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# An Observation-Based Study of Silver Pomfret (*Trachinotus blochii*) Hatchery Practices at Lombok Marine Aquaculture Center

Ihsan Sanggar Rahman

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**Keywords:** Keyword: Breeding practice, Sustainable aquaculture, Water quality control, Seed production .

**Abstract:** Abstract This observation-based study evaluates the seed production practices of Silver Pomfret (*Trachinotus blochii*) at the Lombok Marine Aquaculture Center (BPBL Lombok), West Nusa Tenggara, Indonesia. BPBL Lombok is a key facility for marine aquaculture, focusing on breeding species such as the star snapper in an environment with optimal water quality and well-equipped facilities. The study investigates broodstock management, including hormonal induction for spawning, and the growth and grading processes of fry at various developmental stages. Stocking densities were adjusted based on size, and water quality parameters were closely monitored to ensure the survival and growth of the fry. The study also examines the impact of feed management, gonad maturation, and water quality control on the survival rate (SR) of *T. blochii* fry, with the results indicating a typical SR of 50%, with optimal management. The findings contribute valuable insights for improving Silver Pomfret breeding practices and highlight the importance of sustainable aquaculture techniques for the development of marine fish farming in Indonesia.

## Introduction

Aquaculture plays a crucial role in increasing fish production, particularly for economically significant species, and provides a sustainable solution as wild fish stocks continue to decline (1). The sector is expected to grow at an annual rate of 4.9%, driven by government efforts to expand aquaculture zones. This growth is in response to rising global demand and Indonesia's potential for further development. The expansion of aquaculture is anticipated to boost the national economy, increase income for fishers and farmers, and create job opportunities (2).

One promising species for development in aquaculture is Silver Pomfret. Silver Pomfret (*Trachinotus blochii* or *T. blochii*) is widely farmed due to its rapid growth, good feeding habits, and resistance to diseases (3). According to Hasan M. M. (2023), the demand for Silver Pomfret is high, and its market price is favorable, making it a viable and promising commodity (4). To produce high-quality seeds that grow quickly and have low mortality rates, knowledge of Silver Pomfret biology is essential. This includes selecting suitable locations, providing adequate infrastructure and feed, managing natural feed cultures, ensuring egg production, and overseeing larval rearing while preventing pests and diseases. Silver Pomfret is an omnivorous, non-predatory fish, which reduces the risk of cannibalism during farming, resulting in a relatively high survival rate (SR) (5).

The Marine Aquaculture Fisheries Center in Lampung (BBPBL) has successfully developed a pilot project for Silver Pomfret farming, yielding approximately 28 tons (6). However, common challenges in Silver Pomfret farming include low egg hatchability, poor larval survival, and difficulties in maximizing broodstock for spawning. Therefore, studies on hatchery techniques are needed to improve the availability of high-quality seeds for farmers. This study aims to evaluate the hatchery performance of Silver Pomfret by analyzing egg fertilization rates, egg hatching success, and larval survival.

# Methodology

## Observation and Interview

The research was conducted from March 1st to March 30th, 2024. Observations and interviews were carried out to assess key aspects of *T. blochii* cultivation. The main facility was inspected to ensure proper environmental conditions. Fry size (cm) and stocking density (fish/m³) were measured regularly. Gonad maturation was observed through visual inspection and imaging techniques, with confirmation from interviews with technicians who documented the stages of gonad development and actions taken.

## Spawning Induction of Broodstock

Broodstock of *T. blochii* were induced to spawn using Human Chorionic Gonadotropin (HCG) injections. The injection was administered on the back of the fish at a 45° angle, pointing towards the head. Initial responses, such as abdominal swelling, appeared within 24 h. If spawning did not occur, a second injection at double the dose was applied. HCG was dosed at 1 mL/kg of fish weight, and fish were anesthetized with clove oil before the injection. Clove oil is an effective anesthetic for stunning fish, with an average unconsciousness time ranging from 60 min to 250 min.

HCG plays a role in oocyte maturation in fish. Additionally, it is more effective when given in combination with ovaprim to stimulate ovulation, as ovaprim contains gonadotropin-releasing hormone (GnRH) and anti-dopamine (domperidone). The GnRH and domperidone content in ovaprim allows it to work more effectively as an ovulation induction hormone. Clove oil, obtained from the steam distillation of flowers, leaves, and stems of clove trees, has a specific gravity of 1.038 - 1.063 at 20°C and contains 16 - 21% essential oil. The main compound, eugenol (70 - 90%), is responsible for its active properties, while acetyl eugenol (2 - 17%) and sugeiterpene (15 - 12%) are also present. The aromatic, sweet odor and sharp, spicy taste are due to the eugenol content, which can be used as a local anesthetic. This makes clove oil a powerful anesthetic, as fish anesthetized with this compound can be handled easily within 6 min or less.

