PAROSPHROMENUS
INDONESIA

BREEDING MANUAL FOR **PAROSPHROMENUS SPECIES 2025**

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Parosphromenus Indonesia

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Introduction

This manual was created as a practical breeding guide for Indonesian enthusiasts or professional breeders interested in breeding *Parosphromenus* species. The project began after a conversation with an Indonesian friend who was seeking advice on how to breed these fish. While many *Parosphromenus* species are native to Indonesia, it is striking that local participation in ex-situ conservation projects is limited. This guide seeks to empower Indonesian aquarists by offering accessible knowledge and encouragement, whether the goal is conservation or developing an alternative source of income.

This guide has no academic ambitions and is primarily based on practical experience. The focus is on intensive breeding methods, setting them in contrast with extensive breeding. It aims to present a realistic breeding protocol that can be achieved with limited resources, provided the breeder is committed.

Parosphromenus species, like many other Osphronemids (e.g., *Betta*, *Trichogaster*), exhibit highly specialised reproductive strategies. While all share the labyrinth organ, some are bubble-nesters and others are mouth-breeders. *Parosphromenus* belongs to the first category. The mating process is not much different from betta species from the coccina complex. *Parosphromenus* males construct nests inside confined spaces where they incubate the eggs and care for the brood for around 10 days. They require specific water conditions for successful spawning and egg development, the water must be soft and acidic. Their clutch sizes are rather small, parental care is meticulous, and the fry are sensitive to environmental changes. The fry are not fast growers, and need a lot of tiny live food to thrive.

Biology, Behaviour and Reproduction in the Wild

Figure 1: A. *Parosphromenus juelinae* habitat; **B.** Degraded *P. deissneri* habitat. Photo credit: Benjamin Sécher

In their natural habitat, *Parosphromenus* species are found in highly specialised ecosystems, the acidic blackwater peat swamps of Sundaland (mainly in Peninsular Malaysia, Borneo, and Sumatra). These habitats are characterised by extremely low pH values, often between 3.0 and 5.0, minimal ionic content with conductivity below 30 µS/cm, and water temperatures ranging from 25 to 29°C. The water is often stained dark by humic substances and tannins leached from decomposing leaf litter and organic material, creating a light-limited and structurally complex environment (Kottelat & Lim, 1992; Parosphromenus Project, 2020).

In the wild, Parosphromenus feed on a variety of small aquatic invertebrates such as chironomid larvae, micro-crustaceans (e.g., copepods, ostracods), and juvenile shrimp. Their feeding strategy is visual and selective, relying on sudden strikes to capture prey in the leaf litter and detritus-rich substrate.

Reproductive behaviour is species-specific but follows a common pattern. Males establish territories around small cavities, often composed of leaves, root tangles, or submerged detritus, and construct rudimentary bubble nests in a cavity. During courtship, males display vivid iridescent colours and engage in ritualised fin displays,

postures, and movement patterns to attract females. Once spawning occurs, the male takes on sole responsibility for brood care, guarding the eggs and later the larvae, which remain attached to the nest ceiling for several days (Linke, 2009; Hallmann, 2012).

Unfortunately, detailed observations of Parosphromenus in the wild remain rare. Many species are known only from a few localities, and their behaviour in situ is largely inferred from aquarium studies. As it has been highlighted by The Parosphromenus Project, there is an urgent need for field-based ethological studies to better understand their natural social dynamics, microhabitat preferences, and breeding behaviour under undisturbed conditions.

