture have often focused strictly on the transfer of technology, which frequently leads to a lack of sustainability once the intervention ends (Sulistiyani *et al.*, 2016). While earlier initiatives successfully introduced basic pond management, they often neglected the integration of advanced reproductive technology with a participatory organizational framework. This project fills that gap by adopting a Participatory Action Research (PAR) approach, which differs from conventional top-down extension services. By establishing a strategic partnership between the Aquaculture Study Program at Sriwijaya University and local farming groups, this initiative transitions from simple technical assistance to a co-management model where farmers are active researchers in their own ponds.

The technical core of this transformative approach involves overcoming the biological barriers of *Anabas testudineus* spawning. Natural spawning in ponds remains a significant challenge even when fish reach gonadal maturity (Suhendi, 2012). To address these issues, a semi-natural spawning through hormonal induction using Ovaprim and hCG (Human Chorionic Gonadotropin) is implemented. Ovaprim, a mixture of salmon Gonadotropin-Releasing Hormone (sGnRH-a) analog and an anti-dopamine agent, triggers rapid ovulation and improves larval quality (Rosita *et al.,* 2019; Hasnidar *et al.,* 2022). Complementing this, hCG consists of 90% Luteinizing Hormone (LH) and 10% Follicle-Stimulating Hormone (FSH) (Effendie, 2002; Ghofur *et al.,* 2023), able to accelerate oocyte development and sex hormone production. While previous studies from Violota *et al.* (2019) have demonstrated the efficacy of combined hormones (0.25 mL/kg Ovaprim and 0.90 mL/kg hCG) in controlled environments, this activity scales these findings into a community-led production system. This study builds upon existing models by integrating hormonal technology with a structured mentorship program to foster local leadership in fish seed production. The objective is not only to achieve high fertilization and hatching rates but to establish a sustainable, community-managed hatchery model that enhances local income and promotes the conservation of climbing perch resources.

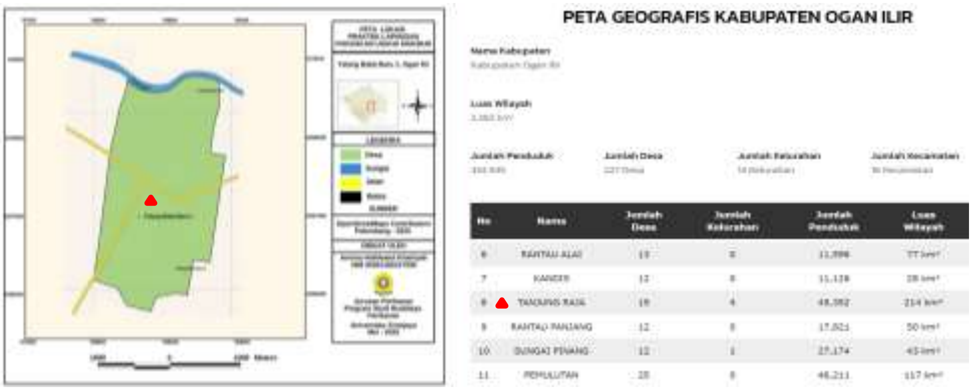

Figure 1. Orientation map of Tanjung Raja Village, Ogan Ilir Regency, South Sumatra

Method

The community involvement was structured into three phases: (1) Planning Phase, involving focus group discussions with Pokdakan leaders to identify local challenges; (2) Implementation Phase, where farmers actively participated in hormone injection and water monitoring; and (3) Evaluation Phase, using pre/post-tests to measure the shift in competence.

The field practice was conducted in Talang Balai Baru 1 Village, Tanjung Raja Subdistrict, Ogan Ilir Regency, South Sumatra, during June and July 2025, involving the Balai Makmur Fish Farmers Group (Pokdakan). The materials used were 10-15 cm climbing perch fish broodstock, Ovaprim and hCG hormones, feed containing 31-33% protein, Artemia sp., and Tubifex sp.

The climbing perch fish broodstock used for spawning were sourced from the wild and were subsequently acclimatized and maintained for 15 days. During this maintenance period, the broodstock were fed pellets three times a day, following the method outlined by Violota et al. (2019). Water quality was monitored daily, both in the morning and evening, to ensure optimal environmental conditions. Before spawning, the broodstock of climbing perch fish was selected to obtain healthy individuals with mature gonads. The male and female climbing perch fish used in the spawning process weighed 47.7 grams and 62.5 grams, respectively, and exhibited characteristics consistent with the gonadal maturity criteria outlined by Burmansyah et al. (2013). Female broodstock could be identified by their larger body size and enlarged abdomens, while male broodstock tended to be smaller with flatter abdomens. During the sorting process, the male broodstock released milky white sperm, while the female broodstock released eggs, indicating their readiness for spawning, as noted by Burmansyah et al. , 2013; Augusta et al. (2020). The ratio of male to female broodstock used in this project was 1:1.

