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Assessing the performance of hatchery-produced mola (*Amblypharyngodon mola*) seed in homestead carp polyculture ponds

Odisha, India

WorldFish

CGIAR

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DEUTSCHE ZUSAMMENARBEIT

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Front cover, pages 7, 9, Rashmi Ranjan Das/WorldFish; pages 2, 3, 5, 11, 12, 18, Sourabh Kumar Dubey/WorldFish.

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List of acronyms

BMZ	German Federal Ministry for Economic Cooperation and Development
GnRH	Gonadotropin hormone-releasing hormone
GP	Gram Panchayat
IIPS	International Institute for Population Sciences
INR	Indian Rupee
PUFA	Polyunsaturated fatty acids
SIS	Small indigenous fish species
STATA	Statistical software for data science

1. Executive summary

Undernutrition remains a critical developmental challenge in India, particularly affecting childhood and maternal malnutrition. Micronutrient deficiencies, notably in vitamins A and D, iron, iodine, and zinc, persist, necessitating urgent and effective interventions. Small Indigenous Fish Species (SIS), regarded as natural 'superfoods,' offer a promising avenue for improving nutrition, with a focus on introducing mola (*Amblypharyngodon mola*) into conventional carp polyculture.

WorldFish is implementing the "Taking Nutrition-Sensitive Carp-SIS Polyculture Technology to Scale" project in India (2021-2024), supported by the German Federal Ministry for Economic Cooperation and Development (BMZ). A breakthrough in 2022 involved developing a technical protocol for hatchery-based induced breeding and mass seed production of nutrient-dense SIS mola, addressing challenges faced by initiatives promoting nutrition-sensitive aquaculture. Subsequently, partner hatchery started selling hatchery-produced mola seeds in 2022.

A systematic data collection process captured essential information about mola seed buyer farmers at procurement, followed by a comprehensive follow-up survey in 2023. A structured questionnaire explored various aspects, including pond characteristics, seed information, production, income, and consumption. Rigorous ethical standards were maintained throughout, ensuring informed consent and reliable data.

Key findings:

- Mola seeds were introduced for sale in Odisha, targeting six blocks and 21 villages. The majority of buyers were male, averaging 46 years, and underwent farm-gate training.
- Pond size averaged 0.32 ha, with approximately 50% ranging from 0.1 to 0.5 ha. The average distance from ponds to the hatchery was 18.86 km, with 48% located within a 10-kilometer (km) radius.
- 24% of seed buyers purchased mola hatchlings or spawns, and 76% opted for mola fry. The hatchery sold 1.23 million seeds, generating a revenue of 40,250 INR. Seed prices varied, with an average of 1176 INR per 1 lakh for mola spawn and 300 INR per thousand for mola fry.
- Farmers stocked mola spawn at 2,83,583 numbers/ha, while mola fry were stocked at 22,190 numbers/ha. The average culture duration was 9 months which allowed breeding of stocks in the pond with several partial harvests.
- Mola production averaged 194 kg/ha, contributing 9% to total fish production. Farmers earned an average of 19,681 INR/ha from mola sales.
- Each household consumed an average of 14 kg of mola, with a per capita consumption of 3.04 kg/year.
- Pond size showed a significant positive correlation with mola production, income, and consumption. Increasing stock density positively influenced sales and production per hectare. Culture duration had a significant positive effect on household-level consumption.

The findings underscore the potential of hatchery-produced mola seed in promoting nutrition-sensitive aquaculture in Odisha. Increasing the pond size and optimizing stock density emerge as crucial factors positively impacting mola production and income. The study provides valuable insights for the wider promotion of mola as a farmed species, contributing to the ongoing efforts to address undernutrition in India.

Glimpses of hatchery-produced mola seed sale for the first time in India from the project's partner hatchery at Odisha


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Polyculture Technology to Scale

2. Introduction

Undernutrition poses a formidable developmental challenge for India, demanding urgent attention. Recent data from the National Family Health Survey underscores the gravity of childhood malnutrition, revealing that 36% of Indian children are stunted, and 32% are underweight (IIPS-ICF, 2021). Micronutrient deficiencies, particularly in vitamins A and D, iron, iodine, and zinc, are pervasive in the region. Addressing this issue requires effective food-based interventions that improve dietary quality, encourage diverse nutrient-rich food consumption, and boost overall energy and macronutrient intake.

Small indigenous fish species (SIS) from freshwater ecosystems play a crucial role in the diets of many fish-dependent populations in South Asia. Recognized as natural 'superfoods,' SIS are prized for their abundant protein, fatty acids, vitamins, and minerals. SIS also present nutritional advantages as they are often consumed in their entirety, encompassing the head, bones, and eyes, thereby utilizing all the available nutrients, including micronutrients.

Over the past decade, the integration of SIS into conventional carp polyculture has been promoted as a promising innovation that can significantly enhance the intake of micronutrients among farming households. The focus of this promotion has been on introducing mola (*Amblypharyngodon mola*), a species that contains higher levels of micronutrients compared to commonly farmed fish such as carps and tilapia. Mola is a valuable source of essential nutrients, including calcium, iron, vitamin A, and vitamin B12. 100 g of the edible portion of mola contains 2503 µg of Vitamin A (Bogard et al. 2015). Additionally, mola is rich in essential amino acids, omega-3 PUFAs, and lipids, while having a protein content comparable to most carps (Bogard et al. 2015; Mustafa et al. 2015).

WorldFish has played a pivotal role in promoting nutrition-sensitive carp-mola polyculture across South Asian countries, yielding significant quantities of mola without compromising carp yields (Ali et al. 2016; Roos et al. 2003; Roos et al. 2007; Milstein et al. 2009; Wahab et al. 2003). Subsequent research has demonstrated that incorporating mola into carp polyculture systems can increase the consumption of micronutrient-rich mola by women and children (Castine et al. 2017; Karim et al. 2017). Moreover, this approach has proven to be cost-effective in addressing the problem of micronutrient malnutrition (Fiedler et al. 2016).

However, unlike mainstream aquaculture practices relying on hatchery-produced fish seed, these initiatives have faced challenges due to the lack of reliable techniques for mass mola seed production. To address this bottleneck, WorldFish is executing the "Taking Nutrition-Sensitive Carp-SIS Polyculture Technology to Scale" project in India (2021-2024), supported by the German Federal Ministry for Economic Cooperation and Development (BMZ). A central goal is to develop scalable methodologies for mass seed production of crucial SIS through hatchery-based breeding approaches.