Species Choice

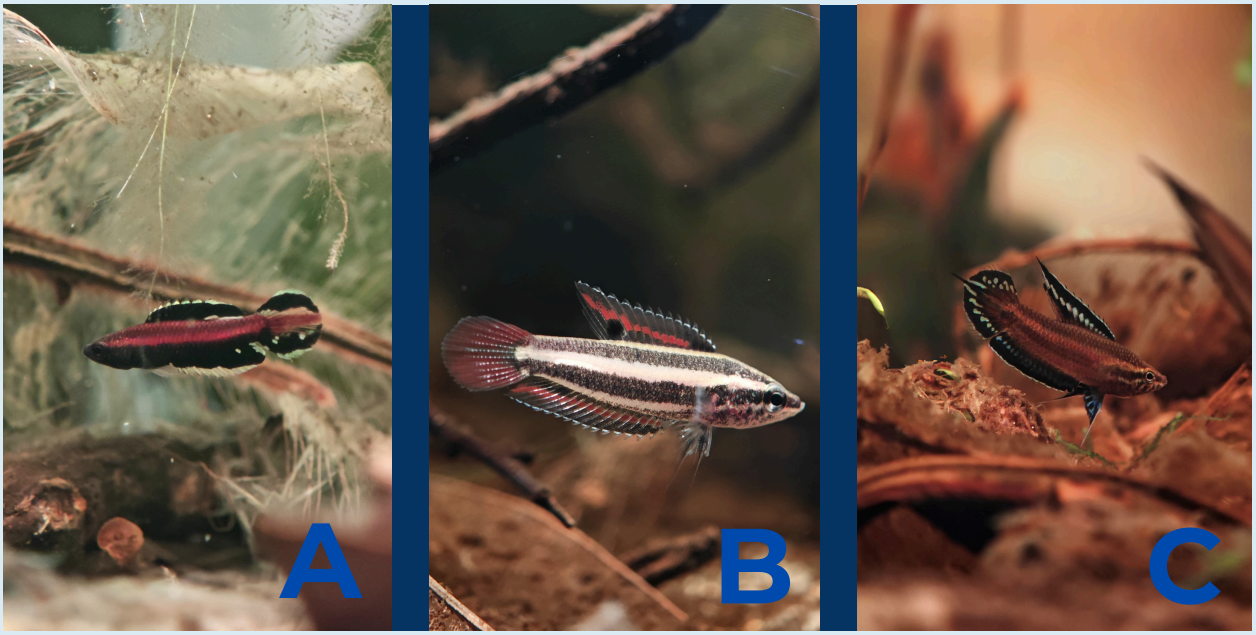


Figure 2: A. *Parosphromenus ornaticauda*, **B.** *Parosphromenus sumatranus*, **C**. *Parosphromenus deissneri.* Photo credit: Claudio Serna .

When breeding *Parosphromenus*, choosing species is not always easy. Availability is most of the time the first criteria. Even though most species are endangered in the wild, for conservation purposes, it is best to prioritise critically endangered species such as *P. quindecim*, *P. kishii*, *P. ornaticauda*, *P. phoenicurus* or *P. deissneri,* for example.

Identifying species correctly can be difficult. To avoid mixing populations or spreading undocumented fish, only breed individuals from known localities. Never mix fish from different locations, especially if your intent is conservation.

Some species like P. parvulus and P. ornaticauda are considered to be more challenging to breed, while P. linkei, P. pahuensis, and P. quindecim are generally easier. Regardless of the species, breeding Parosphromenus species is a challenge, success depends on meeting key requirements, especially water parameters and dietary needs.

Setup

Tank Size

To breed *Parosphromenus* intensively, it is always preferable to use two tanks per pair to maximise fry survival. A 20 to 30-litre tank is sufficient for housing a breeding pair, while a second tank should be dedicated to raising the fry. Although 20 litres can be enough, larger tanks offer greater stability and provide more space for fry to grow. If you intend to breed them extensively and allow the fry to grow alongside the parents, a minimum of 30 litres is recommended.

Substrate

Bare-bottom or inert sand substrates can be used. In my opinion, leaf litter is essential; it mimics the natural habitat, provides hiding places, supports the development of micro-fauna, and releases humic acids that help lower or maintain a low pH. It also contributes to the fish's sense of security. A small amount of leaf litter is sufficient, and local leaf species can be used. Exercise caution with Indian almond leaves, as they are often collected near coastal areas and may contain excessive salt, requiring preparation before use. To further lower pH, peat can also be used.

Decor

For breeding, spawning caves (made of PVC, clay, or similar materials) are essential. Fish prefer caves that are open on one side only. These caves can be placed on the substrate or suspended, offering both options can increase the likelihood of a successful spawning. At least two caves per tank are recommended to give the pair a choice and maximise breeding success. Placement is important: caves should be positioned where they are easily visible to the breeder; otherwise, monitoring the spawning process becomes difficult.

Other decorations are not strictly necessary but can be included in extensive breeding setups. Driftwood is a good option, while rocks should be avoided as they may alter water hardness. Some aquatic plants may be used, though many do not tolerate soft, acidic water. Floating plants are a practical compromise—they typically thrive in such conditions and help reduce light intensity.

Filtration

A sponge filter with minimal flow is preferred. For a single pair, a filter may not be necessary if water changes are regular and bioload is low.

Lighting

Dim, indirect light is best. No direct lighting is needed—ambient room light is usually enough. Aquarium lights are often too strong for paros, especially for fry, which tend to fear light during the first two months. In the wild, Parosphromenus usually remain hidden among structures like leaves and driftwood, and rarely venture into open water. Having a light on the tank is more for the breeder's convenience than for the fish's well-being—unless there is no light at all in your fish room.