Fish spawning was performed semi-naturally by injecting a combination of Ovaprim and hCG hormones as stimulants (Harianja et al., 2017). The dosage used was 0.25 mL of Ovaprim and 0.90 mL of hCG per kilogram of broodstock weight (Rahayu, 2022). The injection is administered intramuscularly using a 1 mL syringe. This procedure is typically conducted at night, after which the male and female broodstock are placed together in a spawning container for 10 to 13 hours (Burmansyah et al., 2013). Once the spawning process is complete, the climbing perch fish broodstock are separated from their eggs to prevent cannibalism. The eggs of climbing perch, which float on the waters surface, will hatch within 1 to 2 days. Intensive monitoring of water quality and egg condition was conducted by Suriansyah et al. (2021). The optimal incubation temperature for hatching eggs is 31°C, with a hatching time of approximately 19 hours and 30 minutes, and the pH level of 8 has been reported to enhance the egg hatching percentage (Suriansyah et al., 2021).

Parameters used in these observations are Fecundity values (F), Fertilization Rate (FR), Hatching Rate (HR), and Survival Rate (SR) that are calculated using the formula according to Effendie (2002) as follows:

$$F = \frac{G \times \chi}{g}$$

Explanation:
F: Total fecundity (eggs)
G: Total gonad weight (grams)
X: Number of eggs in the gonad sub-section (eggs)
g: Weight of the gonad sub-section (grams)

$$FR\ (\%) = \frac{\text{Fertilized eggs (pieces)}}{\text{sample eggs (pieces)}} \times 100$$

$$HR\ (\%) = \frac{\text{hatched eggs (pieces)}}{\text{fertilized eggs (pieces)}} \times 100$$

$$SR = \frac{N_t}{N_0} \times 100\%$$

Explanation:
SR: Survival rate (%)
Nt: Living larvae at the end of cultivation (larvae)
N0: Living larvae at the start of cultivation (larvae)

In climbing perch fish spawning, several water quality parameters are measured, including temperature, pH, dissolved oxygen (DO), and ammonia. The measurements were conducted continuously during broodstock maintenance until the rearing period of the climbing perch fish larvae to ensure that water conditions remained optimal for fish growth and development.

Data analysis involved primary data collected directly by following all activities in the field and secondary data from literature studies for comparison. The collected data were then analyzed descriptively.

Result

The community service program was structured into three phases: Planning, Implementation, and Evaluation. The results are presented according to these phases.

Planning Phase Results

During the planning phase, focus group discussions were conducted with leaders of the Balai Makmur Fish Farmers Group (Pokdakan) to identify local challenges in climbing perch aquaculture. The discussions revealed that the main constraints faced by farmers were the seasonal availability of wild broodstock, low and inconsistent fry production, lack of knowledge about hormonal-induced spawning techniques, and dependence on external fry suppliers for approximately 80% of their seed requirements. The FGDs also identified farmer willingness to learn new spawning techniques and the availability of existing pond facilities as key assets that could be mobilized. Based on these findings, the program objectives were defined to include technology transfer for hormonal-induced spawning, hands-on training in broodstock selection and injection, and competence evaluation through pre-test and post-test assessments.

Implementation Phase Results

The implementation phase was conducted in Talang Balai Baru 1 Village, Tanjung Raja Subdistrict, Ogan Ilir Regency, South Sumatra, during June and July 2025. The program involved 15 farmers from the Balai Makmur Fish Farmers Group (Pokdakan). Broodstock used for spawning were sourced from the wild, acclimatized, and maintained for 15 days. Water quality was monitored daily during this period.

Three spawning trials were conducted using three broodstock pairs. The male and female broodstock used weighed 47.7 grams and 62.5 grams on average, respectively, with a male-to-female ratio of 1:1. Spawning was performed semi-naturally by intramuscular injection of a combination of 0.25 mL/kg Ovaprim and 0.90 mL/kg hCG. After injection, broodstock were placed together in spawning containers for 10 to 13 hours. Eggs were then separated from broodstock to prevent cannibalism and incubated for 1 to 2 days.

Figure 2. Spawning process: a) pond preparation, b) broodstock selection, c) broodstock injection

The following parameters were measured during the implementation phase: fecundity (F), fertilization rate (FR), hatching rate (HR), and survival rate (SR), calculated using formulas from Effendie (2002). Water quality parameters including temperature, pH, dissolved oxygen (DO), and ammonia were measured continuously from broodstock maintenance through larval rearing.

