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Present Status of Fish Seed Production in the Northern Part of Chapai-Nawabgonj District of Bangladesh



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Abstract

Background: Chapai-Nawabgonj is located in the northern part of Bangladesh and is an important region for aquaculture, where fish seed production currently plays a vital role in both the local economy and sustainable fisheries development. **Objective:** The general objective of the study was to assess the present status of fish seed production in Chapai-Nawabgonj, a northern district of Bangladesh, to understand its current practices, challenges, and potential for development. **Methodology:** This study was designed as a descriptive and field-based survey to assess the current status of fish seed production. The research was conducted in various hatcheries and fish farms located in Chapai-Nawabgonj, situated in the northern region of Bangladesh. The study period spanned from January 2024 to December 2024, covering both peak and off-peak seasons of fish seed production. Data were collected through structured questionnaires, personal interviews with hatchery owners and workers, and direct observation of hatchery operations. Secondary data were also gathered from local fisheries offices and previous reports. The collected data were then analyzed to evaluate the production techniques, challenges faced, and potential areas for improvement. **Results:** The study revealed that fish seed production in Chapai-Nawabgonj is growing steadily and plays an important role in the local aquaculture sector. Most hatcheries are operating with limited technological advancement and face challenges such as inadequate training and financial support. Seasonal variations significantly impact seed availability, with shortages commonly observed during the off-season. Key problems identified include poor water quality, disease outbreaks, and lack of modern hatchery management practices. Overall, there is strong potential for enhanced fish seed production through better training, infrastructure, and policy support. **Conclusion:** In conclusion, fish seed production in Chapai-Nawabgonj holds significant potential for growth and it requires improved technical support, training, and infrastructure. [*Bangladesh Journal of Infectious Diseases, June 2025;12(1):125-133*]

Keywords: Fish hatchery; fish seed; brood fish; water parameter; Chapai-Nawabgonj

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Introduction

The fisheries sector plays an important role, contributing 2.4% of total national GDP and less than one-fourth (22.1%) of total agriculture production¹. Hatchery is now the main source of fish seed production. Since 1975, artificial fish breeding techniques and low-cost hatchery designs have been successfully adjusted in Bangladesh². The Borendro region has contributed a lot of fisheries production. The Chapai-Nawabganj district is one of the major contributing districts in Borendro region and the most western district of Bangladesh. It is situated between the latitudes 24'22 to 24'57 and longitudes 87'23 to 88'23.

The north and west part of Chapai-Nawabganj is bounded by Malda and Murshidabad districts of India, the east is by Naogaon District, and the south-east is by Rajshahi District. Many rivers flow over this area, including Padma, Mahananda, Pagla, and Punorvhaba. The main rivers are the Ganges and the Mahananda. Most of the land in this area is plain land with many small ponds and water reservoirs. Currently, the geography has changed due to erosion by the river Padma (Ganges). The overload of river sediment caused by the Farakka Barrage eroded the riverbanks and created a large area of land full of sand, which almost resembles a small desert in this area. Such types of reasons hampered the capture fisheries production in this district.

To fulfill the fish consumption demand of this district, as well as Borendro region, aquaculture industries have contributed a lot. Therefore, the hatchery industries have developed over the past few decades. Due to the high demand for fry and fingerlings in the Borendro region, the Chapai district's hatchery production has increased dramatically. A fish hatchery is a place for artificial breeding, hatching, and rearing through the early life stages of animals, finfish, and shellfish in particular. Hatcheries produce larval and juvenile fish, shellfish, and crustaceans, primarily to support the aquaculture industry, where they are transferred to on-growing systems³. There is much interest in supplementing exploited stocks of fish by releasing juveniles. The variable timing and magnitude of natural spawning events make hatchery production attractive. The hatcheries in Bangladesh face problems related to inappropriate selection of brood stock, indiscriminate hybridization, and inbreeding, but the problems and how they are specifically related to seed quality and seed performance have not been rigorously and comprehensively investigated. For this reason, hatchery owners, nursery operators, fry traders, and stakeholders face economic loss to some

extent. So, the present study is designed to manage the hatchery for increasing the production of fish seed.

