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# Design and Optimization of Aquarium Systems for Breeding and Rearing of the Indian Freshwater Ornamental Shrimp *Caridina hodgarti* (Kemp 1913)

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## ABSTRACT

Successful captive breeding of *Caridina hodgarti*, a native Indian ornamental freshwater shrimp, requires meticulous simulation of its natural stream habitat. This study details a standardized protocol for aquarium-based rearing and breeding, employing a 24″ × 18″ × 18″ tank setup with dark soil substrate, dual-stage sponge and canister filtration and stable temperature maintenance between 22–26°C. Habitat enrichment with aquatic plants, driftwood, rocks, and natural substrates enhanced survival rates and juvenile retention, while effective biological filtration and low-flow circulation maintained a stable ecological balance. Water quality was rigorously managed through routine testing and 25–30% weekly water changes, with a customized reverse osmosis (RO) and tap water mix to maintain pH levels between 6.5 and 7.5 and total hardness between 50 and 75 ppm. A diverse feeding regimen comprising spirulina-enriched pellets, blanched vegetables and natural detritus (almond leaves and driftwood) promoted healthy moulting, vibrant pigmentation and active foraging behavior. Reproductive indicators—including berried females and juvenile emergence—were consistently observed under these conditions, validating the system's suitability for full life-cycle support. The results present a replicable model for ex situ conservation and commercial production of *C. hodgarti*, offering a sustainable alternative to wild stock collection in the ornamental aquaculture sector.

**Keywords** *Caridina hodgarti*, Freshwater ornamental shrimp, Captive breeding, Aquarium standardization, Biofilm, Water quality, Ex situ conservation, Ornamental aquaculture.

## INTRODUCTION

Freshwater atyid shrimps of the genus *Caridina* H. Milne Edwards, 1837 comprise one of the most diverse groups of decapod crustaceans inhabiting tropical and subtropical freshwater ecosystems. They are widely distributed throughout Asia, Africa, Australia and the Indo-Pacific region, occupying hill streams, rivers, lakes, springs and forest brooks. Besides their ecological roles as herbivorous-omnivorous and algal grazers, many *Caridina* species

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are highly valued in the ornamental aquarium trade for their attractive coloration, peaceful behavior, and algal-grazing ability (De Grave *et al*. 2008, De Grave and Fransen 2011, Han *et al.* 2019, Kunjulakshmi and Prakash 2025). Among the Indian species, *Caridina hodgarti* (Kemp 1913) is a relatively understudied indigenous freshwater ornamental shrimp inhabiting cool, well-oxygenated hill streams of North-Eastern India. Its natural habitat consists of rocky substrates, submerged vegetation, leaf litter and biofilm-rich surfaces that provide abundant periphyton, detritus and microorganisms, forming the principal food resources of the species (Kemp 1913, Tiwari and Pillai 1971, Jayachandran 2001, Kunjulakshmi and Prakash 2025).

The global demand for ornamental freshwater shrimps has increased substantially with the growing popularity of planted and nano-aquaria. Although numerous selectively bred *Caridina* and *Neocaridina* varieties are commercially available, many indigenous species continue to be collected from the wild, increasing pressure on natural populations. The development of reliable captive breeding technologies is therefore essential for sustainable utilization and conservation of these valuable aquatic resources (Maceda-Veiga *et al.* 2013, Jabłońska *et al.* 2018. Prati *et al.* 2024). Despite their commercial importance, information on the captive breeding and husbandry of Indian *Caridina* species remains limited. Previous studies have focused mainly on taxonomy, larval development, reproductive biology and biodiversity (Kemp 1913, Tiwari and Pillai 1971, Lakshmi 1975, Soomro *et al.* 2011, De Grave *et al.* 2008), whereas comprehensive investigations on aquarium design, habitat simulation and long-term captive maintenance are scarce. Recent reviews have identified standardized husbandry and captive propagation as research priorities for the genus *Caridina* (Kunjulakshmi and Prakash 2025). Successful captive culture depends largely on replicating the physical, chemical and biological characteristics of the natural habitat. Stable water quality, particularly temperature, pH, dissolved oxygen, hardness and low nitrogenous waste levels, is fundamental to survival, moulting, growth and reproduction. Equally important are biological filtration, habitat complexity, biofilm development and balanced nutrition, all of which contribute to shrimp health and welfare (APHA *et al.* 2023, Namaei Kohal *et al.* 2018, Maciaszek *et al.* 2023). Biofilm is an essential natural food source for freshwater atyid shrimps. Microbial communities growing on rocks, driftwood, leaf litter and aquatic plants provide algae, bacteria, fungi and organic detritus that support continuous grazing throughout the life cycle. Mature biological filtration not only maintains water quality but also enhances natural food availability and juvenile survival (Viau *et al.* 2012, Maciaszek *et al.* 2023). Similarly, spirulina-based formulated feeds supplemented with vegetables and almond leaves improve growth, pigmentation and reproductive performance while promoting microbial colonization and greater ecosystem stability (Sirakov *et al.* 2012, Namaei Kohal *et al.* 2018). Environmentally sustainable aquarium systems that combine efficient filtration, regular water-quality monitoring, appropriate stocking density and habitat enrichment minimize stress and improve breeding success. Such integrated husbandry practices are increasingly recognized as key components of conservation aquaculture for freshwater crustaceans (APHA *et al.* 2023, Prati *et al*. 2024, Kunjulakshmi and Prakash 2025).