In 2022, WorldFish achieved a breakthrough by developing the technical protocol for hatchery-based induced breeding and mass seed production of mola at the project's partner hatchery situated in Tulunga village, Tirtol block, Jagatsinghpur district of Odisha (Rajts et al. 2023). This pioneering effort combines hormone administration (Synthetic GnRH analogue) and environmental manipulation to stimulate seed production. To

optimize the breeding performance of mola, a specific hormone dosage was determined. Males were administered 0.25 ml/kg of body weight, while females received 0.5 ml/kg (Gogoi et al. 2023). Specially designed tanks were used for breeding with a double hapa arrangement, and a continuous supply of oxygen-rich water was provided through an aeration tower to enhance breeding performance and larval survival. During 2022, over the 10 breeding cycles, a total of 8.5 million fertilized eggs and 6.4 million spawns were produced (Rajts et al. 2023). The mola spawns were made available for sale within 3-to 4 days of hatching, and a successful nursery-rearing protocol for raising spawn to fry was developed.

Project partner hatchery either sold or distributed mola spawn and fry to carp farmers at regular intervals who had come to purchase carp seed. From July 2022 to December 2022, 30 farmers took mola seeds from the hatchery. We recorded basic details of seed buyer farmers and performed a follow-up survey to understand the production potential of hatchery-produced mola seed in homestead carp polyculture ponds.

This report presents the findings of this follow-up survey and assesses the performance of hatchery-produced mola seed to scale nutrition-sensitive aquaculture. The report is organized into five sections. Section 1 contains the executive summary of the report. Section 2 offers an introduction and background. Section 3 details the survey methodology and data collection framework. Section 4 presents results relating to pond characteristics, information on seeds, production, income and consumption. Section 5 concludes by reviewing the implications of the results for the wider promotion of mola as a farmed species.

Collection of mola spawn for packaging and live transportation.

3. Methodology

3.1 Survey and data collection

The project systematically captures fundamental information about mola seed buyer farmers on the day of procurement. Additionally, a follow-up survey was conducted in 2023, targeting farmers who had completed or were nearing the end of a one-year production cycle. To ensure comprehensive data collection, a structured questionnaire was devised, employing both open- and close-ended explorative questions where applicable. The survey process encompassed the gathering of both qualitative and quantitative data.

The questionnaire underwent meticulous preparation, initially drafted in English and subsequently translated into Odia, the local dialect. This linguistic adaptation aimed to optimize survey results and facilitate better comprehension among local farmers. Pretesting of the survey questionnaires was undertaken to identify any ambiguities or irrelevant queries, with subsequent revisions made iteratively. Throughout the entire survey process, stringent ethical considerations were upheld, ensuring adherence to ethical standards. Informed consent was diligently obtained from participants before the initiation of data collection.

The data collection format was structured to encompass the following comprehensive information:

- Pond size and characteristics
- Quantity of mola seed purchased and corresponding prices
- Harvesting details of mola and other fish
- Mola sale and associated income
- Household consumption of mola

An "in-depth interview with a "recall method" was used during the survey and data collection process. A total of 29 farmers were interviewed during the reporting period. The After the data was collected, all information was tabulated in the Microsoft Excel work package. Basic descriptive statistics combined with qualitative information were extracted from the collated data and have been presented in this report.

3.2 Statistical analysis

To examine the factors influencing the productivity and household consumption of mola, Spearman’s rank correlation analysis was employed. The primary objective was to observe the relationships between a set of explanatory variables, including the age of farmers, household size, pond size, stock density, etc. Additionally, outcome variables such as the quantity of mola and other fish harvested and sold, household consumption, total production, and income were considered. The statistical analysis was done using STATA software version 17.

In this analysis, the null hypothesis posits that as the ranks of one variable increase, the ranks of the other variable are not more likely to increase or decrease. In such a scenario, the Spearman correlation coefficient, denoted as ρ ("rho"), is expected to be 0. If the dependent variable tends to increase as the explanatory variable increases, the Spearman correlation coefficient is positive. Conversely, if the dependent variable tends to decrease as the independent variable increases, the Spearman correlation coefficient is negative. A Spearman correlation of zero signifies no tendency for the dependent variable to either increase or decrease with changes in the independent variable. When the independent and dependent variables are perfectly and monotonically associated, the Spearman correlation coefficient (rho) reaches its maximum value of 1.

In mathematical notation, the Spearman correlation coefficient is written as:

$$\rho = \frac{6\sum d_i^2}{n(n^2-1)} \qquad (1)$$

Where d_i = difference in paired ranks and n = number of cases.

6 weeks old mola fry collected for sale.

4. Results

4.1 General information on seed buyer

- For the first time in the state of Odisha, hatchery-produced mola seeds were introduced for sale. These were intended for stocking in household ponds and Gram Panchayat (GP) tanks across Jagatshingpur, Kendrapara, and Cuttack districts, encompassing 6 blocks and 21 villages. This initiative took place between July and December 2022.
- The majority of mola seed buyers were male (93%). The average age of these farmers was 46 years, ranging from 30 to 62.
- All participating farmers underwent farm-gate training, specifically focusing on seed stocking and adhering to culture guidelines. Additionally, they received training manuals in the local language.

4.2. Information on homestead ponds

- The average size of homestead ponds was 0.32 ± 0.31 ha (ranging from 0.04 to 1.29 ha), in contrast to the GP tanks with an average size of 1 ha.
- Notably, over 50% of the pond size ranged from 0.1 to 0.5 ha (Fig. 1).
- The average distance of the ponds from the hatchery was 18.86 ± 29.70 km (ranging from 2 to 160 km), with approximately 48% of the ponds located within a 10-kilometer radius (Fig. 2).