Water quality includes all physical, chemical, and biological factors that influence the beneficial use of water. Where fish culture is concerned, any characteristic of water that affects the survival, reproduction, growth, production, or management of fish in any way is a water quality variable. Obviously, there are many water quality variables in pond fish culture. Fortunately, only a few of these normally play an important role. There are two main categories of water supply for aquaculture: groundwater and surface water. Groundwater is commonly considered the most desirable water source for hatchery production. The water quality of the brood stock and larval rearing pond is a vital factor for hatchery production. Good water quality ensures better production in the hatchery. However, private hatcheries are not aware of this, and their production is comparatively less than Govt. hatchery. Therefore, the present study was conducted to assess the impacts of water quality parameters in the hatcheries belonging to Chapai-Nawabganj district, which contribute to the aquaculture production in Rajshahi division, Bangladesh.

Methodology

Study Area: The study was carried out about 8 hatcheries in Chapai-Nawabganj district, and among these 5 hatcheries, namely Amnura hatchery, Nachol hatchery, Punorvoba hatchery, Bokul hatchery and Munir hatchery were selected as the study area for a period of one year from January 2024 to December 2024. All of those sites were selected to observe the fry production trends and problems caused by water quality.

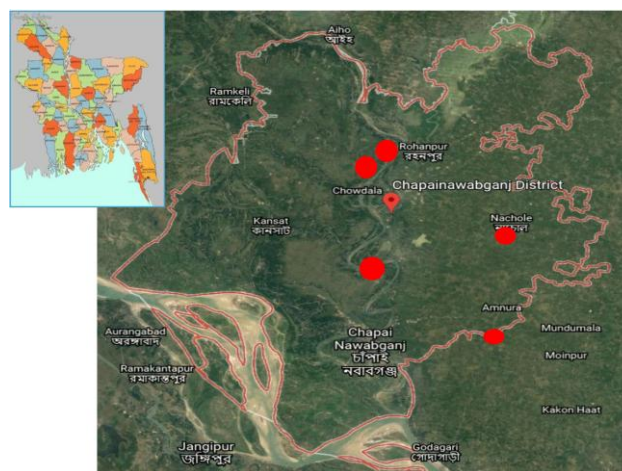


Figure I: Location of study area Map

Collection of Data: In this study, data were collected through both primary and secondary methods.

Primary Data Collection: The relevant primary data, such as fry trends of fry production from the selected stakeholders, were collected through a questionnaire survey from the study sites.

Secondary Data Collection: The FRSS data of fisheries and aquaculture were collected over the last 40 years to show the trend of the aquaculture and capture fisheries production, and the trend of aquaculture in Chapai-Nawabganj district.

Selection of Sampling Sites: Three earthen ponds from the five individual hatcheries with an area of 1 hectare (approximately) each and an average depth of 2.1 m were used for this study. The ponds were square in shape, well-exposed to sunlight, independent, and completely free from aquatic vegetation.

The pond banks were protected and covered with grass. The ponds were not interconnected and had no inlet or outlet. The source of water for these ponds was rainfall and a deep tube-well.

Key Informant Interviews: After collecting the data through questionnaire interviews, it was necessary to check the information for justification of the collected data. Crosscheck interviews were conducted with 5 key informants, such as district fisheries officers (DFO) and relevant NGO workers, where information was contradictory or requested for further assessment.

Collection and Treatment of Water Samples: Several water quality parameters, such as pH, dissolved oxygen (mg/l), carbon dioxide (mg/l), Phosphate (mg/l), ammonia-nitrogen (mg/l) and nitrate (mg/l), TDS (mg/l) were recorded twice in a month. Water samples were collected between 8:30 to 10:00 A.M from each pond's upper surface to a depth of 20 cm.

Black plastic bottles with stoppers having a volume of 250 ml each and marked with pond number were used for the collection of water samples. Water samples were collected by using a sampler in a manner that it is representative of all layers of the water column (vertical haul of the tube sampler covering about 3 to 4 feet depth).

Then water samples were examined in the spot by HACH kit.

Results

The purpose of the study was Hatchery played a vital role in aquaculture production in Chapai-Nawabganj district, as well as all over the country. There were many hatcheries in Chapai-Nawabganj, among them 5 hatcheries were visited. However, hatchery production has been hampered due to poor water quality in this district. Poor management and lack of hatchery operating knowledge are the problems emerging.