Accordingly, the present study aimed to develop and standardize a biologically stable aquarium system for the captive breeding and rearing of *Caridina hodgarti.* The study evaluated aquarium design, habitat enrichment, water-quality management, feeding strategy and routine husbandry practices under controlled laboratory conditions. The resulting protocol provides a practical framework for ex situ conservation, domestication and sustainable commercial production of indigenous freshwater ornamental shrimps.

## MATERIALS AND METHODS

Specimens of the Green Rocket shrimp, *Caridina hodgarti* (Fig.1), were collected from perennial hill streams of North-Eastern India and identified following the taxonomic descriptions and identification keys provided by Kemp (1913), Tiwari and Pillai (1971) and De Grave and Fransen (2011). The collection was carried out by local fishermen who transported the live specimens to Kolkata. The study was conducted in the Fish Breeding Training Centre, located in Kolkata-700152 (22.46°N, 88.41°E). The collected



**Fig. 1.** Studied species, *Caridina hodgarti.*

shrimps were carefully transferred into oxygenated containers and transported live to the laboratory. Only healthy shrimp free from visible injuries and disease were used.

Shrimp were maintained for six months in a rectangular glass aquarium (60.96cm × 45.72cm × 45.72 cm, approximately 100 L capacity) containing about 80 L of conditioned water. 50 acclimatised shrimp




**Fig. 2.** Step-by-Step Aquarium Setup: Adding Substrate, Adjusting Water Level, and Installing Fittings for Complete Aquascaping (A-G). **A.** Construction of an aquarium; **B.** Water level-1/4th with plant soil substrate; **C.** Water level- 3/4th with plant substrate; **D.** Full water level of the tank; **E.** Sand substrate with rock and driftwood; **F.** Tank with Seiryu rock and driftwood aquascaping; **G.** Tank aquascape with plant soil substrate, plant, rock and driftwood.

were stocked per aquarium. The base consisted of dark aqua-soil with patches of washed white sand. Habitat complexity was created using driftwood, Seiryu rock or Dragon stones, conditioned *Terminalia catappa* leaves and aquatic plants (*Hydrilla verticillata, Vallisneria spiralis, Cryptocoryne* spp., *Sagittaria* spp., *Echinodorus amazonicus, Cabomba caroliniana* and *Anubias nana*) to provide shelter and promote biofilm development (Fig. 2).

A dual filtration system, comprising mechanical and biological filtration, was provided using a sponge filter and an external canister filter containing ceramic rings, clay-based porous media, and K1 moving-bed filter media. Temperature was maintained using a JBJ Arctica chiller and monitored using digital and analogue thermometers (Fig.3). A sponge pre-filter prevented juvenile shrimp from entering the filter. Water movement was maintained at a low flow rate to simulate natural hill-stream conditions. Water quality was maintained following APHA *et al.* (2023). Partial replacement (25–30%) with conditioned water was