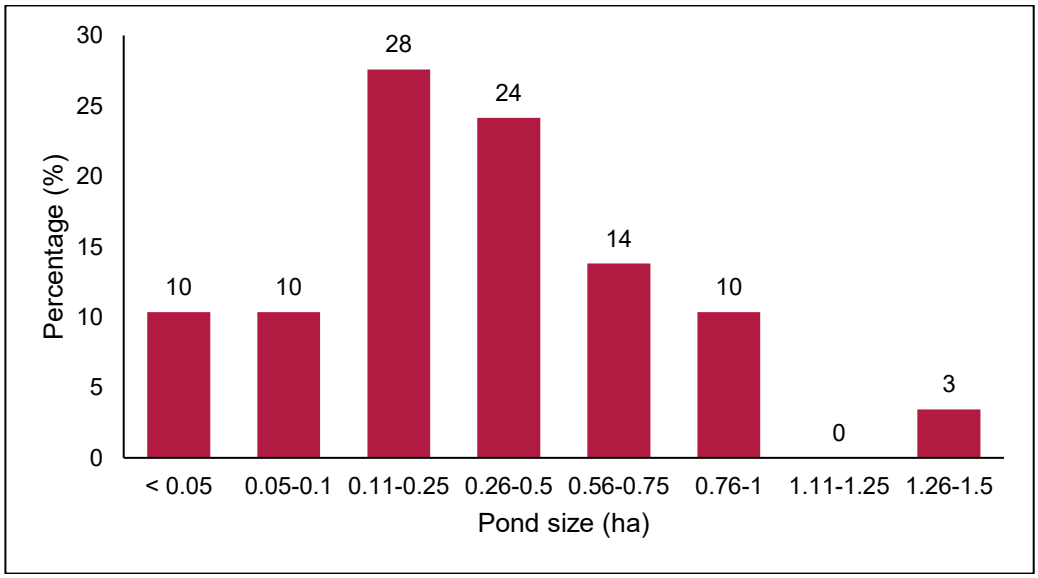

Figure 1. Frequency distribution of sizes of carp-mola polyculture ponds.

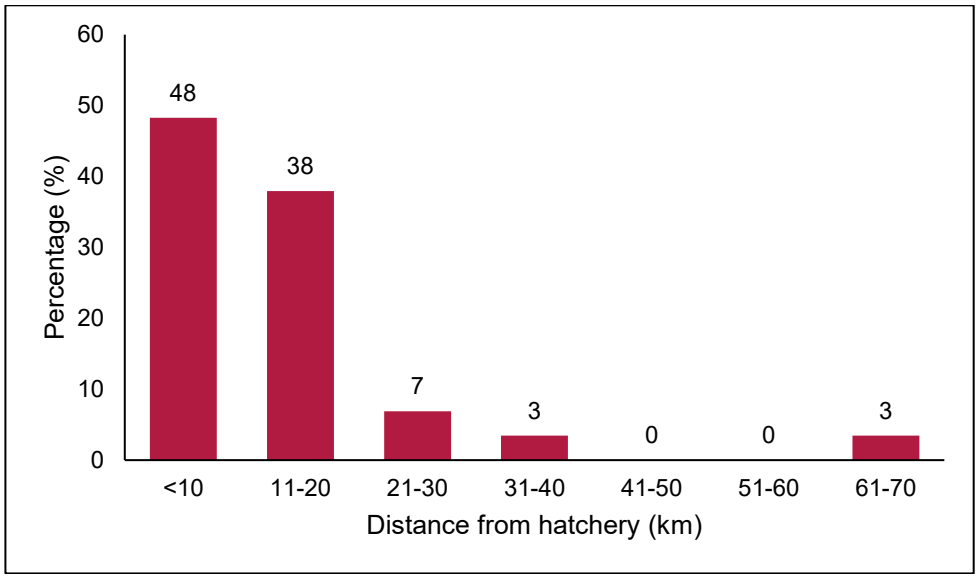

Figure 2. Frequency distribution of distances from hatchery to ponds.

A farmer with his pond stocked with hatchery-produced mola seed.

4.3. Types of mola seed sold and price

- Among the surveyed farmers, 24% purchased mola spawn, and 76% opted for mola fry (1–1.5 inches in size) for stocking. A significant 79% of the ponds were dried before stocking.
- The primary objectives behind mola seed stocking were household consumption and sale; none of the farmers expressed an intention to engage in nursery or seed rearing.
- The partner hatchery sold a total of 1.23 million mola seeds, generating a sales revenue of 40,250 INR (Table 1).
- Mola spawn, on average, was priced at 1176 INR per 1 lakh, while mola fry were sold at an average price of 300 INR per thousand.

Seed types	Farmers purchased (nos.)	Quantity (nos.)	Unit price (INR)	Total amount sold (INR)
Spawn	7	11,30,000	1176.19/ lakh	13800.00
Fry	23	93,500	300.72/ thousand	26450.00
Total	30	1223500	-	40250.00

Table 1. Information on mola seed sale and unit price.

4.4. Packaging and live transport of mola seed

- Mola seeds are transported in a 10-liter polythene bag, filled one-third with water. The empty space above the water is then filled with compressed pure oxygen from a cylinder. The bag is sealed tightly using a jute rope or rubber band to prevent the escape of water and oxygen.
- For protection during long-distance transport and optimal space utilization, oxygen-packed seed bags are placed inside sturdy cardboard boxes or strong plastic bags to prevent damage and heating during transportation. Plastic bags were doubled. The inner bag has 0.05 mm thickness and the outer bag has 0.4 mm thickness.
- Fry were starved and conditioned for two hours prior to transportation.
- The density varies based on travel conditions such as temperature, distance and duration of transportation. The packing density was 500 to 1000 mola fry and 25,000 to 50,000 spawn per seed bag.
- Motorbikes are the preferred transportation method for 80% of farmers (Figure 3).
- Upon arrival at the pond site, mola seeds were acclimatized gradually by adding water from the receiving pond. This adjustment helps to equalize temperature and other water quality parameters before releasing the seeds.