Table 1. Descriptive statistics of spawning parameters for climbing perch fish eggs (*Anabas* testudineus)

Values	N	Min	Max	Mean (%)				St.Dev
				F	FR	HR	SR	
Total gonad weight (grams)	6.22	6.180	6.485	6.326				±153,2
Weight of the gonad sub-section (grams)	1.017							
Fertilized eggs (pieces)	6.238	97,8	99,4		98,6			±0,81
Unfertilized eggs (pieces)	88							
Hatched eggs (pieces)	6.008	95,1	97,5			96,3		±1,20
Post Living larvae (larvae)	5.945	98,6	99,6				99,1	±0,51

Table 2. Water quality of the climbing perch fish larvae rearing pond

Parameters	Range value
pH	6.5 – 8.8
Temperature (°C)	25.8 – 29.4
Ammonia (mg L^{-1})	0.128 – 0.182
Dissolved Oxygen (mg L^{-1})	5.0 – 5.5

Evaluation Phase Results

The evaluation phase assessed both biological outcomes and changes in farmer competence. Biological parameters were measured from the three spawning trials. The mean fecundity was 6,330 eggs (SD ±153). The mean fertilization rate was 98.6% (SD ±0.81), the mean hatching rate was 96.3% (SD ±1.20), and the mean survival rate was 99.1% (SD ±0.51). Water quality remained within stable ranges throughout the rearing period.

Farmer competence was evaluated using a pre-test and post-test questionnaire administered to the 15 participating farmers. The pre-test was conducted before the training and hands-on practice, and the post-test was conducted after the completion of the implementation phase. The assessment covered four aspects: selection of high-quality climbing perch seed, appropriate and quality feeding practices, water quality management, and daily maintenance and monitoring techniques.

Table 3. Improvement of Farmers Competence in Climbing Perch (*Anabas testudineus*) Aquaculture Based on Pre-test and Post-test Results

Assessed Aspect	Pre-test (%)	Post-test (%)	Improvement (%)
Selection of high-quality climbing perch seed	25	60	+35
Appropriate and quality feeding practices	30	65	+35
Water quality management	20	55	+35
Daily maintenance and monitoring techniques	28	62	+34
Average participants' competence	25.8	60.5	+34.7

Figure 3. Active participation and dedication with all team members who contributed to the successful implementation of this activity

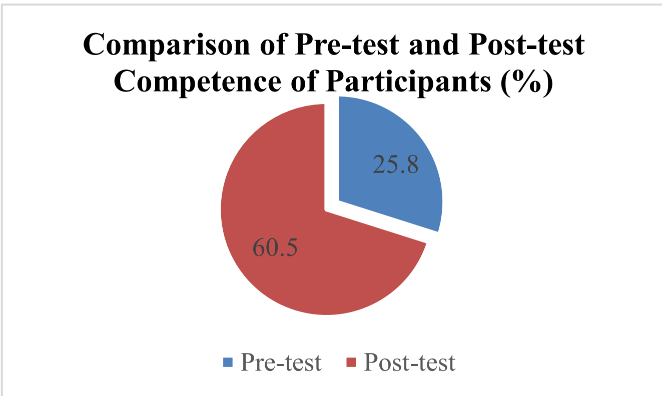

Figure 4. Comparison of Pre-test and Post-test Competence of Participants (%)

In addition to biological and competence outcomes, the program documented institutional changes. Three trained farmers began mentoring five other members of the farming group. A community-managed "Seed Fund" was established using proceeds from initial fry sales, with a documented balance of IDR 500,000 at the end of the program period. The Pokdakan Balai Makmur Fish Farmers Group documented the production of approximately 5,945 larvae that survived to the post-larval stage from the three spawning trials combined.