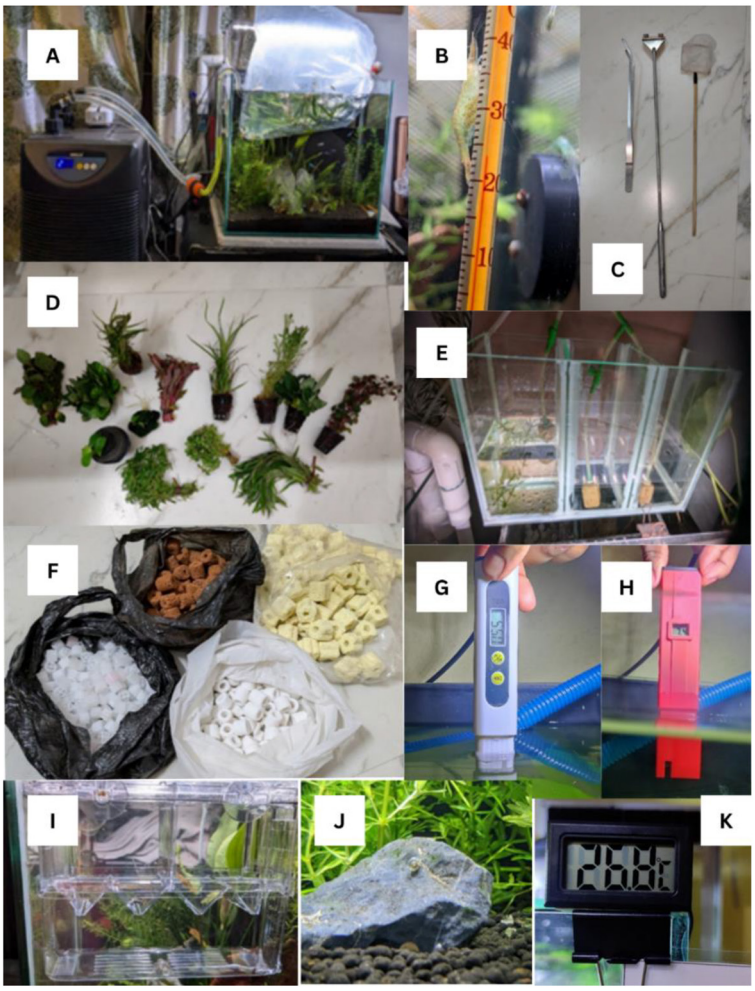



**Fig. 3.** Equipment for Water Quality parameters and Breeding Management(A-K).
**A.** Aquarium chiller; **B.** Analogue thermometer; **C.** Tweezer, scraper, shrimp net; **D.** Aquarium Plants; **E.** Hatching (for salinity shock treatment experimental) tank; **F.** Filter media (ceramic rings, k1 media); **G.** pH meter; **H.** TDS meter; **I.** Hatching box; **J.** Seiryu rock; **K.** Digital thermometer.

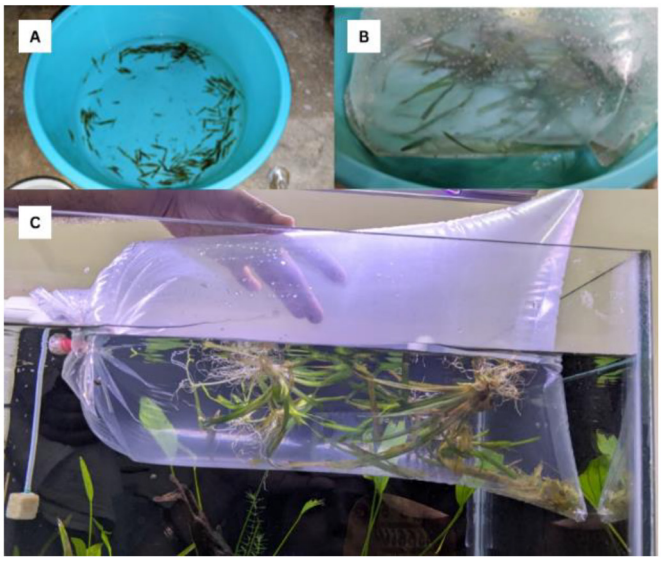



**Fig. 4.** Shrimp Acclimatization (A-C).
**A.** Total Shrimp; **B.** Shrimp bag with packaging condition; **C.** Shrimp within floating bag.

carried out weekly (Table 1). Table 2 provides water conditioning and monitoring protocols.