Amnura Hatchery (Govt.): Amnura Hatchery was one of the most popular hatcheries in Chapai-Nawabganj district. It is located in the Sadr Upazila and led by the Government. It was established in 1961; however, at first its production rate was very low. By the time the changing infrastructure of the hatcheries is developed with the time change. Brood pond is adequate. In 2020, the total fry production was 68 kg, and in 2024 it was 98 kg. Nevertheless, this hatchery also produces fingerlings after one month of nursing. The total fry production in the last 5 years at Amnura hatchery was recorded (Table 1).

Table 1: Sequence of Fry Production in the Last 5 years at Amnura Hatchery

Species	Productions/ Year (kg)				
	2020	2021	2022	2023	2024
Catla	6	10	10	10	10
Rui	10	6	6	11	18
Mrigel	12	12	0	12	15
Calibaus	0	0	12	0	0
Silver carp	20	25	30	30	30
Thai Sarputi	5	0	0	0	0
Bighead carp	10	10	10	10	15
Mirror carp	5	7	7	7	0
Monosex Tilapia	0	0	0	0	10
Total	68	70	75	80	98

Nachol Hatchery (Govt.): Nachol Hatchery is the second Govt. Hatchery in Chapai-nawabganj district. It is located in the Nachol Upazila and is led by the Government. It was established in 1981. The hatchery's fry quality is also good, and the brood pond of the hatchery is adequate. In 2020, production was 21 Kg. Gradually, it has increased due to the huge demand for fry. Therefore, in 2024, the total production was about 65 Kg. Monosex tilapia was not produced by this hatchery. Carp species were the most prominent species to produce fry. The total of fry production in the last 5 years at Nachol hatchery was recorded (Table 2).

Table 2: Sequence of Fry Production in The Last 5 Years at Nachol Hatchery

Species	Productions/ Year (kg)				
	2020	2021	2022	2023	2024
Catla	5	3	3	6	0
Rui	5	5	5	10	10
Mrigel	3	5	5	14	15
Calibaus	0	0	0	0	0
Silver carp	3	5	5	0	20
Thai Sarputi	5	0	0	0	0
Bighead carp	0	0	3	0	0
Mirror carp	0	4	4	0	15
Sarputi	0	0	0	0	5
Total	21	22	25	30	65

Punorvoba Hatchery (Govt.): Punorvoba Hatchery is the biggest hatchery at Chapai-Nawabgonj district. It is also operated by the private owners. It was established in 2008. At the initial time, the production was not so high that it never stopped. In 2020, the total fry production was about 96 Kg, however, dramatically, the production reached 260 Kg in 2024. The fry production in the last 5 years of Punorvoba hatchery was recorded (Table 3). Though its production rate was higher than the Govt. hatchery but they have some management problems, such as a lack of brood rearing ponds, poor quality of brood pond water, quality problems, and disease problems.

Table 3: Sequence of Fry Production in the Last 5 Years at Punorvoba Hatchery

Species	Productions/ Year(kg)				
	2020	2021	2022	2023	2024
Rui	12	15	20	25	30
Catla	3	5	7	8	10
Mrigel	4	10	15	20	25
Silver carp	22	25	25	25	30
Thai Sarputi	12	10	10	10	15
Bata	30	40	50	60	90
Japani	0	0	10	20	20
Bighead carp	5	8	10	12	15
Grass carp	5	7	10	12	15
Calbaus	3	5	7	8	10
Total	96	125	164	200	260

Munir Hatchery (Non-govt.): Munir Hatchery was also operated by the private owners. It is operated Munir Ahmed, who was an ex-worker of a government hatchery. From the experience of the

hatchery knowledge he established it. It was established in 2018, and initially, total fry production was about 100 Kg, and in 2024, it was 150 Kg. The fry production in the last 5 years of Munir hatchery is given in Table 4, though its production rate was higher than the Govt hatchery, but they have some management problems, such as a lack of brood rearing ponds, water quality problems, and disease problems.