Observations showed that the higher the dose of clove oil administered, the longer the recovery time. Andrzej S. (1984) noted that a compound is considered an anesthetic if it produces a reversible effect on the central nervous system. Recovery is indicated by the fish's ability to regain normal function (7).

## Estimating Fertilized and Hatched Egg Counts

To measure the average sample count, fertilized eggs, and hatched eggs in the cultivation of *T. blochii*, sampling was conducted at five different points in the egg collection tank using a 30 mL measuring cup. Fertilized eggs were transparent and floated, while unfertilized eggs appeared opaque white and sank, allowing separation through siphoning. The average sample count was calculated based on the egg quantities at the five sampling points and was used to estimate the total egg count. To calculate the total egg count, Fertilization Rate (FR), and Hatching Rate (HR), **Equations 1**, **2**, and **3** were used, respectively (8).

## Grading of Silver Pomfret Fry

To assess the growth of T. blochii fry, they were grouped into three size categories: large, medium, and small. Sampling was conducted weekly, starting on Day 22 (D22) when the fry were first transferred to the nursery. During each sampling, the fry's length was measured using a ruler for grading, and they were sorted by size. Tools such as baskets, bowls, sieves, and strainers were prepared in the rearing tanks. The fry were harvested once they reached a size of 3–5 cm, which meets consumer demand. Before packaging, the fry underwent a fasting period of 12–24 h, depending on the transportation distance. The harvested fry were graded by size to assess the stock and calculate the Survival Rate (SR) using Equation 4.

$$Total\ eggs = \frac{Average\ sample\ count}{Sample\ volume} \times Hatching\ tank\ volume \times 1000$$ **Equation 1**

$$FR = \frac{Number\ of\ fertilized\ eggs}{Total\ eggs\ count} \times 100\%$$ **Equation 2**

$$HR = \frac{Number\ of\ hatched\ eggs}{Number\ of\ fertilized\ eggs} \times 100\%$$ **Equation 3**

$$SR = \frac{Nt}{N0} \times 100\%$$ **Equation 4**

Nt represents the number of surviving fish at the end of the period and No is the number of fish at the start.

### Water Quality Monitoring

Water quality monitoring involved assessing pH, temperature, dissolved oxygen (DO), and salinity. Measurements were taken periodically to ensure optimal conditions. A pH meter and thermometer were used to measure pH and temperature, while a DO meter and refractometer were used to measure dissolved oxygen and salinity, respectively.

**Table 1.** Aquaculture Facility of The Lombok Marine Aquaculture Center (BPBL Lombok).

| Main Facilities | Size ($m^3$) | Quantity (unit) |
|---|---|---|
| Broodstock pond | 10 | 5 |
| Spawning pond | 18 | 12 |
| Larval pond | 10 | 10 |
| Nursery tank | 4 | 10 |
| Phytoplankton culture container | | |
| · Aquarium | 112 | 15 |
| · Concrete tank | 25.35 | 3 |
| Zooplankton culture container | | |
| · Fiber tank | 0.5 | 2 |
| · Concrete tank | 10 | 4 |
| Natural feed laboratory | - | 2 |
| Fish health laboratory | - | 1 |

## Result and Discussion

The Lombok Marine Aquaculture Center (BPBL Lombok) is strategically located in 7X67+CX Sekotong Barat, West Lombok Regency, West Nusa Tenggara, Indonesia. This research was conducted on March 1st - March 30th, 2024, This facility focuses on breeding marine species, particularly the star snapper (*Trachinotus blochii*), in an area with excellent water quality and well-supported by complete facilities for aquaculture activities (see **Table 1**). Established in 1994, the center operates under the Directorate General of Aquaculture and is responsible for marine fish farming in Java, Bali, Kalimantan, NTB, and NTT. Currently, the center is developing several commodities, including pearl oysters (*Pinctada maxima*), star snapper, groupers (*Cramileptes altivelis, Ephinephelus fuscoguttatus*), abalones (*Haliotis asinine*), lobsters (*Panulirus* sp.), and seaweed (*Eucheuma cottonii, E. spinosum*). The center's location, surrounded by small islands (see **Figure 1**), helps protect the breeding areas from strong waves and winds, making it an ideal site for fish breeding activities.