Shrimp were acclimatised by floating transport bags for approximately 30 min, followed by drip acclimatisation for 1–2 h before transfer with a fine-mesh net (Fig.4). They were fed (Table 3) once daily with spirulina-based shrimp pellets supplemented with blanched spinach, pumpkin, cucumber, conditioned almond leaves and naturally developed biofilm (Fig.5). Uneaten prepared feed was removed after 2–3 h, whereas leaf litter and driftwood were retained as

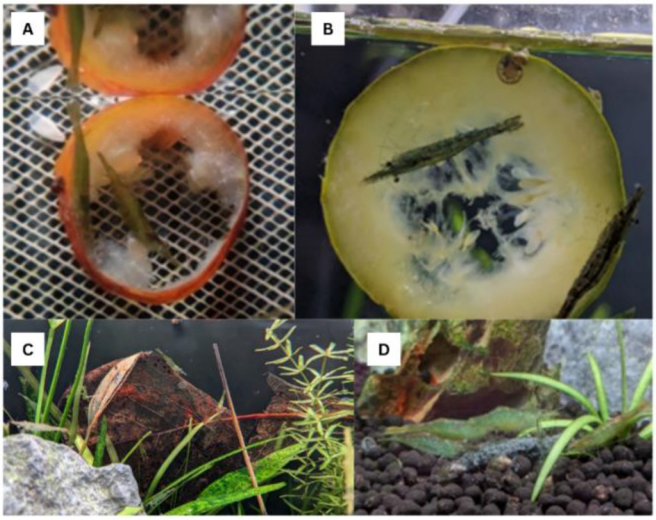



**Fig. 5.** Different shrimp feed (A-C).
**A.** Feed on Cucumber slice fully; **B.** Feed on Cucumber slice partly; **C.** Feed on Almond leaf; **D.** Feed on spirulina-based pellet.

**Table 1.** Aquarium Setup Specifications for *Caridina hodgarti.*

| Parameter | Specification/Details |
|---|---|
| Tank Size | 60.96 cm (L)× 45.72cm (W) × 45.72 cm (H) |
| Total Volume | ~100 litres (80% filled) |
| Stocking Density | 50 shrimps per tank |
| Substrate | Tropica Aqua Soil (Dark soil) |
| Filtration System | Sponge filter + Canister filter (with sponge pre-filter) |
| Filter Media | Ceramic rings, Clay balls, K1 media |
| Temperature Range | 22–26°C maintained by JBJ Arctica Chiller |
| Water Source | RO + Tap water blend |
| pH Range | 6.5–7.5 |
| Total Hardness | 50–75 ppm |
| Lighting | SOBO LED lights (20W; 6 hours/day) |
| Breeding infrastructure | Hatching box, Hatching tank (9cmx9cmx9cm) |

**Table 2.** Water Quality Monitoring and Conditioning.

| Component Monitored | Method/Tools Used | Frequency |
|---|---|---|
| pH, DO, $CO_2$, Ammonia, Nitrites, Nitrates | API Freshwater Master Test Kit | Weekly |
| Temperature | Digital LCD thermometer (analogue backup) | Daily |
| Water Change | 20–30% with dechlorinated water | Weekly |

**Table 3.** Acclimation and Feeding Strategies.

| Aspect | Method/Items Used |
|---|---|
| Shrimp Acclimation | Floating bag for 30 mins + drip acclimation (1–2 hours) |
| Main Diet | Spirulina-based shrimp pellets |
| Supplementary Feed | Blanched spinach, pumpkin, cucumber, almond leaves, rotten cucumber slices |
| Feeding Frequency | Daily (Remove uneaten food after 2–3 hours) |
| Moulting & Enrichment | Driftwood, Seiryu/Dragon rocks, leaf litter |
| Aquatic Plants | Hydrilla, Vallisneria, Cryptocoryne, Sagittaria, Amazon Sword, Cabomba,, Dwarf Anubias Plant. |

natural grazing substrates.

## RESULTS

### Performance of the Standardized Aquarium System

The standardized aquarium system successfully supported the maintenance, growth, moulting and captive breeding of *Caridina hodgarti* throughout the six-month experimental period. Stable physico-chemical conditions, biological filtration and habitat enrichment collectively provided an environment conducive to normal physiological activities, resulting in high survival and successful reproduction under laboratory conditions.

### Water Quality Stability

Water quality remained highly stable throughout the study. The combination of biological filtration, reverse osmosis–tap water blending and scheduled partial water replacement effectively maintained all physicochemical parameters within the desired range (Table 4).

Mean water temperature was maintained at 23.9 ± 0.6°C, with only minor daily fluctuations (<0.5°C). The pH remained close to neutrality (7.0 ± 0.2), while total hardness averaged 61.8 ± 4.5 ppm, providing suitable mineral conditions for successful moulting and exoskeleton development. Dissolved oxygen remained consistently above 6.5 mg $L^{-1}$, whereas ammonia and nitrite concentrations remained below detectable stress levels throughout the experimental period. Nitrate concentrations never exceeded 20 mg $L^{-1}$, indicating efficient biological nitrification and effective routine maintenance. The stability of these parameters demonstrated the effectiveness of the aquarium design in maintaining a biologically balanced aquatic environment suitable for long-term culture of *C. hodgarti*.