Water Parameters

Parameter	Recommended Range
Temperature	24–28°C (max 30°C)
pH	3.0–6.0 (species-specific)
Conductivity	Ideal <30 µS/cm Acceptable <70 µS/cm
Hardness	0–1 dGH / dKH

Use RO water and leaf litter or peat for acidification. If you don't have access to RO water, rainwater can be used, provided you don't live in a heavily polluted area. Active acidification using chemical products is possible but requires experience and knowledge; it is therefore not recommended unless absolutely necessary. Achieving

the right water parameters is essential for breeding Parosphromenus. Some species, such as P. linkei or P. pahuensis, are more tolerant than others. A drop in conductivity often triggers spawning behaviour. However, maintaining both a low pH and low conductivity at the same time is not easy, as organic matter tends to raise conductivity. To achieve this balance, start by using a decent amount of botanicals and/or peat to lower the pH. Once the tank is established, increase water changes with RO water to gradually bring down the conductivity without drastically affecting the pH. Keep in mind that low conductivity makes pH more unstable, so proceed with care. This requirement can be challenging for beginners, but with proper preparation and dedication, it is entirely manageable.

Understanding Water Chemistry

Understanding water chemistry is crucial when aiming for soft and acidic conditions in a breeding tank. Soft water means low mineral content (low concentrations of calcium, magnesium, and other dissolved ions), often reflected by low conductivity, while acidic water has a low pH. Meaning it has a higher concentration of hydrogen ions (H^+) compared to neutral or alkaline water. This increased acidity can result from natural processes like the breakdown of organic matter (such as leaf litter or peat) that release organic acids. Acidic water often has a lower buffering capacity, making it more sensitive to changes in pH.

Achieving both simultaneously can be challenging because natural organic materials like leaf litter or peat lower pH but may increase conductivity. Using reverse osmosis (RO) or clean rainwater helps reduce minerals and maintain softness. Gradual water changes with RO water can lower conductivity without causing sudden pH swings. Careful balance and patience are key to creating a stable environment that encourages successful breeding.

Diet

Feeding *Parosphromenus* species is considered challenging, as most individuals accept only live food (Kopic, 2012). After a period of acclimation, some may take frozen food, but reliance on frozen diets is not recommended. Live prey is essential for maintaining fish health and promoting successful reproduction. Therefore, keeping *Parosphromenus* typically involves culturing live foods alongside the fish. Adults thrive on live Daphnia, Artemia nauplii, cyclops, mosquito larvae, Grindal worms, and more. On rare occasions, certain individuals might accept dry food.

