Successful captive propagation of *Coptodon discolor*: an IUCN Red List near threatened fish in Ghana

Consulting in Aquatic Research and Training for Development

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INTRODUCTION

Coptodon discolor is a cichlid endemic to Lake Bosomtwe (Ghana), and a few river basins of southeastern Ghana and western Cote d'Ivoire. It was recently designated "near threatened" on the IUCN Red List due to fishing pressure, habitat destruction, and introduced Nile tilapia.

Objectives

1. Breed *C. discolor* in captivity.
2. Assess acceptability and growth of juvenile *C. discolor* to formulated commercial fish feeds.
3. Assess morphometric parameters, growth, and condition of wild *C. discolor* held in captivity for breeding.

RESULTS

- Wild *C. discolor* held in concrete tanks reproduced naturally in grass substrates after two months in captivity (Fig. 3, Fig. 4).
- Offspring readily accepted commercial feed.
- Fingerlings in unfertilized-fed treatment had best FCR (0.8-0.9) (Fig. 5), and spawned when they reached 30-40g in 4 months.
- Wild brood stock started at 20-30g attained sizes of 100-150g on a natural diet of aquatic plants (water hyacinth) and supplementary commercial feed, and maintained health and consistent body condition throughout captivity (Fig. 6, Fig. 7).