### Survival and General Health

Following acclimatisation, the shrimp population

**Table 4.** Mean (±SD) water quality maintained in the aquarium system.

| Parameter | Observed Range | Mean ± SD |
|---|---|---|
| Temperature (°C) | 22.1 – 25.8 | 23.9 ± 0.6 |
| pH | 6.6 – 7.4 | 7.0 ± 0.2 |
| Total Hardness (ppm) | 52 – 73 | 61.8 ± 4.5 |
| Dissolved Oxygen (mg/L) | 6.5 – 7.8 | 7.1 ± 0.3 |
| Ammonia ($NH_3$) (mg/L) | <0.05 | 0.02 ± 0.01 |
| Nitrite ($NO_2$) (mg/L) | <0.10 | 0.06 ± 0.02 |
| Nitrate ($NO_3$) (mg/L) | 10 – 19 | 14.5 ± 2.1 |

**Table 5.** Survival performance of *Caridina hodgarti* under captive conditions.

| Survival parameter | Result |
|---|---|
| Experimental period | 6 months |
| Mean survival rate (%) | 92.3 ± 3.1 |
| Mortality phase | Initial acclimatisation |
| Survival thereafter | High and stable |

**Table 6.** Developmental stages and approximate duration of post-hatching growth in *Caridina hodgarti*.

| Developmental stage | Approximate duration |
|---|---|
| Newly hatched juvenile | Day 1 |
| Early juvenile | 3–4 weeks |
| Sub-adult | 6–7 weeks |
| Mature adult | 12–14 weeks |

exhibited a mean survival rate of 92.3 ± 3.1% over the six-month observation period. Most mortalities occurred during the initial acclimatisation phase and were associated with handling and transportation stress. After this period, survival remained consistently high. Healthy individuals displayed continuous grazing, regular swimming, active substrate exploration, normal moulting, no visible disease symptoms, and bright green body coloration. No significant disease outbreaks were observed during the experimental period (Table 5).

## Growth Performance

Juveniles exhibited continuous growth under the standardized husbandry conditions (Table 6).

Growth occurred uniformly throughout the population. Individuals receiving the mixed feeding regime appeared to exhibit brighter body coloration than shrimp maintained primarily on naturally occurring biofilm.

## Moulting Behavior

Regular moulting was observed throughout the study. Adult shrimp generally moulted every 25–32 days, while juveniles moulted more frequently. Successful moulting was characterized by: complete exuviae shedding, rapid recovery, immediate grazing behav-




**Fig. 6.** Experimental tank setup (A-D).
**A.** Complete aquarium set-up; **B.** Complete set-up tank (interconnected) with chiller; **C.** Aquarium set-up with plant soil substrate; **D.** Aquarium set-up with white sand substrate.

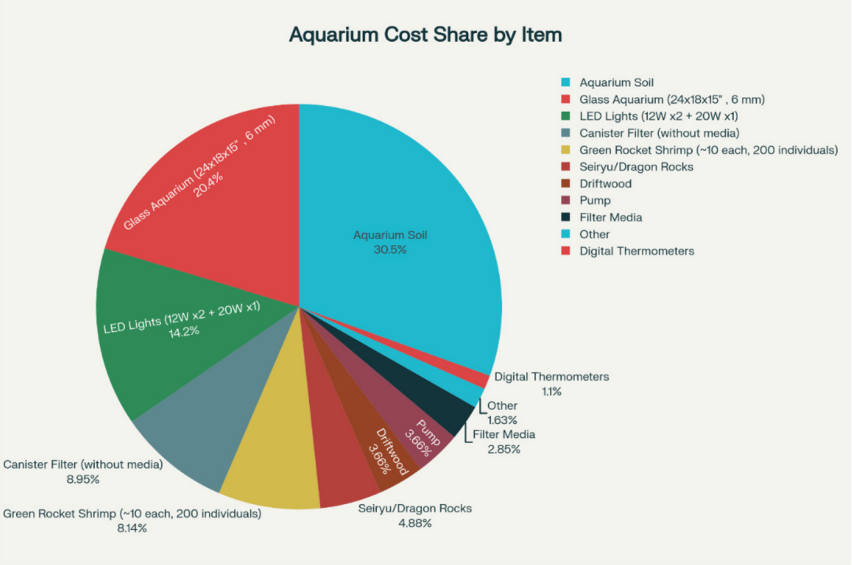



**Fig. 7.** Estimated Cost for Complete Setup (For two tanks).

ior, and normal locomotion. Less than 2% of shrimp exhibited incomplete moulting or exoskeletal deformities. The presence of natural refuges, leaf litter and stable water chemistry appeared to minimize moulting stress.