### Broodstock Maintenance and Gonadal Maturation

Broodstock selection for breeding is based on external characteristics, including gonad maturity and overall condition (9). Male broodstock are typically slimmer and smaller, weighing less than 2 kg, while females are larger, bulkier, and exhibit clear urogenital swelling, with a body weight exceeding 2 kg (see **Figure 2**). The selected broodstock included 10 males and 5 females. Healthy female broodstock display bright coloration, clear eyes, and active swimming behavior. To assess gonad maturity, BPBL Lombok employs the canulation method, which involves extracting eggs or sperm from the gonads using a catheter. The fish are anesthetized with clove oil to minimize stress during the procedure. Canulation enables the evaluation of gonad development, ensuring the optimal timing for spawning and successful breeding (10).

### Spawning

The star pomfret broodstock at BPBL Lombok spawn naturally, with spawning conducted en masse. The broodstock are maintained at a 2:1 ratio, consisting of 20 males and 10 females broodstock. According to Mustahal et al. (2020), a similar spawning ratio of 2:1 was applied, involving 12 males and 6 females, with female broodstock weighing 3–4 kg and males weighing 2–3 kg (11). Environmental manipulation was used to enhance spawning by creating temporary conditions that mimic natural cues.

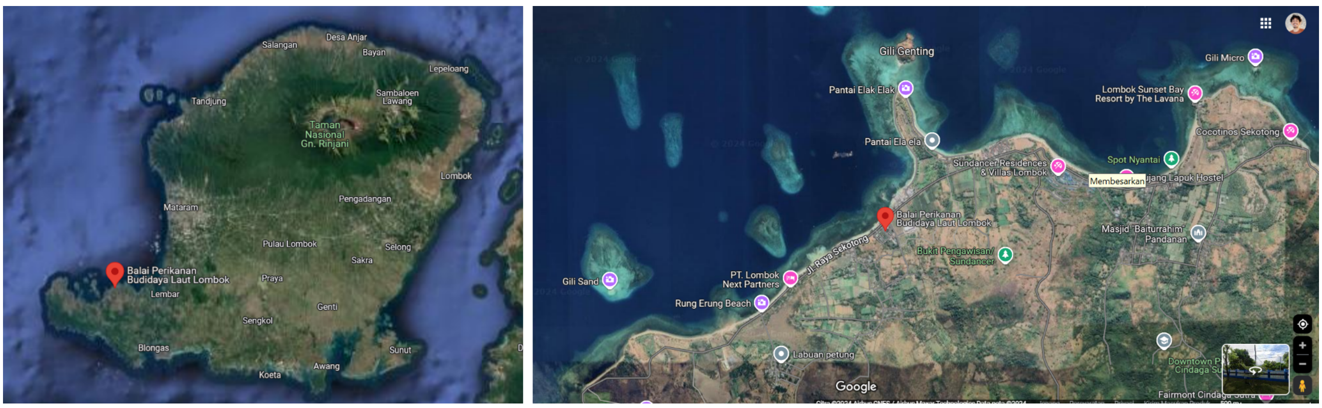


**Figure 1.** Lombok Marine Aquaculture Center Location (source: google map, 2024).

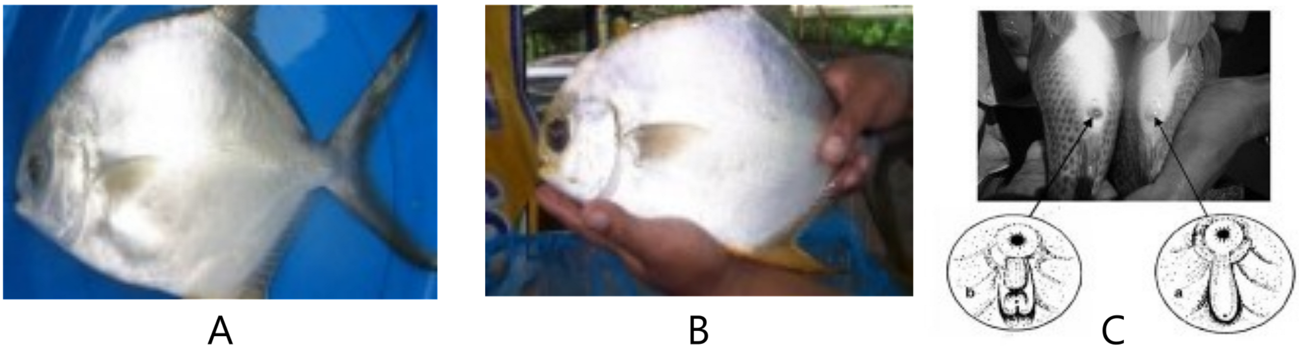


**Figure 2.** Image of (A) male silver pomfret, (B) female silver pomfret, and (C) their primary sexual characteristics.

## Egg Handling

A total of 62,400 eggs were obtained, with a fertilization rate of 74.36%, resulting in 46,400 fertilized eggs. The hatching rate was 74.78%, producing 34,698 hatched larvae. The relatively high total egg count compared to the previous period was attributed to the broodstock's readiness (12). Fertilized eggs are characterized by a clear and transparent appearance, as the oolemma remains intact, making the perivitelline cavity visible. In contrast, unfertilized eggs turn pale white and die (13). FR *(fertilization rate)* is the degree of egg fertilization expressed in percent. This FR can be calculated by first calculating the number of fertilized eggs, the method is the same as calculating the total number of eggs, namely by doing 5 side-by-sides in different places, then the results are averaged and multiplied by the volume of the tub used to accommodate the eggs, before calculating the number of fertilized eggs we must separate the fertilized eggs from the unfertilized ones using a siphon, the eggs at the bottom will be siphoned and only the fertilized eggs remain.