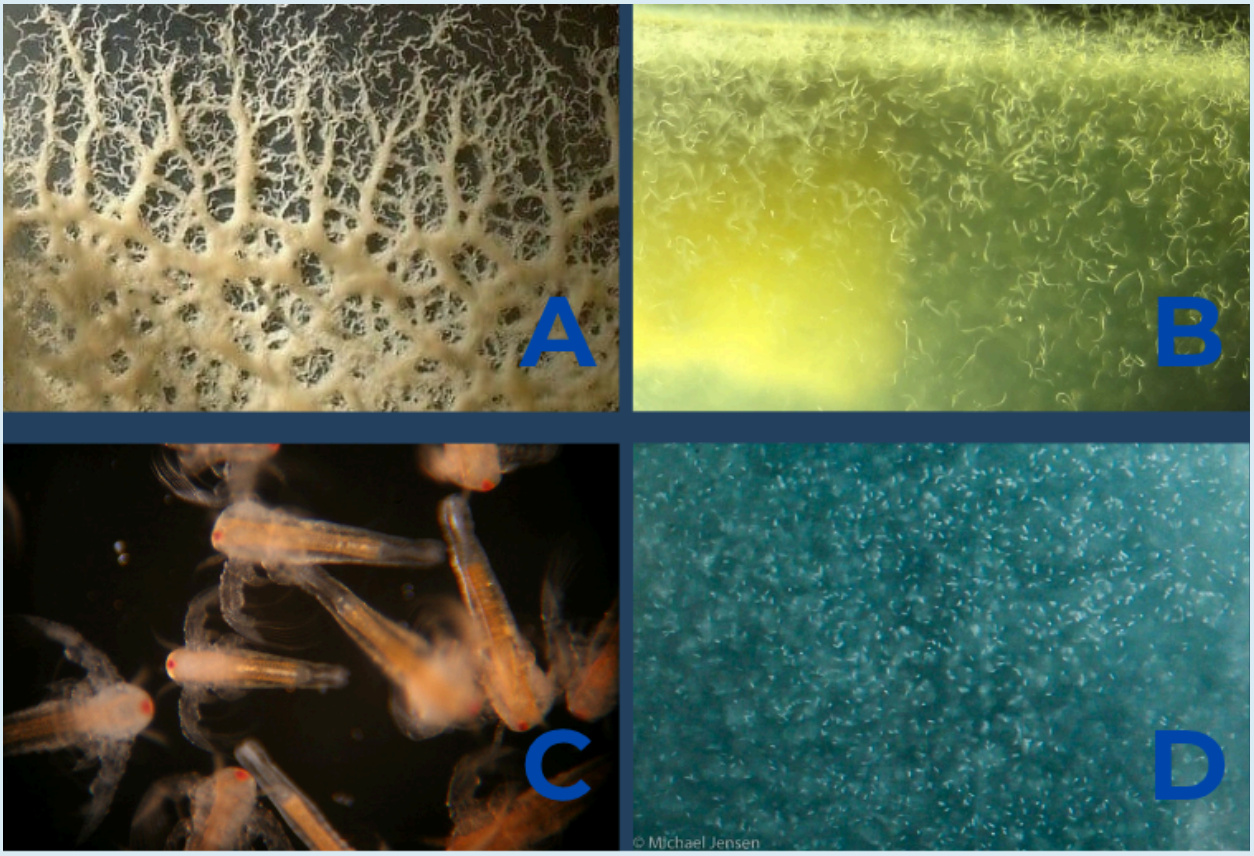


Figure 3: A. Microworms, **B.** Vinegar eels, **C**. Artemia nauplii, **D**. Infusoria. Photo credit: JBL, Alfredo Eloisa and Michael Jensen.

Feeding fry is challenging because Parosphromenus fry grow slowly and initially require very small live foods such as microworms, vinegar eels, or infusoria. After approximately two to three weeks, fry generally begin accepting Artemia nauplii.

- **Adults**: Live(or frozen) Daphnia, Artemia nauplii, cyclops, mosquito larvae, grindal worms, chopped blackworms.
- **Fry**: Micro-worms, vinegar eels, infusoria, and later Artemia nauplii.

Conditioning Fish

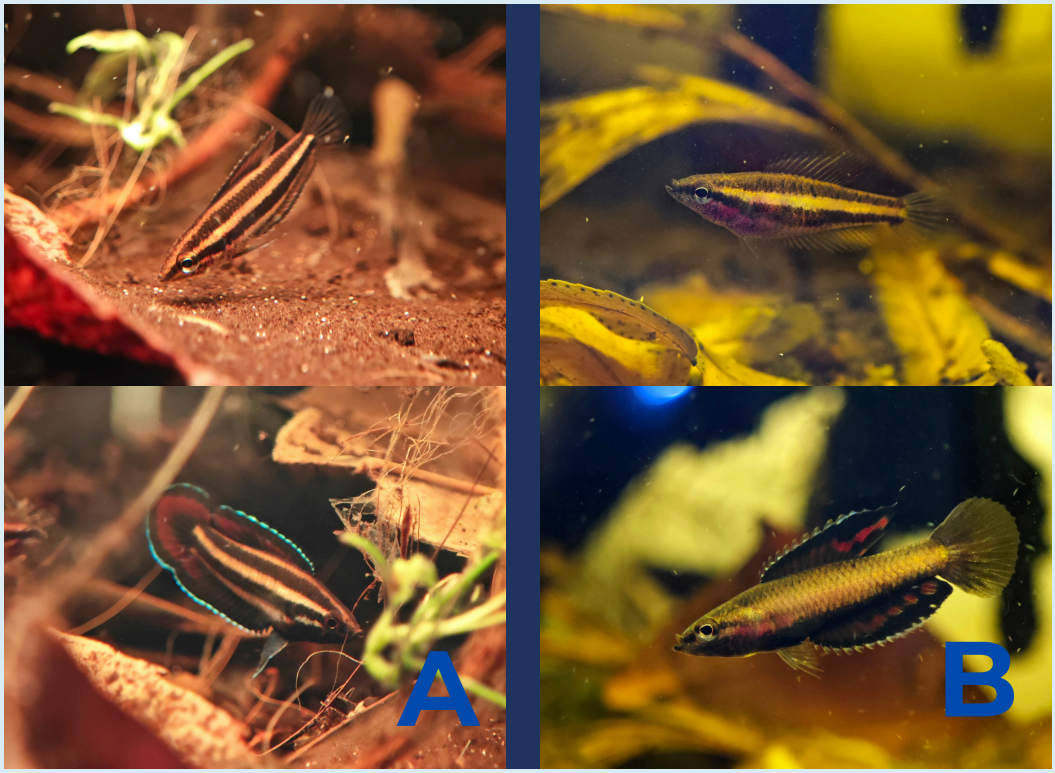


Figure 4: A. Female & Male *P. cf. phoenicurus*, **B**. Female & Male *P. parvulus*. Photo credit: Claudio Serna

To condition the fish for breeding, live food should be offered daily over the course of several weeks. This rich diet will stimulate females to begin egg production, though it may take anywhere from a few days to a few weeks before a female is fully ready to spawn. Males should also be conditioned, as they may stop feeding for several days while incubating and guarding the brood. A feeding frenzy, triggered by the sudden abundance of live food, will often help initiate courtship behaviours.

To maximise breeding success, sexes could be separated prior to pairing. However, the male must be given enough time to establish a territory before introducing the female into his tank—this step significantly increases the likelihood of successful spawning. For practical reasons, many breeders will prefer to condition both fish together directly in the breeding tank.