### Feeding Behavior

Shrimp actively grazed on: aquarium biofilm, driftwood, submerged rocks, decomposing almond leaves, cucumber, blanched vegetables, spirulina pellets. Natural grazing activity continued throughout the day, with peak feeding occurring during early morning and evening. Decomposing almond leaves supported extensive microbial colonization and remained heavily grazed for several weeks after introduction. Uneaten formulated feed was generally consumed within two hours, indicating good feed acceptance.

### Reproductive Performance

The first ovigerous females were recorded during the fifth week following stocking. Females carried approximately 60–80 eggs per clutch, with an incubation period of 22–24 days. Juvenile recruitment occurred regularly under the standardized environmental conditions. Mean post-hatch survival exceeded 85%, particularly in aquaria containing abundant aquatic vegetation, driftwood and rock crevices. Continuous breeding resulted in overlapping generations within the same aquarium after approximately three months of culture. These observations confirmed that the developed aquarium system was capable of supporting the complete reproductive cycle of *Caridina hodgarti* under captive conditions.

### Effect of Habitat Enrichment

Experimented Aquaria (Fig. 6) containing driftwood, Seiryu rocks, aquatic macrophytes and leaf litter demonstrated noticeably improved shrimp activity and juvenile survival. Habitat enrichment resulted in: increased grazing surfaces, enhanced refuge availability, improved juvenile retention, reduced behavioral stress, and improved reproductive success. Biofilm developed extensively on submerged hard surfaces and served as a continuous natural food source throughout the experimental period.

### Overall Performance of the Standardized Aquarium System

The integrated aquarium design maintained stable environmental conditions throughout six months of ob-

servation and successfully supported: high survival, healthy growth, regular moulting, continuous grazing behavior, successful reproduction, juvenile recruitment, and maintenance of water quality. Stable pH (6.8–7.3) and hardness (60–70 ppm) were maintained. Weekly water changes sustained ammonia and nitrite near-zero levels. Bacterial balance was evident from active biofilm grazing and lack of bloom. The lighting regime supported the maintenance of aquatic macrophytes and contributed to overall habitat stability. The system therefore provides a reliable protocol for captive breeding and conservation-oriented culture of *Caridina hodgarti*. A cost-effective tank setup (For 2 tanks) for sustainable *Caridina hodgarti* culture is summarised in Fig. 7.

## DISCUSSION

The present study successfully developed and standardized a biologically stable aquarium system capable of supporting the complete captive life cycle of *Caridina hodgarti* (Kemp 1913). High survival, regular moulting, successful reproduction and continuous juvenile recruitment over six months demonstrate that replicating the species' natural habitat is essential for successful captive maintenance and domestication. These findings agree with previous studies highlighting the importance of suitable environmental conditions and habitat complexity for freshwater ornamental shrimps (De Grave *et al.* 2008; De Grave and Fransen 2011; Kunjulakshmi and Prakash 2025).

Stable water quality was maintained throughout the study, with temperature, pH, dissolved oxygen, hardness and nitrogenous compounds remaining within suitable limits for atyid shrimps. The combination of reverse osmosis-treated water, weekly partial water replacement and efficient biological filtration effectively prevented ammonia accumulation and provided favorable conditions for survival, growth and reproduction, consistent with earlier reports (Jayachandran 2001; APHA *et al.* 2023).

The integrated sponge and canister filtration system efficiently maintained water quality while producing gentle water circulation similar to natural hill-stream habitats. The biological filter media supported nitrifying bacterial communities, ensuring effective ammonia removal and reducing physiological stress. Similar benefits of biologically mature filtration have been reported for freshwater decapods cultured in recirculating systems (Viau *et al.* 2012).

Habitat enrichment using driftwood, rocks, aquatic macrophytes and leaf litter created a structurally complex environment that provided shelter during moulting, reduced stress and enhanced juvenile survival. These substrates also promoted biofilm development, which served as a continuous natural food source. Previous studies have likewise demonstrated that biofilm-rich environments improve feeding efficiency, growth and welfare in ornamental freshwater shrimps (Maciaszek *et al.* 2023; Prati *et al.* 2024).