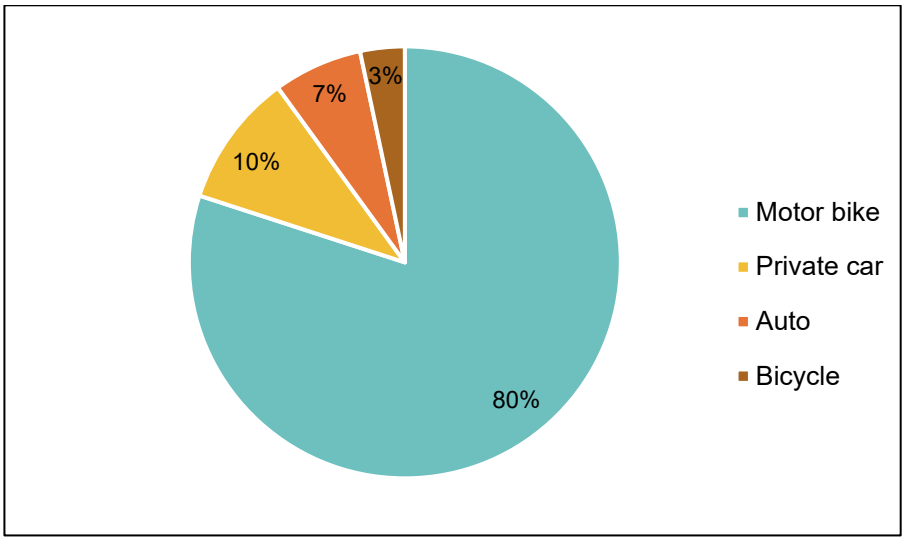

Figure 3. Various modes of transportation of mola seed are adopted by farmers.

Oxygen-packed mola spawn seed bags for transportation

4.5. Seed stocking and culture duration

- Farmers stocked mola spawn at an average density of 2,83,583 numbers/ha, with the majority (29%) opting for a stocking density of 200,001 to 350,000 nos./ha for mola spawn (Table 2 and Fig. 4).
- Mola fry were stocked at an average density of 22,190 numbers/ha, with 55% of farmers choosing a density within 10,000 nos./ha (Table 2 and Fig. 5).
- The average culture duration was 9 months, with 52% of farmers following a cultivation period of 10-11 months (Fig. 6).

Seed Type	Stocking Density (nos./ha)	Pond size (ha)
Spawn	2,83,583 ± 90462 (1,23,553 – 4,11,842)	0.57 ± 0.13 (0.40 - 0.80)
Fry	22,190 ± 22266 (1544 – 76,032)	0.31 ± 0.31 (0.04 - 1.29)

Note: Data is expressed as Mean ± Standard Deviation (SD). Figures within the parentheses indicate the range.

Table 2. Details of mola seed stocking density.

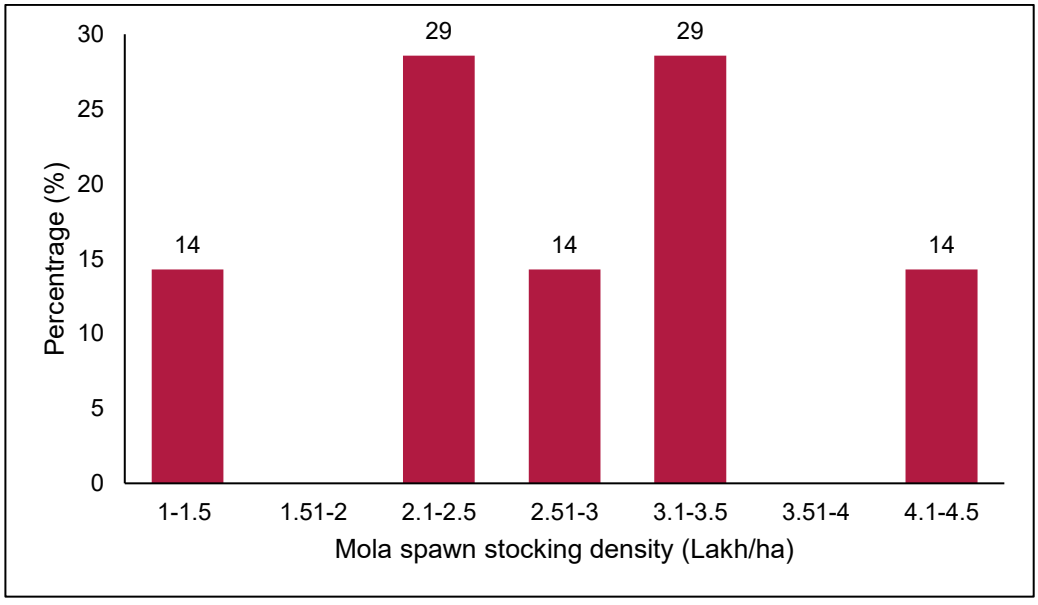

Figure 4. Frequency distribution of stocking density (Lakh/ha) of mola spawn.

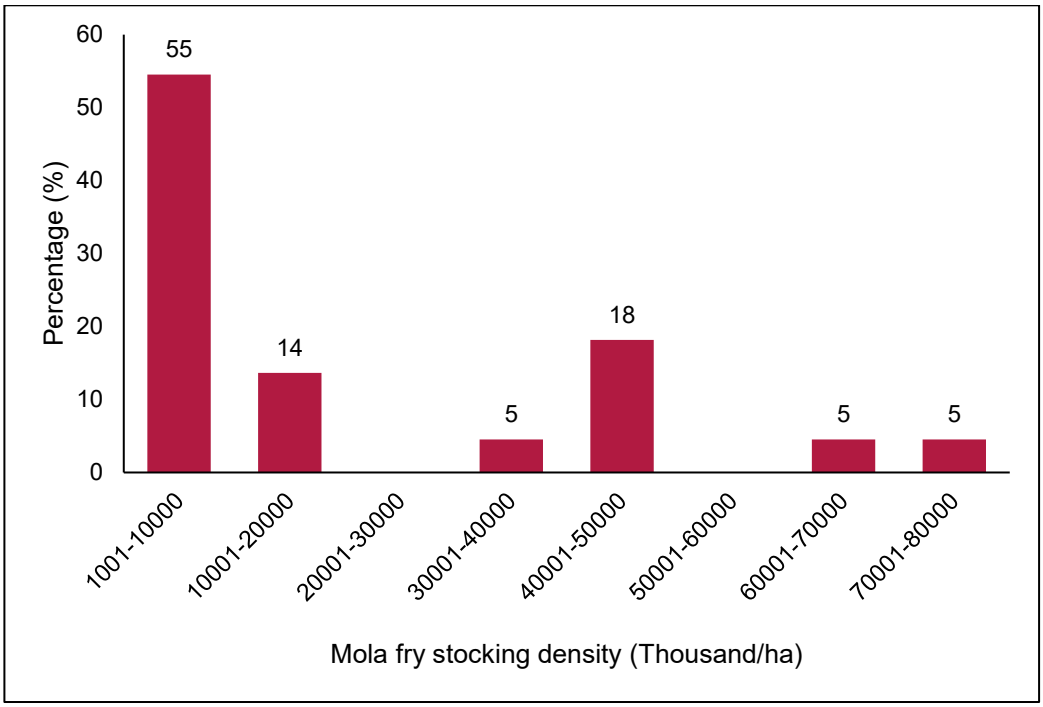

Figure 5. Frequency distribution of stocking density (Thousand/ha) of mola spawn.