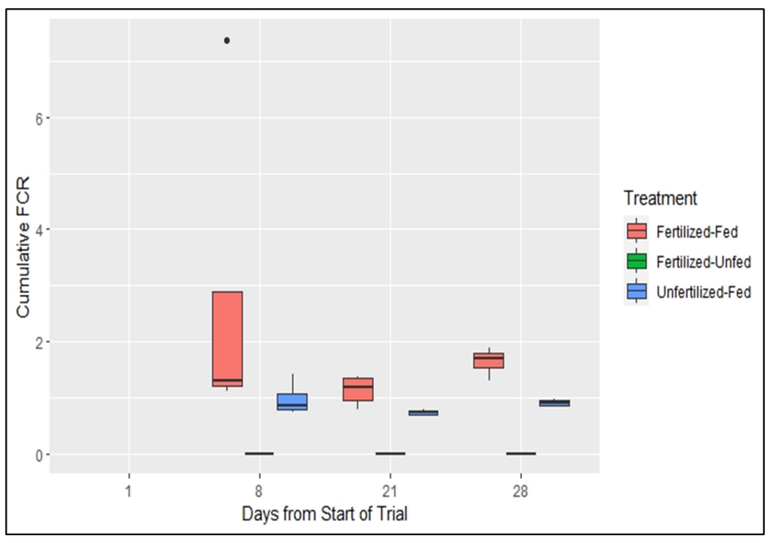

Fig. 5: Total FCR over 28 days of fingerlings feeding trial

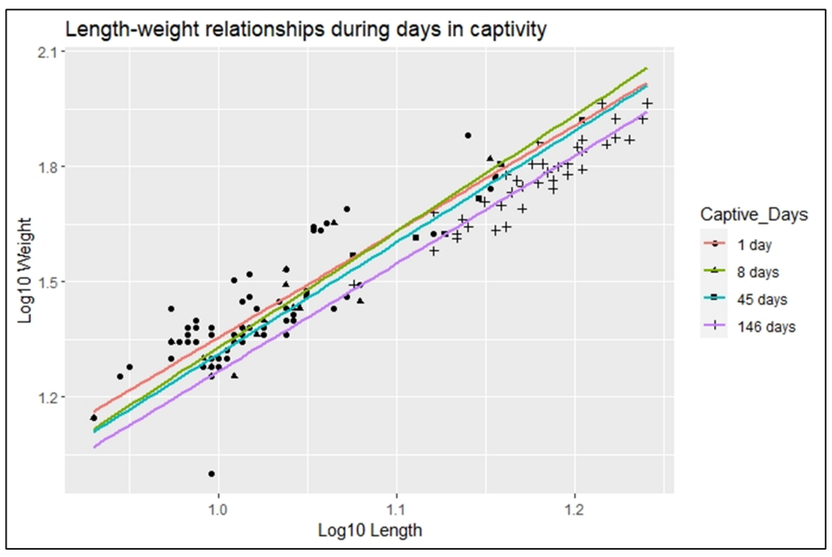

Fig. 6: Length-weight relationship of *C. discolor* in captivity

CONCLUSION

- This study provides evidence that *C. discolor* has remarkable adaptability to captivity.
- Hence, demonstrating its potential as successful aquaculture species.
- This also provides an avenue for successful conservation, as individuals raised in captivity can be used to recover declining wild populations.

Recommendation

- A thorough assessment of dietary requirements is recommended to evaluate the feasibility of cultivating these species in an environmentally friendly way. Follow-up genetics studies are recommended to understand the viability of wild population and help in future broodstock selection.