The feeding regime comprising Spirulina-enriched pellets, fresh vegetables and decomposing almond leaves closely matched the predominantly herbivorous-omnivorous feeding habit of *C. hodgarti,* which naturally grazes on algae, biofilm, plant detritus and associated microorganisms. Spirulina provides high-quality protein, vitamins, essential fatty acids and natural carotenoids that support normal growth, body coloration and reproductive performance, while decomposing leaf litter promotes microbial colonization and continuous biofilm development, providing a natural grazing substrate. The active grazing behavior observed throughout the study further emphasized the nutritional importance of naturally developed biofilms (Sirakov *et al.* 2012; Namaei Kohal *et al.* 2018).

The high post-acclimatisation survival demonstrated the effectiveness of gradual drip acclimatisation and careful environmental management. Mortality was largely confined to the initial adjustment period, whereas survival remained consistently high thereafter, supporting earlier observations in ornamental atyid shrimps (Nur and Christianus 2013). Regular moulting with very few unsuccessful events (<2%) further confirmed that the maintained water quality and mineral balance provided favorable conditions for normal exoskeleton formation (Jayachandran 2001; Namaei Kohal *et al.* 2018).

Successful reproduction, indicated by the appearance of berried females within five weeks, normal

embryonic development and continuous juvenile recruitment, confirmed that the aquarium system effectively supported the complete reproductive cycle of *C. hodgarti*. The occurrence of overlapping generations after three months demonstrates the feasibility of closed-cycle captive propagation under controlled conditions, consistent with previous studies on atyid shrimp reproduction (Lakshmi 1975; Soomro *et al*. 2011).

The standardized aquarium system has significant implications for conservation aquaculture and the ornamental fish industry. Captive propagation can reduce dependence on wild populations threatened by habitat degradation and overexploitation while supporting ex situ conservation, restocking programmes and sustainable commercial production. The protocol also offers opportunities for diversifying indigenous ornamental shrimp culture, improving animal welfare and reducing disease risks associated with wild collection (Maceda-Veiga *et al.* 2013; Maciaszek *et al*. 2023; Prati *et al.* 2024; Kunjulakshmi and Prakash 2025).

Overall, the present study demonstrates that successful captive breeding of *Caridina hodgarti* depends on the integration of stable water quality, efficient biological filtration, habitat enrichment and balanced nutrition. The standardized aquarium protocol provides a practical and scientifically validated foundation for future conservation, research and sustainable commercial culture of this indigenous ornamental freshwater shrimp.

## CONCLUSION

The present study successfully developed and standardized an aquarium system capable of supporting the complete captive life cycle of the indigenous freshwater ornamental shrimp *Caridina hodgarti* (Kemp 1913). Stable water quality, efficient biological filtration, habitat enrichment and balanced nutrition provided favorable conditions for high survival, regular moulting, successful reproduction and continuous juvenile recruitment under captive conditions. The maintenance of optimum physicochemical parameters, together with the use of aquatic macrophytes, driftwood, rocks and leaf litter, promoted biofilm development, natural grazing behavior and improved juvenile survival. The occurrence of berried females, normal embryonic development and continuous recruitment confirmed that *C. hodgarti* can complete its reproductive cycle under carefully simulated natural conditions. The standardized aquarium protocol provides a practical and reproducible model for laboratory research, ornamental shrimp culture and conservation aquaculture. Its adoption can reduce dependence on wild populations, thereby supporting sustainable utilization and *ex situ* conservation of this indigenous species. The protocol may also serve as a reference for captive breeding of other freshwater atyid shrimps with similar ecological requirements.

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## REFERENCE

APHA, AWWA., & WEF. (2023). Standard Methods for the Examination of Water and Wastewater (24th ed.). American Public Health Association, American Water Works Association and Water Environment Federation, Washington, DC.

De Grave, S., Cai, Y., & Anker, A. (2008). Global diversity of shrimps (Crustacea: Decapoda: Caridea) in freshwater. *Hydrobiologia*, 595, 287–293. https://doi.org/10.1007/s10750-007-9024-2

De Grave, S., & Fransen, C. H. J. M. (2011). Carideorum Catalogus: The recent species of the dendrobranchiate, stenopodidean, procarididean and caridean shrimps. *Zoologische Mededelingen*, 85, 195–589.