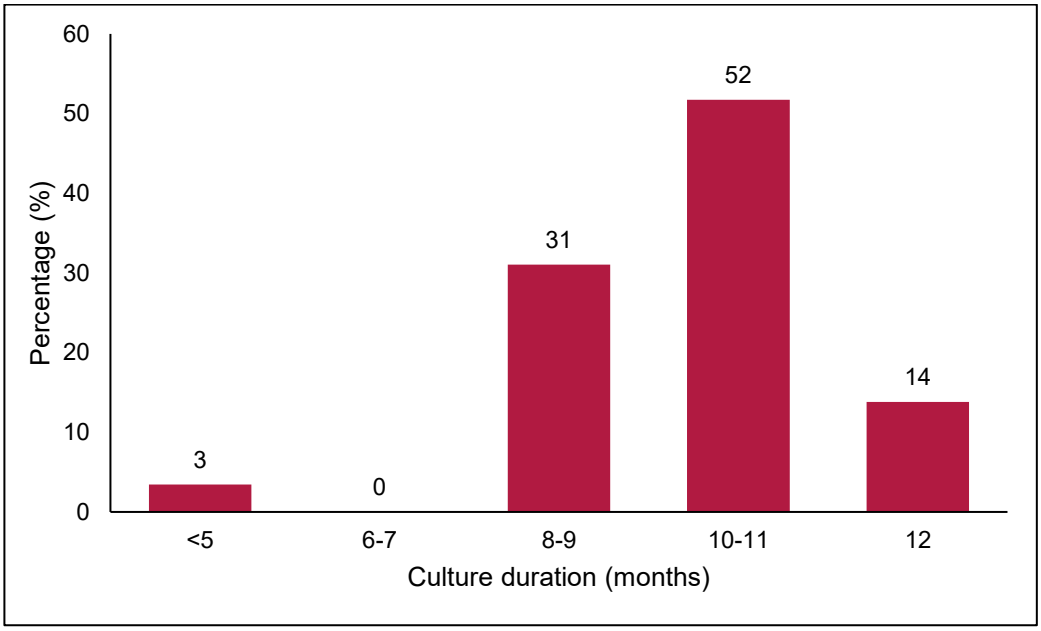

Figure 6. Frequency distribution of culture durations (months) of carp-mola polyculture ponds.

4.6. Production and income

- Mola production commenced within 3-5 months of seed stocking, with 93% of farmers achieving successful mola production through hatchery-produced seed.
- Harvesting practices varied, with 31% of farmers opting for partial harvesting and the remaining 69% performing complete harvesting, primarily utilizing cast nets and drag nets.
- The majority of farmers directed the produced mola for household consumption and additional income through sales.
- Mola production averaged 194 kg/ha, with 34% of farmers obtaining 151-200 kg/ha and 28% achieving 101-150 kg/ha (Table 3 and Fig. 7)
- Total fish production from carp-mola polyculture ponds averaged 2831 kg/ha, with 24% of farmers reaching 2501-3000 kg/ha (Table 3 and Fig. 8)
- Mola was sold at an average price of 146 ± 13.52 INR/kg, with the majority of farmers selling at prices ranging from 140-150 INR/kg.
- On average, farmers earned an additional 19,681 INR/ha from mola sales, translating to 7,354 INR per household (Table 3 and Fig. 9 and 10).
- Income disparities were observed, as 38% of farmers earned less than Rs 15,000-20,000 INR/ha from mola, while 45% earned less than Rs 5,000/household.
- Mola contributed an average of 9% to the total fish production from carp-mola polyculture ponds, reaching a maximum contribution of up to 26%.

Parameters (n = 29)	Unit/ ha	Unit/ household
Mola harvested and sold (kg)	123 ± 49 (30.89- 222.39)	48 ± 43 (5 -170)
Mola consumed and gifted (kg)	52 ± 32 (10 – 124)	14 ± 12 (4 - 40)
Total mola produced (kg)	194 ± 81 (62 - 445)	69 ± 56 (10 - 210)
Carps and other fish produced (kg)	2637 ± 1153 (412 - 4695)	1034 ± 1141 (70 – 5000)
Total fish production (kg)	2831 ± 1168 (555.99 - 4867.97)	1104 ± 1175 (84 - 5090)
Total income from mola sale (INR)	19681 ± 11546 (2100 - 59305)	7354 ± 6614 (700 - 27000)
Contribution of mola in total production (%)	8.68 ± 6.13 (1.77 - 25.93)	8.68 ± 6.13 (1.77 - 25.93)

Note: Data is expressed as Mean ± Standard Deviation (SD). Figures within the parentheses indicate the range.

Table 3. Total mola and other fish production and income through hatchery-produced mola seed.

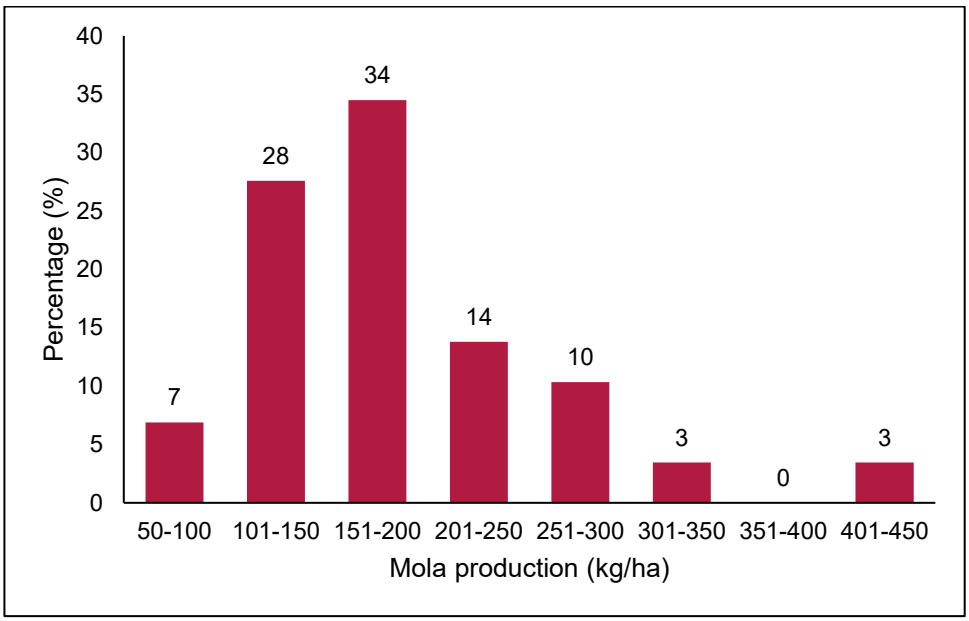

Figure 7. Frequency distribution of mola production (kg/ha) through hatchery-produced mola seed.