Table 4: Sequence of Fry Production in The Last 5 Years at Munir Hatchery

Species	Productions/ Year(kg)	
	2023	2024
Rui	30	45
Catla	15	10
Mrigel	20	25
Silver carp	0	0
Thai Sarputi	20	40
Bata	10	20
Japani	0	0
Bighead carp	0	5
Grass carp	0	5
Calbaus	0	0
Total	95	150

Bokul Hatchery (Non-govt): Bokul Hatchery was operated by the private owners. The hatchery is named by its owner, Bokul. It is situated at his home under the bamboo tree. It was established in 2010. But in the meantime, the 3-year production was stopped. The production started again initially in 2020, the total fry production was about 32 Kg, but the production dramatically reached 212 Kg in 2024. Though its production rate was higher than the Govt. hatchery but they have some management problems, such as a lack of brood rearing ponds, water quality problems, and disease problems. The fry production in the last 5 years of Bokul hatchery was recorded (Table 5).

Table 5: Sequence of Fry Production in the Last 5 Years at Bokul Hatchery

Species	Productions/Year(kg)				
	2020	2021	2022	2023	2024
Catla	0	3	5	7	10
Rui	10	10	20	21	30
Mrigel	7	5	10	12	25
Calibaus	0	0	5	7	10
Silver carp	0	7	15	20	30
Thai Sarputi	0	0	7	8	10
Bighead Carp	0	0	7	10	15

Species	Productions/Year(kg)				
	2020	2021	2022	2023	2024
Bata	10	15	25	30	40
Japani rui	0	3	10	13	20
Grass carp	5	10	6	7	12
Calbaus	0	0	5	7	10
Total	32	53	115	142	212

Water Quality Parameters: Water quality parameters of a large number of samples were analyzed in this experiment to observe any appreciable changes. The individual mean values of each water quality parameter in different hatcheries are presented below.

Table 6: Water Quality Parameters in the Study Area

Parameters	Amnura Hatchery	Nachol Hatchery	Punorvoba Hatchery	Bokul Hatchery	Munir Hatchery
DO(mg/l)	5.1	5.0	4.2	3.1	3.0
pH	6.5	6.5	8.2	8.9	9.0
Nitrate (mg/l ⁻¹)	0.1	0	5.0	6.0	6.7
Phosphate (mg/l ⁻¹)	0.5	1.0	4.8	5.9	6.0
Ammonia (mg/l ⁻¹)	0.01	0.01	0.3	0.4	0.5
CO ₂ (mg/l ⁻¹)	4.5	4.8	7.6	7.9	8.5
TDS (mg/l ⁻¹)	52.51	54.55	70.04	65.05	74.53

Dissolved Oxygen (mg/l⁻¹): The ranges of different oxygen concentrations in different ponds were 5, 5, 4, 3, and 3 mg/l, respectively (Figure I). The desired limit of oxygen is 5.

Therefore, Amnura and Nachol Hatchery are suitable for fry production; however, Punorvoba, Bokul, and Munir Hatchery are not suitable regarding the oxygen limit. It was reported that dissolved oxygen concentration of at least 5 mg/l is required for maintaining a healthy aquatic life, and DO concentration of less than 5 mg/l indicates pollution⁴.

Dissolved oxygen concentration is an important water quality parameter that affects the growth and survival process of fish. Reduction in dissolved oxygen content has negative effects on growth, reproduction, and other biological activities of fish, and very low dissolved oxygen content is lethal to fish.

pH Values: The ranges of different pH in different ponds were from 6.5, 6.5, 8, 9 and 9, respectively (Figure II). The desired limit of pH is 6.5 to 8. Therefore, Amnura Nachol and Punorvoba Hatchery are suitable for fry production; however, Bokul and Munir Hatchery are not suitable regarding the pH limit. Aquatic organisms are affected by pH because most of their metabolic activities are pH-dependent. Fish have an average blood pH of 7.4; a little deviation from this value, generally pH between 7 to 8.5 is ideal for biological productivity.