Han, C. C., Hsu, K. C., Fang, L. S., Cheng, I. M., & Lin, H. D. (2019). Geographical and temporal origins of *Neocaridina* species (Decapoda: Caridea: Atyidae) in Taiwan. *BMC Genetics*, 20: 86, 1-15. https://doi.org/10.1186/s12863-019-0788-y

Jabłońska, A., Mamos, T., Gruszka, P., Szlauer Łukaszewska, A., & Grabowski, M. (2018). First record and DNA barcodes of the aquarium shrimp, *Neocaridina davidi*, in Central Europe from the thermally polluted River Oder canal. *Knowledge and Management of Aquatic Ecosystems*, 419, 14. https://doi.org/10.1051/kmae/2018004

Jayachandran, K. V. (2001). Palaemonid Prawns: Biodiversity, Taxonomy, Biology and Management, *Aquaculture International*, 9(6):545-548. https://doi.org/10.1023/A:1020581119018

Kemp, S. (1913). Zoological results of the Abor Expedition, 1911–1912. XX. Crustacea Decapoda. *Records of the Indian Museum*, 8, 289–310.

Kunjulakshmi, K., & Prakash, S. (2025). Review of research trends and gaps in the biology of freshwater shrimps of the genus *Caridina* H. Milne Edwards, 1837 (Decapoda: Caridea: Atyidae). *Journal of Crustacean Biology*, 45(2), article ruaf023. https://doi.org/10.1093/jcbiol/ruaf023

Lakshmi, S. (1975). Early larval development of Caridina sp. (Crustacea, Decapoda, Atyidae). *Indian Journal of Fisheries*, 22(1–2), 68–79.

Maceda-Veiga, A., Escribano-Alacid, J., De Sostoa, A., & García-Berthou, E. (2013). The aquarium trade as a potential source of fish introductions in south-western Europe. *Biological Invasions*, 15, 2707–2716. https://doi.org/10.1007/s10530-013-0485-0

Maciaszek, R., Świderek, W., Prati, S., Huang, C.-Y., Karaban, K., Kaliszewicz, A., & Jabłońska, A. (2023). Epibiont cohabitation in the freshwater shrimp *Neocaridina davidi*, with the description of two species new to science, *Cladogonium kumaki* sp. nov. and *Monodiscus kumaki* sp. nov., and redescription of *Scutariella japonica* and *Holtodrilus truncatus*. *Animals*, 13, 1616. https://doi.org/10.3390/ani13101616

Namaei Kohal, M., Esmaeili Fereidouni, A., Firouzbakhsh, F., & Hayati, I. (2018). Effects of dietary incorporation of Arthrospira (Spirulina) platensis meal on growth, survival, body composition and reproductive performance of red cherry shrimp *Neocaridina davidi* (Crustacea, Atyidae) over successive spawning. *Journal of Applied Phycology*, 30, 431–443. https://doi.org/10.1007/s10811-017-1220-5

Nur, F. A. H., & Christianus, A. (2013). Breeding and life cycle of *Neocaridina denticulata sinensis* (Kemp, 1918). *Asian Journal of Animal and Veterinary Advances*, 8, 108–115. https://doi.org/10.3923/ajava.2013.108.115

Prati, S., Grabner, D. S., Hupało, K., Weiperth, A., Maciaszek, R., Lipták, B., Bojko, J., Bérces, F., & Sures, B. (2024). Invisible invaders: range expansion of feral *Neocaridina davidi* offers new opportunities for generalist intracellular parasites. *Biological Invasions*, 26: 2499–2523. https://doi.org/10.1007/s10530-024-03324-3

Sirakov, I., Velichkova, K., & Nikolov, G. (2012). The effect of algae meal (Spirulina) on the growth performance and carcass parameters of rainbow trout (*Oncorhynchus mykiss*). *Journal of BioScience and Biotechnology*, Special Edition, 151–156.

Soomro, A. N., Suzuki, H., Kitazaki, M., & Yamamoto, T. (2011). Reproductive aspects of two atyid shrimps, *Caridina sakishimensis* and *Caridina typus*, in headwater streams of Kikai-jima Island, Japan. *Journal of Crustacean Biology*, 31(1), 41–49.

Tiwari, K. K., & Pillai, R. S. (1971). Atyid shrimps of the genus *Caridina* H. Milne Edwards, 1837, from the Andaman Islands (Decapoda, Caridea). *Crustaceana*, 21(1), 79–91.

Viau, V. E., Ostera, J. M., Tolivia, A., Ballester, E. L. C., & Rodríguez, E. M. (2012). Contribution of biofilm to water-quality maintenance, survival and growth of juveniles of the freshwater crayfish *Cherax quadricarinatus. Aquaculture*, 324–325, 70–78.