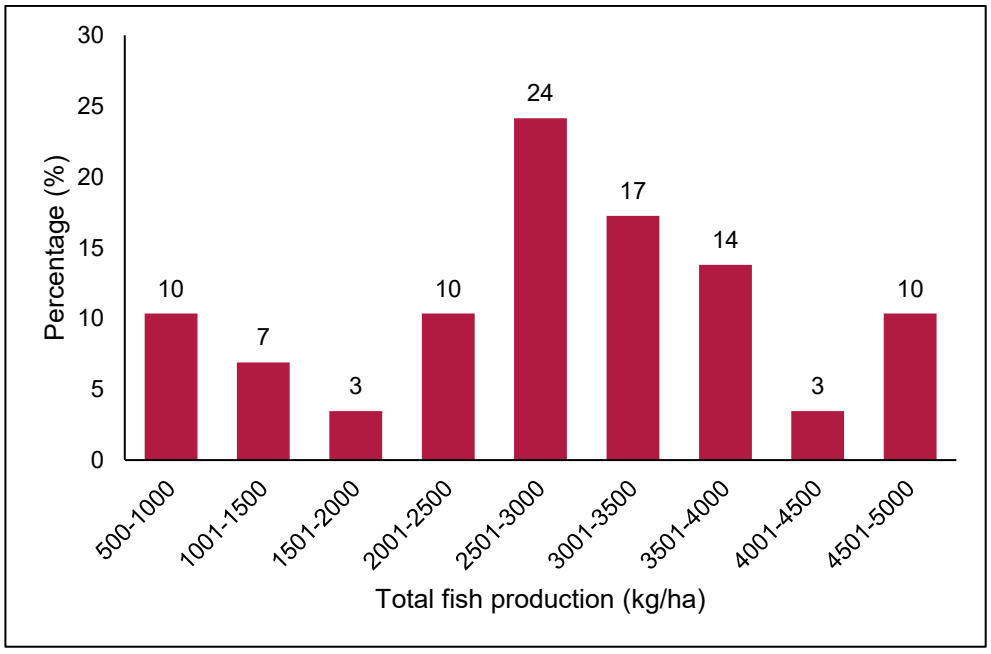

Figure 8. Frequency distribution of total fish (kg/ha) from carp-mola polyculture ponds.

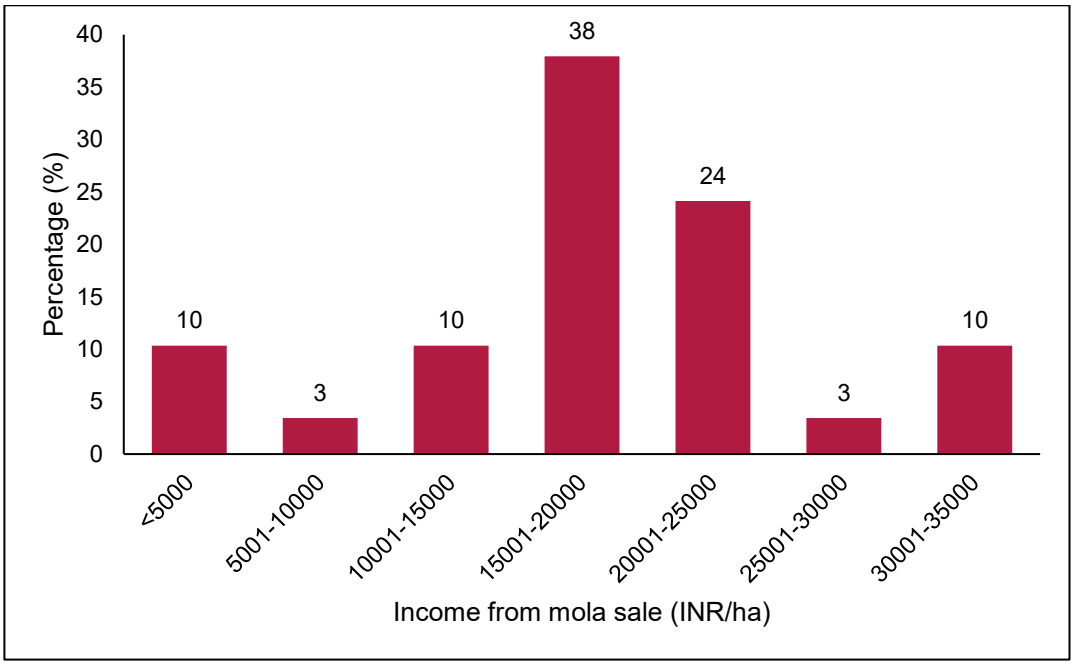

Figure 9. Frequency distribution of total income from mola sale (INR/ha) from carp-mola polyculture ponds.