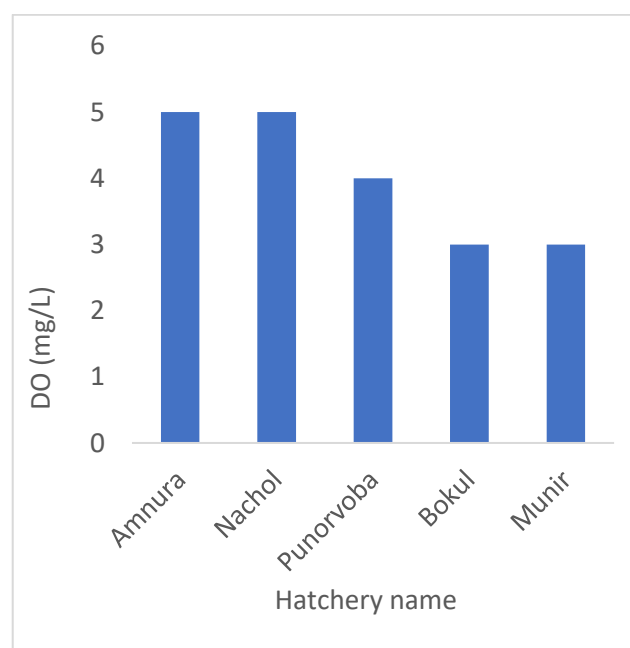


Figure I: Dissolved Oxygen in Different Hatcheries

Carbon Dioxide (mg/l⁻¹): The ranges of different CO₂ in different ponds were from and respectively 4.5, 4.8, 7.6, 7.9, and 8.5(mg/l⁻¹) (Figure III). The desired limit of CO₂ is 5 to 8. Therefore, Amnura Nachol Bokul and Punorvoba Hatchery are suitable for fry production; however, Munir Hatchery is not suitable regarding the Carbon dioxide limit. According to Ekubo and Abowei⁴, tropical fishes can tolerate CO₂ levels over 100 mg L⁻¹, but the ideal level of CO₂ in fishponds is less than 10 mg L⁻¹.