To simulate rainy season conditions and trigger spawning, the breeder should gradually lower both conductivity and pH (if necessary) through repeated water changes, while simultaneously increasing the quantity of live food offered.

Reproduction

Ensure that you have both male and female specimens, and select only healthy individuals free from deformities for breeding purposes. Breeding *Parosphromenus* being quite challenging, it is recommended to work with multiple pairs, not only to increase the chances of success but also to maintain healthy genetic diversity for conservation purposes.

Territory, Parade and Mating

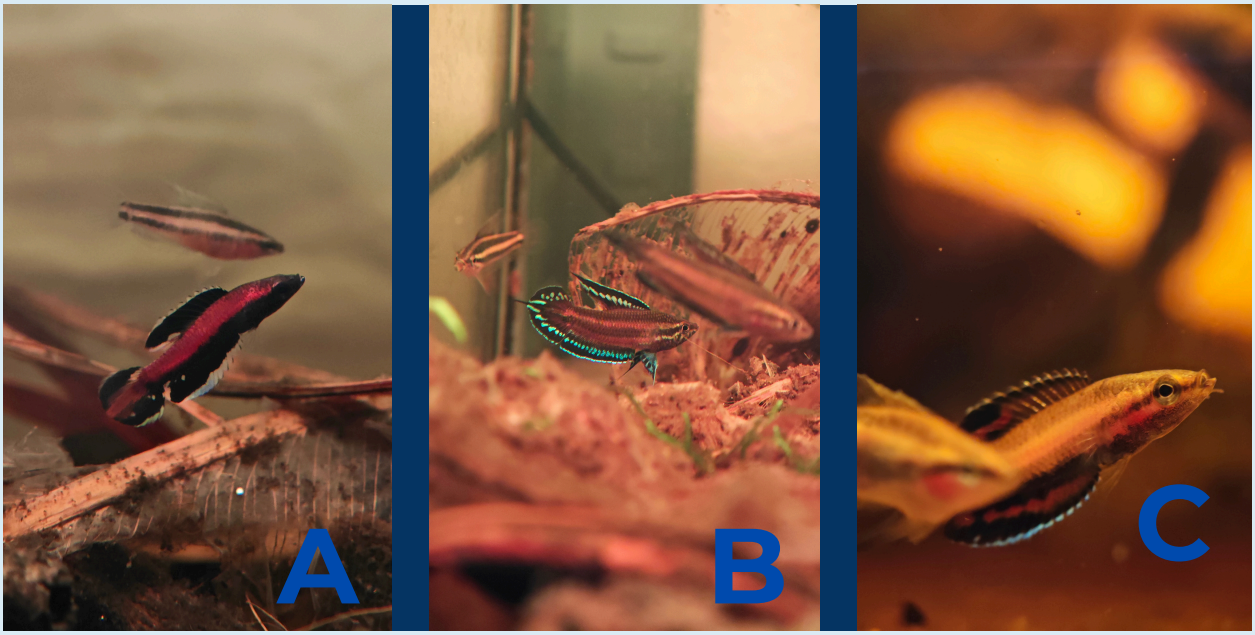


Figure 5: A. *P. ornaticauda* displaying, **B.** *P. deissneri* displaying, **C.** P. *parvulus* displaying. Photo credit: Claudio Serna

First, males will establish a territory and select a cave for nesting. This process may take just a few hours, but it can also last several days if conditions are not ideal. Once ready, males will begin courtship, displaying intensified colouration and spreading their fins to attract the female. If receptive, the female will also change colouration, typically adopting a uniform pale robe. A distinct and easily observed sign in many species is the appearance of the “sexy eye”, a vertical black band in the iris, often more pronounced in females and usually indicating that spawning is imminent.

Courtship behaviour varies somewhat between species but generally includes chasing, circling, and fin displays (lateral or head-down posturing). When a pair bonds and conditions are favourable, they will often spawn repeatedly over time (Goodwin et al., 2024). In well-established pairs, the female may even initiate the courtship.

Figure 6: A. Female *P. phoenicurus* with sexy eyes, **B.** Male *P. quindecim* with sexy eyes. Photo credit: Claudio Serna & Laurie Cattiaux

While the courtship sequence follows a similar pattern across most species, the specifics of the display can vary. For instance, in *P. parvulus* and *P. ornaticauda*, neither sex shows the typical 'sexy eye', and males of these species approach females from above, which is uncommon among *Parosphromenus* (Hallmann, 2012).

Nest and Incubation

Figure 7: A., **B.** & **C.** Pair of *P. nagyi* spawning in a cave. Photo credit: David Jones - The Parosphromenus Project

The nest, sometimes consisting of only a few bubbles, will be built at the ceiling of a horizontal or slightly inclined cave. The quality of the nest will depend more on the individual male than on the species. During mating, the fish will perform a spawning embrace similar to that of Betta species.