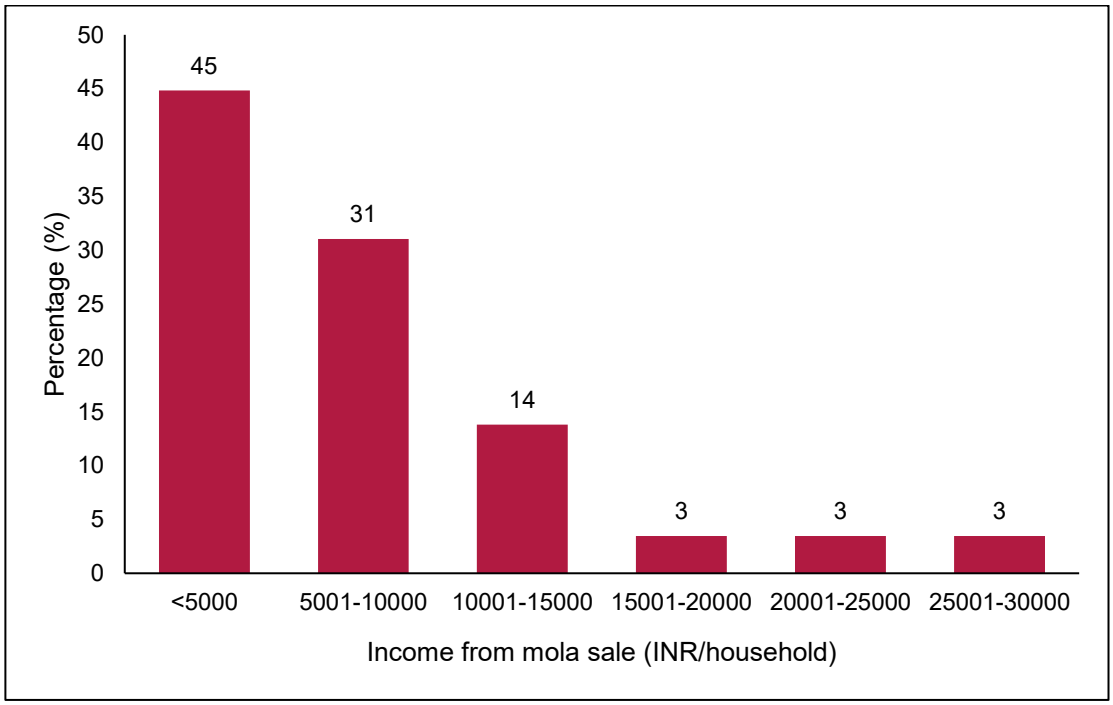

Figure 10. Frequency distribution of total income from mola sale per household from carp-mola polyculture ponds.

4.7. Household consumption of mola

- In the reporting year, each household, on average, consumed 14 kg of mola, ranging from 4 to 40 kg (Table 3). A majority of households (55%) consumed less than 10 kg of mola, while 21% consumed between 11 and 20 kg (Fig. 11).
- Taking into account the surveyed households' average size of 5.74 ± 3.04 individuals, the per capita mola consumption was calculated at 3.04 ± 2.45 kg per year.
- Over half of the surveyed households consumed mola at the rate of 1-3 kg/capita/year (Fig. 12).

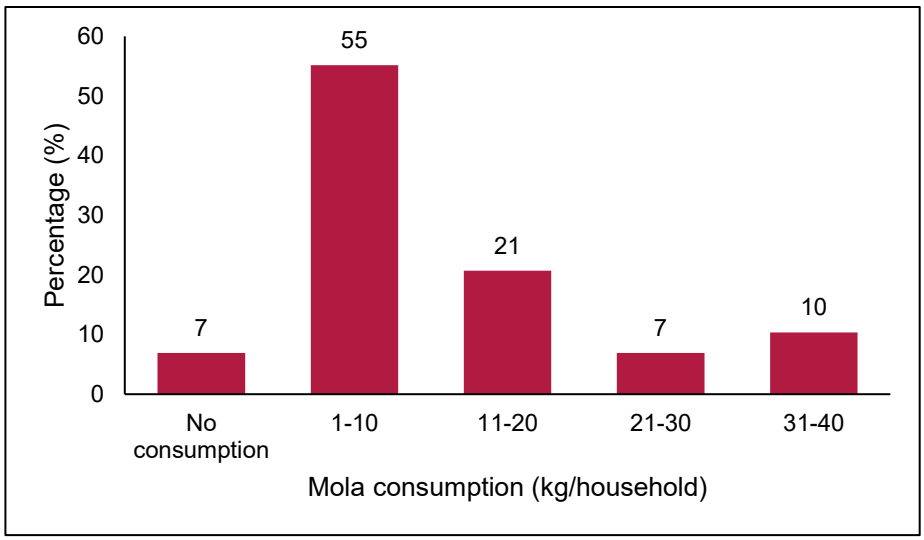

Figure 11. Frequency distribution of per household mola consumption (kg/household).


Common cooking method of mola for household consumption.

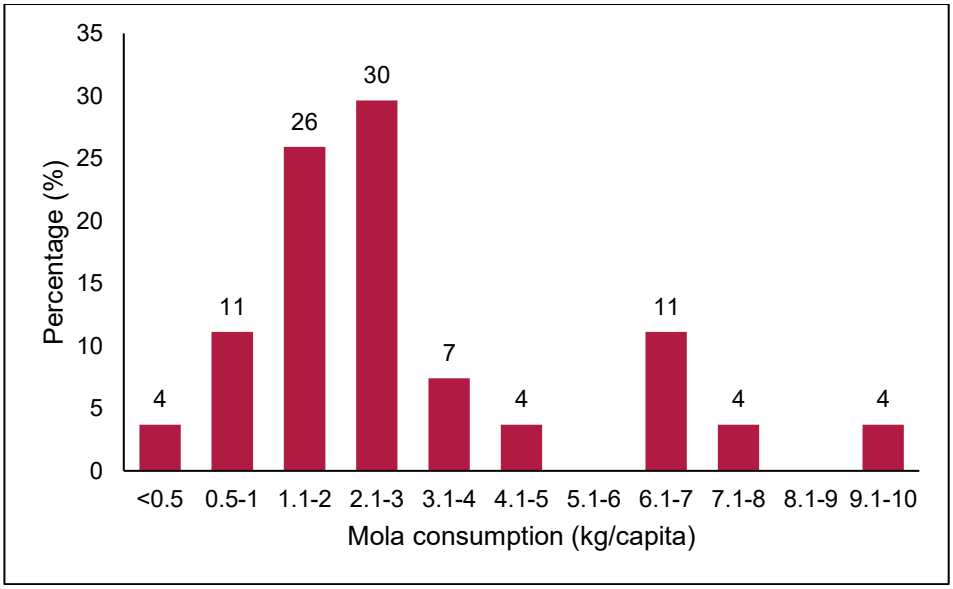

Figure 12. Frequency distribution of per capita mola consumption (kg/person).