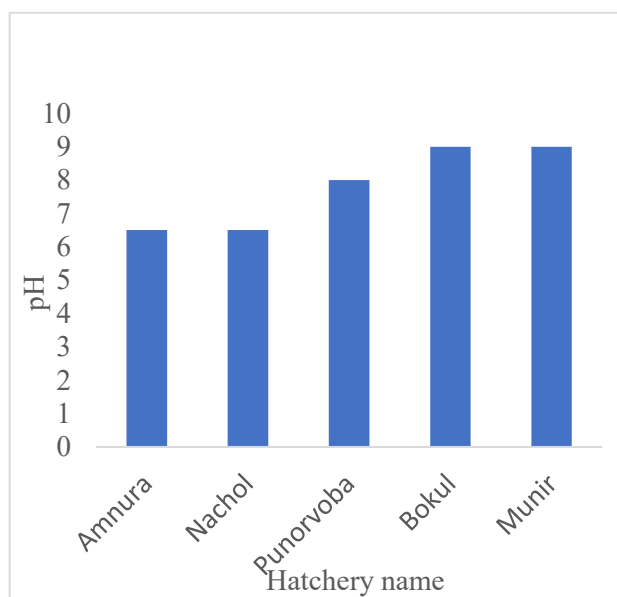


Figure II: pH Level in Different Hatcheries

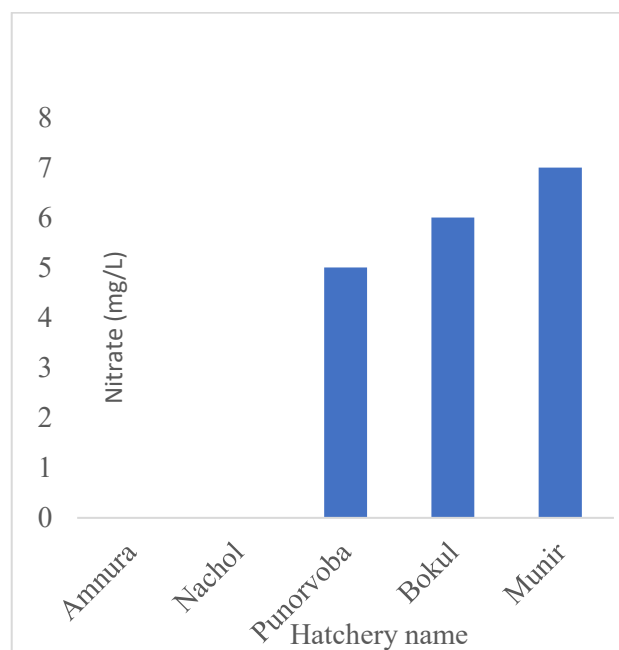


Figure IV: Nitrate Level in Different Hatcheries

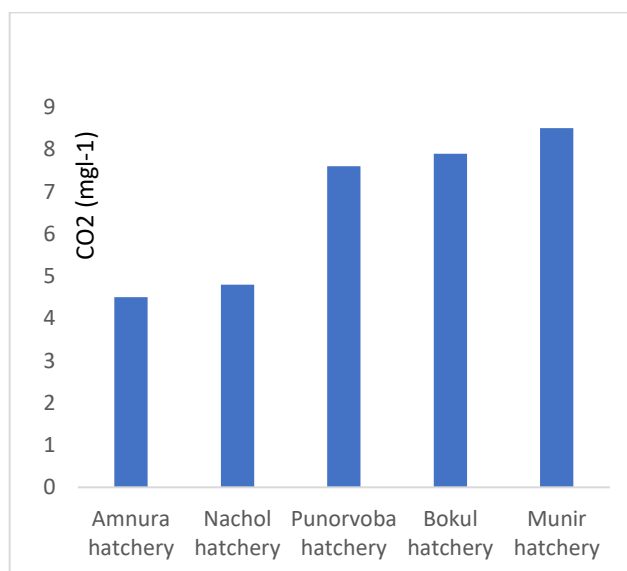


Figure III: CO₂ Level at Different Hatcheries

Nitrate (mg/l): The ranges of different nitrate concentrations in different ponds were from 0, 0, 5, 6, and 7 mg/l, respectively (Figure IV). The desired limit of nitrate is 0.01 to 4.5. Therefore, Amnura and Nachol Hatchery are suitable for fry production; however, Punorvoba, Bokul and Munir Hatchery are not suitable regarding the nitrate limit. Nitrate is a water-soluble fertilizer nutrient that exists as a negative ion (NO_3^-) and therefore moves readily with surface runoff into ponds, rivers, and into the groundwater through percolation⁸. Santhosh and Singh⁹ described the favorable range of 0.1 mg/l to 4.0 mg/l in fish culture water.

Phosphate (mg/l): The ranges of different phosphate concentrations in different ponds were from 0.05, 1, 5, 6 and 6 mg/l, respectively (Figure V). The desired limit of phosphate is 0.01 to 3. Therefore, Amnura and Nachol Hatchery are suitable for fry production; however, Punorvoba, Bokul and Munir Hatchery are not suitable regarding the phosphorus limit. Phosphate plays a major role in primary productivity in an aquatic ecosystem as it promotes growth for organisms and limits the phytoplankton production⁶.

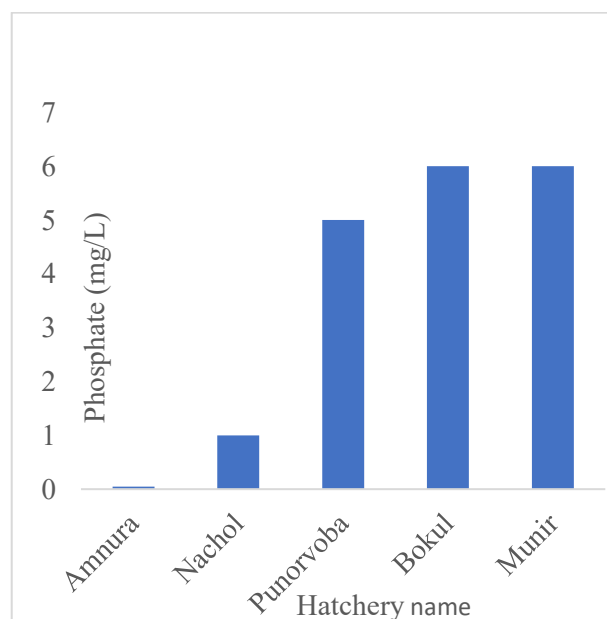


Figure V: Phosphate Level in Different Hatcheries

Ammonia (mg l^{-1}): The ranges of different Ammonia concentrations in different ponds were from 0.01, 0.01, 0.03, 0.04, and 0.05 mg l^{-1} , respectively (Figure VI). The desired limit of ammonia is 0 to 0.025. Therefore, Amnura and Nachol Hatchery are suitable for fry production; however, Punorvoba, Bokul and Munir Hatchery are not suitable regarding the ammonia limit. Ammonia is the second gas of importance in fish culture; it is toxic to fish if allowed to accumulate in fish production systems. The unionized form of ammonia (NH_3) is extremely toxic, while the ionized form (NH_4^+) is not, and both forms are grouped as total ammonia¹⁰.