**Table 2.** Measurement result of eggs handling.

| Measurement | Number |
|---|---|
| Sample volume | 0.03 L |
| Hatching container volume | 10 L |
| Sample egg average | 187.2 eggs |
| Number of fertilized eggs | 46,400 eggs |
| Number of hatched eggs | 34,698 eggs |

## Seed Stocking

The stocking density of *T. blochii* fry was carefully adjusted based on size to optimize growth and minimize mortality in the nursery tanks. For smaller fry, between 1–2 cm in length, a higher stocking density of 1000–1750 fish per cubic meter was maintained. As the fry grew to larger sizes, the density was gradually reduced to account for their increasing need for space and resources. For example, at 3.5–4 cm, the density was reduced to 500–750 fish per cubic meter, and by 7–8 cm, it was further reduced to 200–250 fish per cubic meter (see **Table 3**).

**Table 3.** Size and stocking density of silver pomfret (*T. blochii*).

| No. | Stocking Size (cm) | Stocking Density (fish/m³) |
|---|---|---|
| 1. | 1 - 2 | 1000-1750 |
| 2. | 2.5 - 3 | 750-1000 |
| 3. | 3.5 - 4 | 500- 750 |
| 4. | 4.5 - 5 | 400- 500 |
| 5. | 5.5 - 6.5 | 250- 350 |
| 6. | 7 - 8 | 200-250 |

Adjusting the stocking density is essential, as *T. blochii* fry are active swimmers that require adequate space, dissolved oxygen, and access to feed to prevent stress and promote uniform growth (14). High stocking densities can lead to competition for food and limited movement, potentially stunting growth and increasing mortality due to poor water quality and waste buildup. Properly matching the stocking density to the size of the fry, along with regular grading and tank cleaning, ensures a balanced environment that supports the health and survival of *T. blochii* fry throughout the rearing cycle (15).

**Table 4.** The growth of silver pomfret (*T. blochii*).

| Sampling Time | Fry Length |
|---|---|
| D-1 | 2.50 mm |
| D-4 | 2.79 mm |
| D-7 | 4.51 mm |
| D-10 | 5.16 mm |
| D-13 | 7.78 mm |
| D-16 | 10.1 mm |
| D-19 | 13.6 mm |
| D-22 | 19.1 mm |
| D-25 | 20.3 mm |

The growth of *T. blochi* fry at BPBL Lombok was monitored every three days over a one-month cycle, with the fry being prepared for transfer to the next stage in the nursery pond. Growth was influenced by the quality of both the feed provided and the water conditions, which were critical for the larvae's development. As shown in **Table 4**, the fry's length increased steadily throughout the sampling period. Starting at 2.50 mm on day 1, the fry reached 5.16 mm by day 10, and grew to 20.3 mm by day 25. This steady growth indicated favorable rearing conditions, including proper feeding and water management, which were essential for supporting the healthy development of *T. blochii* fry (15).