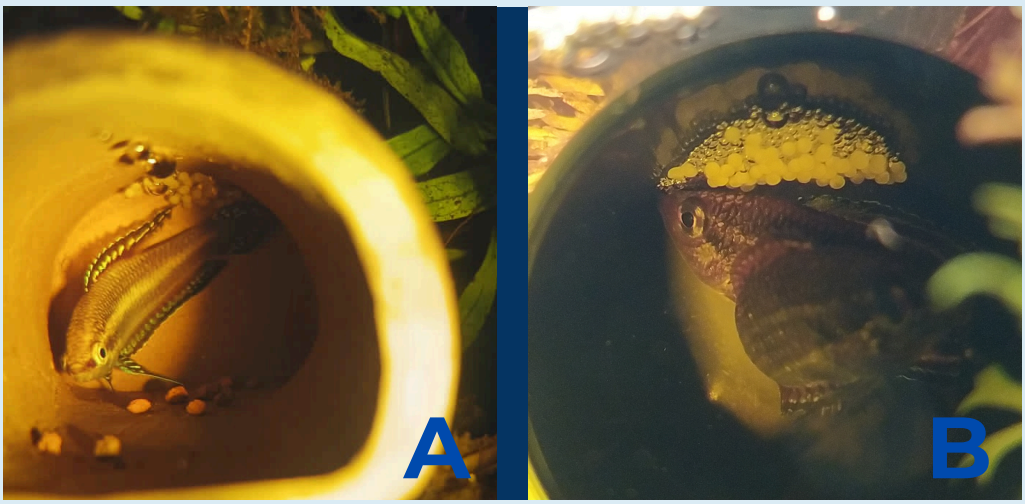


Figure 8: A. Male *Paroshromenus deissneri* protecting a nest, **B.** Pair of *P. quindecim* in the nest. Photo credit: Sylvain Mathieu & Laurie Cattiaux

Eggs will be collected and carefully placed in the nest by one or both partners. The number of eggs can vary greatly depending on the species and individual, ranging from just a few to around 150 in *P. nagyi* (Kopic, 2012), though such high counts will be rare.

Following spawning, the male will take over all parental duties. He will guard the eggs, tending them and fanning them to ensure proper oxygenation. The female will typically be chased away from the nest after spawning. Depending on water temperature, the eggs will hatch within one to two days.

Hatching

Eggs will hatch within 1–2 days, after which the larvae will remain attached to the ceiling of the nest for approximately 5–6 days. During this period, they will undergo several developmental stages. Initially, the larvae will appear transparent or whitish and will be extremely sensitive—they would not survive without the care of the male.

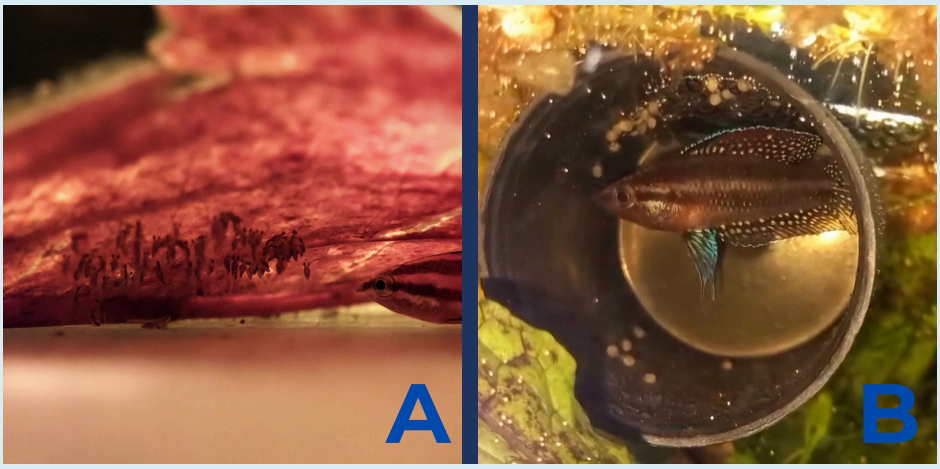


Figure 9: A. Nest with fry hanging under a leaf, **B.** Male proctecting a nest with young larvae Photo credit: Claudio Serna & Alain Leroy

As they develop, they will begin to darken, show signs of movement, and eventually start swimming within the cave area. Throughout this time, the male will tend to the brood by repositioning any larvae that fall from the ceiling, often staying within the nest unless disturbed.

For those considering artificial rearing, the ideal time to remove the cave is just before the fry become free-swimming, typically on day 6 or 7 post-spawning. Once ready, the fry will detach from the ceiling and begin to leave the cave. This process may occur over 1 or 2 days and not necessarily all at once. At this stage, they will be weak swimmers with an erratic swimming pattern and will mostly remain near the bottom of the tank. The fry will still be fairly small and appear highly sensitive to light. Because they are cryptic by nature and spend most of their time hiding, they can be difficult to detect in the aquarium for an extended period, sometimes up to two months. For this reason, and based on experience, removing the brood just before the free-swimming stage is often more practical for monitoring and care.