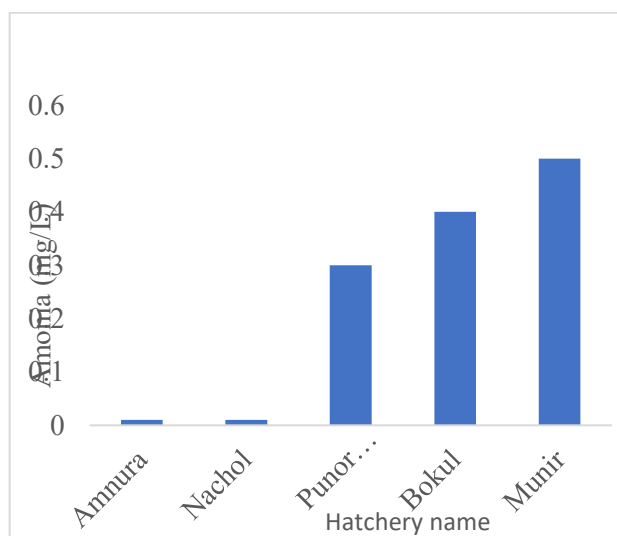


Figure VI: Ammonia Level in Different Hatcheries

Total Dissolved Solids (TDS): The ranges of TDS in different ponds were from 52.51, 54.55, 70.04, 65.05, and 74.53 mg l^{-1} , respectively (Figure VII). The desired limit of TDS is up to 500 mg l^{-1} . Sayeed et al⁹ recorded TDS varied from 68 to 425 mg l^{-1} in the Chalan Beel.

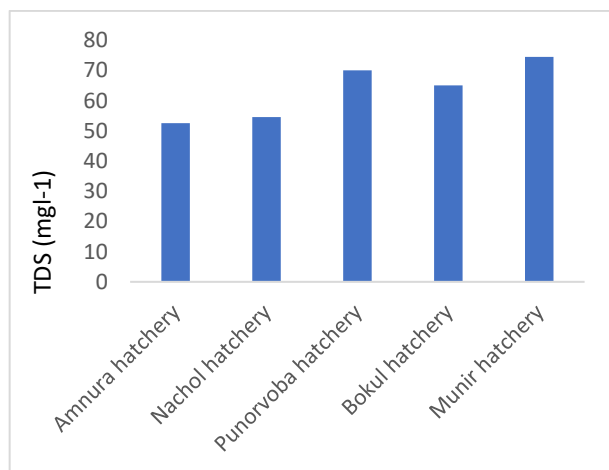


Figure VII: TDS Level in Different Hatcheries

Relation between the Water Quality Parameter in Different Hatcheries: Good water quality is the first priority for fish fry production in hatcheries. The water quality parameters are at a satisfactory level in the two Govt. hatcheries. However, rest of the three private hatcheries are not capable of keeping the water clean for good production. Due to the large trees beside the pond in the hatchery's compound, the leaves decompose in the water and keep it dirty.

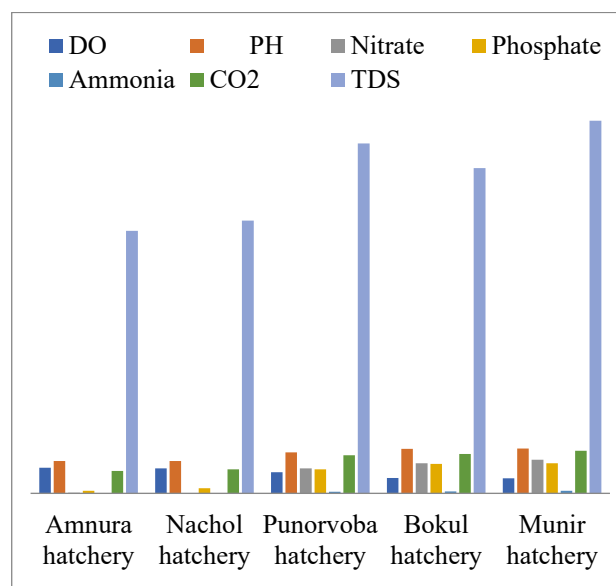


Figure VIII: Water quality parameters in different hatcheries in Chapai-Nawabganj district

Disease Problems and Mortality: The hatchery owner mentioned that they encountered diseases in their farms. They considered disease to be an important issue in hatcheries and nurseries.