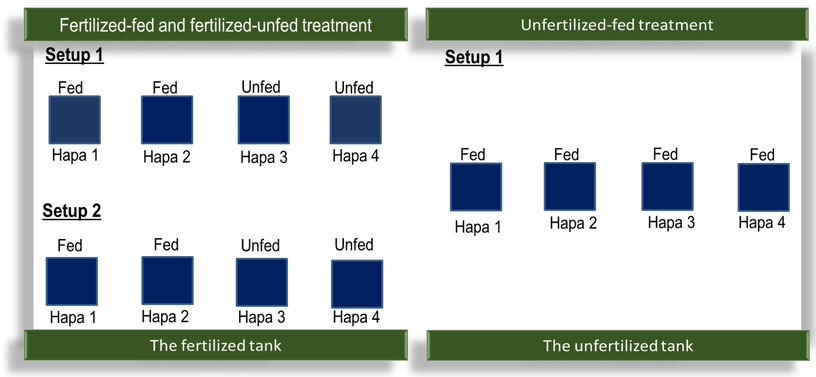

Fig. 1: Progeny experimental Set Up

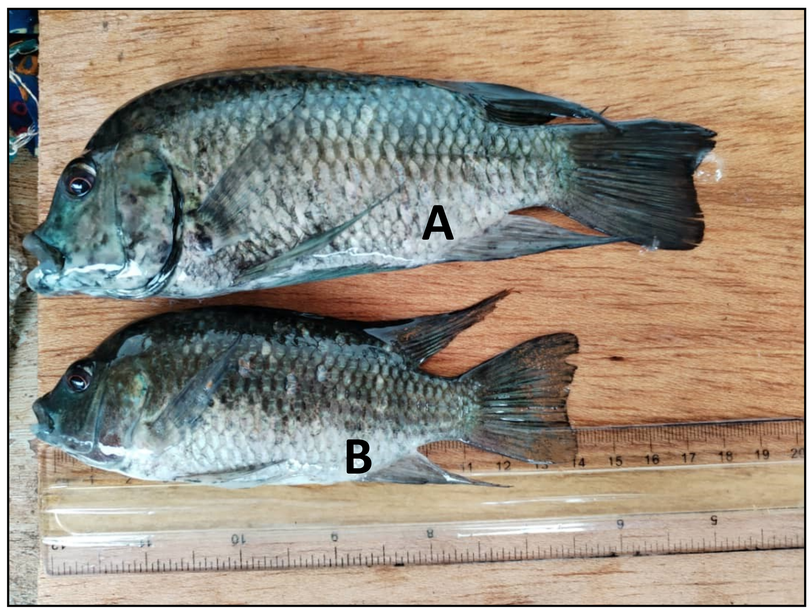

Fig. 3: Adult (breeding) *C. discolor* A = Male B = Female

Fig. 4: *C. discolor* fingerlings

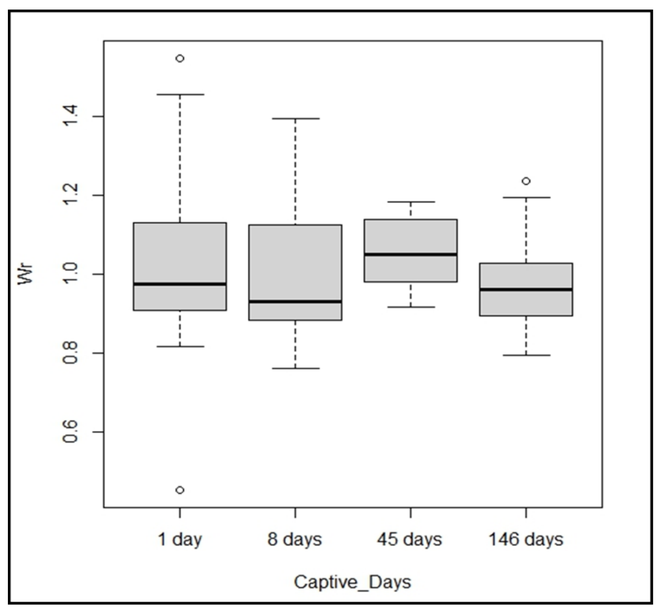

Fig. 7: Relative weight (Wr) of broodstock during days of captivity

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- Bulbul, A., Anushka, and Mishra, A. (2022). Effects of dissolved oxygen concentration on freshwater fish: A review [Electronic Version] International Journal of Fisheries and Aquatic Studies 2022, 10 (4), 113-127.
- Froese, R., J. Thorson and R.B. Reyes Jr., 2014. A Bayesian approach for estimating length-weight relationships in fishes. J. Appl. Ichthyol. 30(1):78-85. http://dx.doi.org/10.1111/jai.12299.

METHODS

The study was conducted in Ghana at CART4D, Domenase-Ashanti region for a period of 20 weeks.

- Three treatments (fertilized-fed and unfed, and unfertilized-fed) in two 12m^3 concrete tanks.
- 4 replicates per treatment ((Fig. 1, Fig. 2).
- Measured: Acceptability, weight gain, and food conversion ratio (FCR) of offspring on commercial feed.
- Periodic sampling for length and weight of wild brood-stock to determine growth and condition in captivity.

Fig. 2: Concrete tanks and Hapas set up

DISCUSSION

• Success of Captive Breeding

Wild *C. discolor*'s (average 27g) ability to reproduce after 2 months in captivity illustrates their adaptability and resilience. Progeny at 30–40g spawning in captivity further indicates their potential as aquaculture species. Progeny spawning serves as an indicator of the domestication success (Bilio 2008). There is a clear potential to re-establish declining wild stock of the species through captive propagation.

• Morphometric parameters, growth, and condition of wild *C. discolor* held captive

The starting lengths and weights regression allowed us to assess whether captivity had any detrimental effects on the species or if it serves as a reliable method for preserving their population and safeguarding their genetic lineage. The length-weight relationship, previously unknown, was consistent with predictions of Forsee et al. (2014) in FishBase.

Relative weight (Wr) score around 90%, aligns with definition of good health, affirming that captive breeding is a promising method to recover the species. Further, a species readily adapting to aquaculture conditions can be grown in captivity for food and reduce exploitation of wild stocks.

• Acceptability and growth of juvenile *C. discolor* on formulated feeds

The differences in weight gain among the three feeding treatments confirms that dissolved oxygen (DO) strongly influenced growth — a well established fact (Bulbul et al., 2022). Evidently, the unfertilized-fed treatment, characterized by high DO levels, elicited superior feeding responses and exceptional feed utilization (FCR) consistently less than 1.0, with rapid weight gain throughout the trial. This underscores that, enough space, partially fertilized water and ambient temperature to maintain high DO levels, are ideal to achieve optimal growth in this species in aquaculture.

C. discolor marketability

The quality taste of *C. discolor* made its introduction into the market successful. Although this species is small in size compared to the common Nile tilapia (*Oreochromis niloticus)*, consumers preferred it due to its taste. The preference for *C. discolor* over Nile tilapia, implies a potential market for diversification of small-scale tilapia production.