Development and Raising Fry

Figure 10: Fry's stages of development. Photo credit: Claudio Serna & Benjamin Sécher

If you think achieving a successful spawn will be the most difficult part of the process, you may be mistaken. Raising the fry will require not only a steady supply of live food but also a great deal of patience. Compared to most Betta species, Parosphromenus grow significantly more slowly.

After becoming free-swimming, typically around 5 to 7 days post-hatching, the fry will still rely on their yolk sac for an additional 1 to 2 days and will not begin active feeding immediately. To stay on the safe side, small quantities of first food can be introduced at this stage, though this may be unnecessary in a well-established tank rich in leaf litter, where microfauna are naturally present. Suitable first foods will include infusoria, vinegar eels, and microworms, with the latter being especially effective as they remain near the bottom, where fry tend to forage.

Depending on species and water temperature, fry might begin accepting Artemia nauplii after 7–10 days, though it is not uncommon for them to require up to 15 days before being able to handle this food. As the fry grow, larger prey such as Daphnia or Moina can gradually be introduced, often after about one month.

Raising Parosphromenus fry will be a test of patience, for some reason their growth doesn't seem to be uniform from one batch to another with seemingly identical conditions. In some cases, it can take up to six months for juveniles to reach a decent size. Compared to other osphronemid species, Parosphromenus are consistently slower-growing—a phenomenon not yet fully understood and in need of further study.

As expected, the fry will be sensitive to current, ammonia, inadequate feeding, and poor water quality. However, they are not as fragile as they might appear. Once past the initial stages, mortality tends to be relatively low if conditions are appropriate.

Sexing juveniles is not always easy. It is advisable to wait until the sub-adult stage to make reliable identifications. Some individuals may show signs of aggressive or territorial behaviour early on, but these are not definitive indicators of sex. As in many other species bred in captivity, sex ratios will often be skewed toward males, although no formal studies have yet confirmed this observation.

Intensive Breeding Protocol

Requirements

Two tanks: One for the breeding pair and another for growing out the fry.

Caves: At least two, to give the male options when selecting a nesting site.

Leaf litter and/or peat: To naturally lower the pH, support microfauna development (a food source for fry), and provide shelter.

Water testing equipment: A reliable conductimeter and pH meter (or at minimum, accurate drop tests).

Appropriate water: Soft and acidic water matching the specific needs of *Parosphromenus* breeding.

Live food cultures: A variety of live foods is essential for both adult nutrition and to meet the changing needs of fry as they grow. Options could include infusoria, vinegar eels, microworms, *Artemia* nauplii, *Daphnia*, and others as needed.

Estimated Duration

From conditioning the pair to raising juveniles to a sexable size, the full breeding project may take approximately **9 months**. This timeline includes:

- Tank cycling
- Several weeks of conditioning
- Courtship and spawning
- Hatching and early fry development
- A prolonged rearing phase, as *Parosphromenus* species are notably slow-growing

Protocol

1. Tank Cycling and Setup

Begin by preparing and cycling the required number of tanks with soft, acidic water. You will need one breeding tank per pair and at least one dedicated grow-out tank for the fry. Each breeding setup should include leaf litter, a couple of suitable caves, and meet the target water conditions necessary to trigger natural spawning behaviours.

It is highly recommended to prepare both tanks simultaneously and in the same way, ensuring stable conditions and making water maintenance easier. The only exception is that caves are not strictly necessary in the grow-out tank, though leaf litter remains beneficial.

Allow approximately 1 month to fully cycle and stabilise the tanks before introducing the breeding pair.

Target water parameters: pH: 4-5, Conductivity: <50µS/cm, Hardness 0-1dGH / dKH

2. Conditioning and Territory Establishment

Introduce the pair into the breeding tank. Both fish may be introduced simultaneously before conditioning begins, or alternatively, the female can be introduced later, after the male has established his territory. In either case, it is essential to allow the male sufficient time to claim a territory and select a nesting site, typically within one of the provided caves.

Fish can be conditioned either together or individually, although conditioning them together in the breeding tank is often more practical and ensures the male has already established a territory when the female is ready to spawn.

Over the course of the next two weeks, provide daily feedings of high-quality live food to condition both fish. By the end of this period, the female should appear visibly plump and full of eggs, signalling readiness to spawn.

Time estimation: 2 weeks

3. Courtship and Mating

Continue to feed the pair generously with live food while monitoring for signs of courtship. If environmental conditions are optimal, spawning should occur shortly after courtship begins. In some cases, a large water change combined with a heavy live feeding can act as a trigger, mimicking natural environmental cues such as rainfall.

The male may construct the nest before initiating courtship, although in some cases, nest building may only begin once mating behaviours are underway. Spawning itself can take several hours, as the pair engages in multiple embraces and transfers of eggs to the nest.