The diseases were white spot, tail and fin rot, epizootic, sudden spawn mortality, fish lice, gill rot, dropsy, malnutrition, air gulping, deformed larvae, and others. Disease was identified to be a more of a problem in the hatcheries and nurseries of the Chapai-Nawabganj area.

In the private hatcheries, the percentage of disease was comparatively high because of their management problems and that's why the fry mortality is also higher than the Govt. hatcheries. The mortality rate in 2024 was Amnura (8.0%) and Nachol (7%), Punorvoba (33.0%), Bokul (31.0%) and Munir (18.0%), respectively. The Govt. hatcheries were capable of maintaining the water quality in a suitable range. Therefore, less mortality and a high survival rate were found in these hatcheries.

Discussion

The findings indicate that government hatcheries in Chapai-Nawabganj generally maintain better water quality and have lower fry mortality compared to private hatcheries. This suggests that proper water quality management is essential for sustainable fish seed production. Poor water quality, including elevated levels of nitrate, phosphate, ammonia, and low dissolved oxygen, was linked to higher mortality and disease outbreaks in private hatcheries¹⁰.

The increase in fry production over the years, especially in Punorvoba and Bokul hatcheries, reflects the growing demand for fish seed but also highlights management challenges such as inadequate brood ponds and water quality issues. The variations in water quality parameters across hatcheries suggest that environmental and operational factors like pond maintenance, water exchange, and surrounding vegetation which contributes to decomposing organic matter, influence hatchery performance.

To improve overall seed production, hatchery managers must focus on maintaining optimal water parameters, disease control, and training to improve hatchery practices. The study emphasizes the importance of balancing production goals with sustainable management to minimize mortality and ensure quality fry supply.

Conclusion

Seed production is getting enhanced day by day to meet the demand of increasing aquaculture production in Bangladesh as well as in Chapai-Nawabganj district. For producing a high amount of fish, it is important to maintain water quality parameters in hatcheries. Aquaculture production largely depends on the good quality of fry production. Therefore, water quality should be maintained in the required range. It reduces the mortality and at the same time reduces the wastage of money and time. Thus, reduces the chances of water quality deterioration. By knowing the specific range of the water quality, proper management is needed for the fish production in different stages, such as egg, fry, and fingerlings. Overall, this study suggests that hatchery production can be increased by ensuring good quality of water quality. This study also indicates that fry mortality can be minimized by ensuring good water quality. Finally, it could be recommended that to obtain a better performance from hatcheries, all aspects of water quality must be maintained at a suitable level. Besides this, the

excessive tendency to earn money should be given up. However, most of the water quality-related problems can be solved with adequate water exchange, and proper training and knowledge for hatchery owners can minimize the problem and maximize the production. The results of this study would be an effective tool for fishery biologists, hatchery managers to initiate prompt management strategies and regulations for the sustainable fry production.

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Conflict of Interest

The authors declared no competing interests.

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Authors' contributions

Conceptualization, methods and literature review: Joadder MAR, Islam MR, Hossain MF; Statistical analysis: Hossain MF, Rahman MH, Khanom MM; Data collection: Joadder MAR, Islam MR; Preparation of draft manuscript: Joadder MAR; Finalization of manuscript: Khanom DA, Sarkar MAA, Siddika MA. All the authors approved the final manuscript.

Data Availability

Any questions regarding the availability of the study's supporting data should be addressed to the corresponding author, who can provide it upon justifiable request.

Ethics Approval and Consent to Participate

The Institutional Review Board granted the study ethical approval. Since this was a prospective study, every study participant provided formal informed consent. Each method followed the appropriate rules and regulations.

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