## Grading

At the beginning of the rearing process, three separate tanks were used, each containing fry of different sizes. By Day 41 (D41), the fry were graded again and placed into six separate tanks to provide more space as their size increased (see **Table 5**). This grading process was essential for removing defective or non-marketable fry and standardizing the size of the remaining fish. Grading enhanced the survival rate by preventing cannibalism and reducing competition for food, particularly under high stocking density. It also minimized disease transmission, facilitated easier size-based harvesting, and ensured the fry were of uniform size (16), meeting market demands.

**Table 5.** Sampling and grading of *T. blochii*.

| No. | Size | Length (cm) | Weight (g) | Fry Age |
|---|---|---|---|---|
| 1 | Large | 1.6 | 0.08 | D22 |
| | Medium | 1.2 | 0.05 | |
| | Small | 0.8 | 0.03 | |
| 2 | Large | 2.8 | 1.3 | D29 |
| | Medium | 2.2 | 0.8 | |
| | Small | 1.6 | 0.3 | |
| 3 | Large | 3.6 | 1.9 | D36 |
| | Medium | 2.9 | 1.1 | |
| | Small | 2.4 | 0.6 | |
| 4 | Large | 4.8 | 2.3 | D43 |
| | Medium | 3.9 | 1.9 | |
| | Small | 2.8 | 1.3 | |
| 5 | Large | 5.3 | 3.1 | D50 |
| | Medium | 4.5 | 2.4 | |
| | Small | 3.3 | 1.8 | |

During the larval rearing and nursery stages, a flow-through water system was maintained continuously for 24 h to keep the tank clean and maintain dissolved oxygen (DO) levels. To ensure good water quality, the tank's bottom was siphoned twice daily to remove leftover feed and waste. After siphoning, the outlet valve was opened to fully exchange the water, which was then scrubbed to prevent blockages caused by dirty water. Once the water was fully replaced, the outlet was closed, and the clean water level was restored.

**Table 6.** Water quality of *T. blochii* aquaculture pond.

| No. | Parameter | Result | Standard (17) |
|---|---|---|---|
| 1 | Temperature (°C) | 29-31 | 28-32 |
| 2 | Dissolved Oxygen (ppm) | 4.5-5.0 | ≥5.0 |
| 3 | Salinity (ppt) | 30-32 | 29 - 32 |
| 4 | pH | 7.5-8.2 | 6.8 - 8.4 |

To prevent mass mortality and maintain optimal water conditions, regular monitoring of water quality is essential. At BPBL Lombok, water samples were brought to the laboratory every week to measure key water quality parameters such as temperature, pH, DO, and salinity, using tools like a pH pen, DO meter, and refractometer. **Table 6** shows the standard reference and the results of measurements from BPBL Lombok (17). Comparing the measured values with the optimal ranges, it is evident that the water quality in the rearing tanks was within the ideal range, supporting the survival and growth of the fish.

**Table 7.** Number of seeds sown and harvested.

| Size (cm) | Quantity (larvae) | Quantity (fish) |
|---|---|---|
| 5 | 15,200 | 7,600 |
| 4 | 10,800 | 5,400 |
| 3 | 9,000 | 4,500 |
| Defective | 250 | 350 |
| Total | 35,250 | 17,850 |

Survival Rate (SR) is an essential parameter in aquaculture, indicating the percentage of fish that successfully survive throughout the cultivation process (18). In the case of *T. blochii*, the survival rates generally 50% per rearing cycle (based on **Table 7**). highlighting the impact of proper care and environmental conditions on fish health and survival during cultivation.

# Conclusion

The evaluation of Silver Pomfret seed production at BPBL Lombok reveals that effective broodstock management, careful monitoring of water quality, and proper grading and stocking densities are crucial for successful fry production. The study demonstrates that hormonal induction and appropriate feed, such as Spirulina, play significant roles in gonad maturation and reproductive success. The center has achieved a consistent survival rate of 50%, which is calculated to determine the survival rate of larvae during maintenance. The high and low mortality rates of the larvae are influenced by environmental factors and the level of cannibalism among the fish, with potential for improvement through enhanced management practices. This research underscores the importance of sustainable aquaculture practices in supporting the growth of Indonesia's marine fish farming industry and offers valuable recommendations for optimizing seed production processes in similar facilities.

# Declarations

## Author Informations

**Ihsan Sanggar Rahman**
*Affiliation:* Kupang State Agricultural Polytechnic.
*Contribution:* Writing - Original Draft.

## Conflict of Interest

The author declares no conflicting interest.

## Data Availability

The unpublished data is available upon request to the corresponding author.

## Ethics Statement

Not applicable.

## Funding Information

Not applicable.

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