Time estimation: 1-3 days

4. Incubation and Fry Development

After spawning, the male will assume full responsibility for egg and larval care. Eggs typically hatch within 1 to 2 days, depending on temperature. The resulting larvae remain attached to the ceiling of the nest for approximately 5 to 6 days, during which they are largely immobile and highly dependent on the male's care.

Larvae are usually firmly attached to the nest ceiling and only begin to move once they approach the free-swimming stage. During this period, the male rarely leaves the cave, even at feeding times, making cave placement important for observation and monitoring.

It is generally unnecessary to remove the female, as she typically keeps her distance from the nest and does not interfere with parental care.

Time estimation: 7-8 days.

5. Cave Removal Prior to Free-Swimming Stage

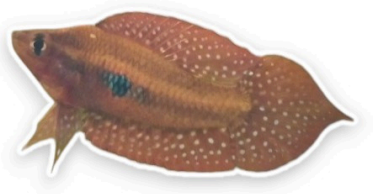
At around day 6 or 7 post-spawning, just before the fry become free-swimming, the cave should be removed if your goal is to grow the broodstock intensively. This step is important because, once the fry begin to leave the nest, there is a risk of predation by the parents, especially in smaller or relatively bare setups.

It is crucial not to remove the cave too early, as newly hatched larvae are fragile and reliant on stable conditions. However, delaying too long risks losing fry to parental predation.

To remove the cave safely:

- Submerge a small container in the breeding tank and gently transfer the cave into it underwater to avoid exposing the larvae to air.
- If the cave has only one opening, it can be sealed during transfer using a hand or a flat piece of plastic to prevent escape or damage.
- The most delicate part of the process is encouraging the male to leave the cave beforehand, which may require patience or gentle coaxing.

Once transferred, place the cave into a separate grow-out tank with similar water parameters.



6. Repeating the Breeding Cycle

Stages 2 to 5 (conditioning, courtship, spawning, and early development) can be repeated with the same breeding pair if the initial attempt was successful. However, it is important to allow sufficient recovery time for both the male and female. If the pair is not properly reconditioned between spawnings, the size and viability of subsequent egg clutches may decrease.

When spawns occur close together, and the size difference between fry is minimal, new batches can often be raised alongside older siblings in the same grow-out tank. Care should still be taken to monitor for competition or predation among different age groups.

7. Feeding Progression: From First Bites to Juvenile Growth

After leaving the nest, fry are not immediately ready to feed, as they continue to absorb nutrients from their yolk sacs for 1–2 days. Nevertheless, it is wise to have live food available in advance. In tanks rich in micro-fauna—thanks to leaf litter or biofilm—fry may begin to forage naturally on microorganisms.

At this early stage, fry will only accept tiny live food such as microworms, vinegar eels, or infusoria. These should form the core of their initial diet. Artemia nauplii may be introduced after around 10 days, but only in small amounts, as not all fry will be able to handle them that early.

If you rely on wild-collected live food like Moina, Daphnia, or Cyclops, keep in mind that fry can only consume the smallest individuals. These prey types become more appropriate after 3–4 weeks, once the fry have grown significantly. Until then, consistent feeding with appropriately sized food is essential to ensure uniform growth and low mortality.

8. Maintain Water Quality and Consistent Feeding.

To grow *Parosphromenus* fry, patience is key. It’s important to feed them regularly; twice a day works best, but once a day can also be enough. The more you feed, the higher the risk of water pollution, so keeping the water clean is very important. Unless the tank is very crowded, young *Parosphromenus* don’t produce much waste. Water changes should still be done regularly, but not too often. Make sure the new water has the same pH, conductivity, and temperature as the tank. Keeping water conditions stable is more important than changing water too frequently.

Fry grow slowly, and you'll need to care for them consistently for about six months before the juveniles are large enough to be sold or reliably sexed.

Conclusion

Breeding *Parosphromenus* species requires a high level of precision, dedication, and above all, patience. From carefully managing water chemistry to ensuring a continuous supply of live food, each step presents its own challenges, but the rewards are significant. Successful breeding efforts contribute not only to species preservation but also to a deeper understanding of one of Southeast Asia's most unique freshwater fish groups.

Given the increasing threats to their natural habitats, captive breeding plays a vital role in ex-situ conservation. It supports genetic preservation, raises public awareness, and strengthens the case for habitat protection. To maximise conservation value, breeders are strongly encouraged to document the origin of their stock, maintain distinct locality lines, and collaborate with conservation organisations.

For those wishing to expand their knowledge and refine their breeding practices, the EAZA Best Practice Guidelines for Liquorice Gouramis (Goodwin & Hutchins, 2024) offer an excellent and scientifically grounded reference.

Breeding Parosphromenus is not just a technical challenge—it is also a meaningful contribution to the long-term survival of a genus at risk.

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