4.8. Factors influencing productivity and household consumption of mola

Tables 4 and 5 present the Spearman rank correlation, examining key outcome variables, such as mola and total fish production, sale, income, and mola consumption, in relation to various influencing factors. These factors include the age of the farmer, household size, pond size, stock density, distance between the pond and hatchery, and culture duration. The analysis is conducted at both the household level and on a per-hectare basis.

- **Age and household size:** The age of the farmer, often considered a proxy for experience, demonstrated no significant correlation with the outcome variables. Similarly, household size did not exhibit noteworthy associations.
- **Pond size:** A positive and statistically significant correlation ($P<0.01$) was found between pond size and mola production, total fish production, income from mola sales, and household-level consumption of mola (Table 4). This suggests that an increase in pond size beyond existing levels is linked to higher mola production, income, and consumption.
- **Stock density:** Increasing stock density displayed a positive and statistically significant effect ($P<0.05$) on the sale and production of mola per hectare (Table 5).
- **Distance to SIS hatchery:** Theoretical expectations proposed a negative influence of greater distance on mola production, sale, consumption, and income. However, in our case, this relationship was statistically insignificant, except for household-level production and income.
- **Culture duration:** Culture duration exhibited a significant positive effect ($P<0.01$) on household-level mola consumption, possibly due to fish remaining in the pond for an extended period, allowing more frequent harvesting (Table 4). Table 5 further indicates that culture duration significantly affects per-hectare production, sale, and income.

Variables N=29	Mola production (kg/household)	Total fish production (kg/household)	Mola sale (kg/household)	Income from mola sale (INR/household)	Mola consumption (kg/household)
Age of farmer	0.046	0.0466	-0.0608	-0.1054	0.0274
Household size	-0.1417	-0.1346	-0.0659	-0.0851	0.0416
Pond size (ha)	**0.9195*** **	**0.8663*** **	**0.9147*** **	**0.9039*** **	**0.5600*** **
Mola stock density (numbers/ha)	0.084	-0.0933	0.1259	0.0974	0.3662
Distance between pond and hatchery (km)	-0.0531	0.0149	0.0223	-0.1395	0.0726
Culture duration (months)	0.3294	0.2632	**0.4527** **	**0.4425** **	**0.5733*** **
Note: *** and ** indicate Significant at 1% and 5% level					

Table 4. Spearman rank order correlation (rho) between key outcome variables and influencing factors of carp-mola polyculture production system (household level).

Variables N=29	Mola production (kg/ha)	Total fish production (kg/ha)	Mola sale (kg/ha)	Income from mola sale (INR/ha)
Age of farmer	0.0056	-0.088	-0.0742	-0.0785
Household size	-0.0076	0.049	0.1526	0.0755
Pond size (ha)	0.0582	0.1435	0.2155	0.1698
Mola stock density (numbers/ha)	**0.3926** **	0.0593	**0.4428** **	0.3084
Distance between pond and hatchery (km)	-0.0456	0.0881	0.1432	-0.1325
Culture duration (months)	**0.4601** **	0.0654	**0.4601** **	**0.3946** **
Note: *** and ** indicate Significant at 1% and 5% level.				

Table 5. Spearman rank order correlation (rho) between key outcome variables and influencing factors of carp-mola polyculture production system (per ha level).

5. Discussion and conclusion

This study provides critical insights into the performance of hatchery-produced mola seed in homestead carp polyculture ponds, offering valuable contributions to the ongoing efforts in promoting nutrition-sensitive aquaculture. The successful development of a technical protocol for hatchery-based induced breeding and mass seed production of mola in 2022 represents a significant milestone. Subsequent implementation involved the sale or distribution of mola spawns or hatchlings and fry to carp farmers, with a follow-up survey conducted in 2023 to gauge the production potential of hatchery-produced mola seed in homestead carp polyculture ponds.

The partner hatchery's sale of 1.23 million seeds generated revenue amounting to 40,250 INR, directly contributing to farmers' income. Mola production, averaging 194 kg/ha, made a substantial contribution of up to 26% to total fish production. Farmers earned an average of 19,681 INR/ha from mola sales, with each household consuming an average of 14 kg of mola annually, translating to a per capita consumption of 3.04 kg/year. Notably, mola production through hatchery-produced seed surpassed that from GP tanks in Odisha using wild broodstock (Padiyar et al. 2021), indicating the potential for sustained household consumption and income.

Optimizing the carp-mola production system requires strategic partial harvesting. Pond size demonstrated a significant positive correlation with mola production, income, and consumption, suggesting that an increase in pond size beyond existing levels is associated with higher outcomes. Increased stock density positively influenced sales and production per hectare, emphasizing the importance of stocking practices. Culture duration exhibited a significant positive effect on household-level consumption, attributed to the prolonged presence of mola in the pond through auto-breeding, allowing for more frequent harvesting.

Several experimental studies have been conducted on the polyculture of mola and other SIS with carps and yielded varying degrees of success (Wahab et al. 2002, 2003; Alim et al. 2004, 2005; Gupta and Rai 2011). Importantly, the integration of SIS in polyculture has proven to be a viable and profitable concept, avoiding reductions in cash crops like carp production. This system showcases no dietary overlapping or species competition, emphasizing resource sharing and niche utilization among different species. These benefits highlight the potential of polyculture with SIS as an effective and sustainable approach to maximize productivity without compromising other farming aspects.

In conclusion, the successful execution of hatchery-based mola seed production technology presents a promising avenue for scaling up nutrition-sensitive aquaculture. The positive correlations observed in pond size, stock density, and culture duration emphasize the potential for optimizing mola production and consumption in homestead carp polyculture ponds. These findings contribute valuable insights to the broader promotion of mola as a farmed species, emphasizing the continued need for research and implementation in addressing food insecurity through sustainable aquaculture practices.

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About WorldFish

WorldFish is an international, not-for-profit research organization that works to reduce hunger and poverty by improving aquatic food systems, including fisheries and aquaculture. It collaborates with numerous international, regional and national partners to deliver transformational impacts to millions of people who depend on fish for food, nutrition and income in the developing world.

The WorldFish headquarters is in Penang, Malaysia, with regional offices across Africa, Asia and the Pacific. The organization is a member of CGIAR, the world's largest research partnership for a food secure future dedicated to reducing poverty, enhancing food and nutrition security and improving natural resources.

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