Discussion

The application of semi-natural spawning techniques using a combination of Ovaprim and hCG hormones produced excellent biological outcomes, with average fecundity reaching 6,330 eggs per female broodstock. This result is notably higher than the 3,775 eggs reported by Rosita et al. (2019) using only Ovaprim on broodstock weighing 57–82 g, and falls within the upper range of natural spawning fecundity (253–13,398 eggs) observed by Hasnidar et al. (2022) in Lake Tempe, South Sulawesi. The high fecundity in this program suggests good broodstock quality, and the administration of Ovaprim and hCG likely played a significant role in stimulating egg maturation and ovulation, as both hormones increase gonadotropin concentration and secretion time, which subsequently affects the ovulation cycle and egg performance (Darmawi, 2011; Leonita et al., 2021). Beyond fecundity, the program achieved a fertilization rate (FR) of 98.6% (SD ±0.81), a hatching rate (HR) of 96.3% (SD ±1.20), and a survival rate (SR) of 99.1% (SD ±0.51), all of which exceed previous studies using natural spawning or different hormonal extracts (Ghofur et al., 2024). From a technical perspective, the synergy between Ovaprim, which stimulates gonadotropin production, and hCG, which accelerates oocyte maturation through its high luteinizing hormone (LH) content, proved highly effective for climbing perch (Anabas testudineus). However, these biological yields were not merely isolated technical successes; they were deeply connected to proper water quality management and feeding practices. Throughout the program, water quality parameters remained within suitable ranges (pH 6.5–8.8, temperature 25.8–29.4°C, dissolved oxygen 5.0–5.5 mg/L, and ammonia 0.128–0.182 mg/L), consistent with the optimal conditions identified by Rahmi et al. (2016) and Pebriyanti et al. (2015). In addition, natural feeds such as Artemia sp. and Tubifex sp. (silkworms) were provided to larvae after yolk sac depletion, which is known to support optimal growth and development (Burmansyah et al., 2013; Pebriyanti et al., 2015).

Beyond these biological parameters, the program achieved significant improvements in farmer competence, with the average score increasing from 25.8% (SD ±8.2) in the pre-test to 60.5% (SD ±7.4) in the post-test, a statistically significant gain of 34.7 percentage points (paired t-test, $t(14) = 9.84$, $p < 0.001$). This finding aligns with Adult Learning Theory (Andragogy), which states that adult learning is most effective when it is task-oriented and builds on participants' prior experience (Haerudin et al., 2025). By involving Pokdakan members in every stage—from intramuscular hormone injection to monitoring egg hatching at 19 hours and 30 minutes—the program facilitated deep internalization of Good Fish Farming Practices (CBIB). The emergence of local leadership further demonstrates social transformation: three trained farmers now mentor five other members, and a community-managed "Seed Fund" (currently IDR 500,000) has been established to procure hormones independently. This stands in contrast to conventional extension models that focus solely on technology transfer without a participatory framework (Sulistiyani et al., 2016). The Participatory Action Research (PAR) approach used in this program allowed farmers to become active researchers in their own ponds, increasing their sense of ownership and program sustainability. Empowerment in this context is defined as the community's increased bargaining power and independence from external fry supplies, and the competence improvements in seed selection (+35%), feeding practices (+35%), and water quality management (+35%) demonstrate that farmers are now better equipped to manage their own hatchery operations.

Despite these successes, several methodological limitations must be acknowledged. The spawning trials were conducted using only three broodstock pairs, and although the results were consistent across trials (as reflected in low standard deviations), the small sample size limits generalizability to broader populations. Furthermore, there was no control group in the competence assessment, making the pre-post test design susceptible to testing effects (participants remembering answers from the pre-test) and maturation effects (natural improvement over time). The program duration was only two months, which is insufficient to assess long-term sustainability, and income data were not collected before or after the intervention. While the program successfully increased fry production capacity, claims about income enhancement remain potential rather than empirical. Additionally, the same team delivered the training and evaluated the outcomes, with no blinding, which may introduce experimenter bias. Future programs should address these limitations by using at least five broodstock pairs with replication across multiple spawning cycles, including a control group in competence assessments, measuring income before and after the intervention using standardized household economic surveys, and conducting 12-month follow-up evaluations to assess long-term sustainability of both biological and social outcomes. The establishment of a farmer cooperative for collective hormone procurement and the extension of training to additional farmer groups in Tanjung Raja Subdistrict would also help scale up the program's impact. In conclusion, this program demonstrates that integrating hormonal spawning technology with participatory training (PAR) is more effective for long-term community empowerment than technology transfer alone, providing a replicable model for community-based aquaculture empowerment in similar rural contexts. However, future research should employ more rigorous experimental designs, such as staggered intervention or matched control groups, to isolate the causal effect of the PAR approach from other confounding factors.

Conclusion

The application of semi-natural spawning techniques successfully increased both biological yields and community competence. The trials demonstrated effective semi-natural breeding, resulting in 6,238 fertilized eggs out of a total of 6,326 eggs, driven by successful water and feed quality management. Theoretically, this project demonstrates that technology-driven empowerment is most effective when paired with a participatory social framework. The activity has demonstrated its potential to enhance the farming communities income by providing knowledge, technologies, and competence in terms of farming practices. To ensure sustainability, Pokdakan Balai Makmur has established a "Seed Fund" from initial sales to purchase future hormones independently, ensuring the program continues beyond the university funding cycle.

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Conflicts of Interest

The authors declare that there is no conflict of interest related to this manuscript.

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