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Distribution Range Update of Red Wine Betta, *Betta burdigala* in Central Bangka with Description of Different Color Variants

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ABSTRACT

Betta burdigala is a small labyrinth fish endemic to the peat swamp forests of Bangka Island, Indonesia. Previously, the species was known only from South Bangka, where individuals exhibited plain body coloration without spotting. A new distribution in Central Bangka Regency was reported and a distinct spotted ("dot") color variant was described. These findings underscore the importance of conserving fragmented peat swamp habitats that support phenotypically diverse populations of *B. burdigala*. The newly discovered population inhabits an area increasingly threatened by environmental degradation due to oil palm expansion and tin mining activities.

INTRODUCTION

The genus Betta represents one of the most diverse groups in the family Osphronemidae **(Ayuningthias *et al.*, 2021; Gruneck, *et al.*, 2022; Nur *et al.*, 2022; Syarif *et al.*, 2023a)**. They consist of small anabantoids fish that adapt to a variety of freshwater habitats throughout Southeast Asia **(Islamy *et al.*, 2025a; Tan & Ng, 2005a)**. Among them, the red wine betta, *Betta burdigala*, is a wild betta species endemic to Bangka Island, Indonesia **(Kottelat, 2013; Valen *et al.*, 2023a)**. This species is highly specialized for life in peat swamp forests—ecosystems characterized by nutrient-poor, highly acidic blackwater, dense organic matter deposits, and low oxygen availability **(Tan & Ng, 2025b)**. Adaptations such as labyrinthine respiratory structures enable *B.*

burdigala to survive in these extreme conditions where few other fish can persist **(Schindler & Linke, 2013; Valen *et al.*, 2023b)**.

Historically, *B. burdigala* has only been recorded in small, remnant peat swamp forest patches in South Bangka **(Kottelat & Ng, 1994)**. This population is morphologically uniform, exhibiting a consistent red wine-colored body without distinct markings **(Valen *et al.*, 2023b)**. However, peat swamp habitats across Bangka are increasingly threatened by anthropogenic pressures, particularly large-scale tin mining **(Robin *et al.*, 2022; Hasan *et al.*, 2023a; Kusumah *et al.*, 2023; Maftukhah *et al.*, 2023)**.

Both legal and illegal tin extraction have led to widespread deforestation, soil erosion, and hydrological disruption across the island **(Adi *et al.*, 2025)**. Mining often involves stripping native vegetation, draining wetlands, and leaving behind degraded, acidified landscapes. Such environmental degradation not only destroys critical habitats for peat swamp specialists like *B. burdigala* but also fragments populations, increasing their vulnerability to local extinction **(Syarif *et al.*, 2025)**.

In addition to mining, the expansion of industrial agriculture—especially oil palm plantations—poses another severe threat to the species' habitat. Ongoing peatland conversion has resulted in extensive habitat loss, pushing *B. burdigala* closer to extinction **(Supriatna *et al.*, 2023; Syarif *et al.*, 2023b)**. It is currently classified as Endangered on the IUCN Red List of Threatened Species.

The survival of *B. burdigala* is closely tied to the preservation of peat swamp ecosystems. Its highly restricted range makes it particularly vulnerable in the face of rapid landscape transformation. Continued peatland degradation has serious implications not only for this species but also for the broader ecological integrity of the region **(Hasan *et al.*, 2020; Valen *et al.*, 2022a)**.

Given *B. burdigala*'s specialized habitat requirements and the increasing environmental pressures it faces, understanding its distribution limits and intraspecific morphological variation is essential for effective conservation **(Gani *et al.*, 2021; Ndobe *et al.*, 2022)**. This study investigated a newly identified population in Central Bangka, examining the species' range expansion and documenting variation in color patterns—particularly the emergence of spotted morphs ("dots") in contrast to the uniform coloration of South Bangka populations. These findings are discussed in the context of urgent conservation needs **(Hasan *et al.*, 2021; Serdiati *et al.*, 2024)**, especially in light of the continued pressures from the palm oil industry on peat swamp forests.

MATERIALS AND METHODS

Fieldwork was conducted between January and April 2025 at two sites within the peat swamp forests of Central Bangka Regency, Bangka Island, Indonesia (approx. 2°12'S, 106°9'E). The surveyed habitats exhibited typical lowland peat swamp characteristics, including acidic blackwater conditions (pH 3.8–5.2), dense forest canopy

providing shade, submerged root systems, decomposing leaf litter, and soft detritus rich substrates microhabitats crucial for *Betta burdigala* **(Valen *et al.*, 2023b)**. However, clear signs of anthropogenic disturbance were observed, particularly linked to nearby tin mining activities. These included elevated water turbidity, cleared vegetation, and sediment accumulation in previously undisturbed swamp channels.

A total of 25 *B. burdigala* specimens were collected using handheld nets in shallow leaf-litter-rich waters – typically less than 10cm deep along riverbanks and water-filled depressions in the forest floor. Sampling was conducted over 2-3 hours per location. Captured individuals were temporarily held in plastic containers filled with water from the location and leaf litter to minimize handling stress. Most specimens were released after identification and documentation, while a select few were retained for detailed morphological analysis **(Valen *et al.*, 2023b)** and maintained as broodstock at the Aquaculture Hatchery, University of Bangka Belitung for controlled breeding.

Immediately after collection, all specimens were photographed alive using a phone camera under controlled ambient lighting conditions in transparent photo tanks. Color variant identification was based on both direct observation and photographic documentation.

Individuals were categorized into two distinct morphotypes: (1) the Plain Variant, exhibiting a uniform reddish to brown body devoid of markings; and (2) the Dot Variant, characterized by one or more dark spots along the flanks and dorsal region. These patterns were consistent within each sampling site, with dot variants observed exclusively in populations from Central Bangka.

Environmental parameters, including water temperature, pH, and depth were recorded at each site using portable field instruments (Hanna Instruments HI98103 pH meter and standard mercury thermometer). Additional habitat characteristics such as canopy cover, substrate composition, and visible signs of anthropogenic disturbance (notably proximity to tin mining activity) were documented using a standardized field survey checklist. This contextual data enabled comparative analysis of habitat conditions and facilitated the assessment of potential correlations between environmental variation and phenotypic differences observed among *B. burdigala* populations.

RESULTS

A field survey conducted in a peat swamp forest area in Central Bangka Regency successfully documented the presence of *Betta burdigala*, thereby extending the known distribution of the species beyond its previously recorded range in South Bangka **(Kottelat *et al.*, 1994; Valen *et al.*, 2023a)**. The newly recorded population inhabits blackwater peat swamp ecosystems characterized by acidic conditions (pH 3.8-4.5), water temperatures ranging from 25–27°C, and a habitat area approximately 30% larger than that observed in South Bangka. However, signs of environmental degradation linked to oil palm plantation expansion were evident, including partial loss of vegetation cover, increased sedimentation, and altered hydrological flow in the swamp system. A total of

25 *B. burdigala* individuals were collected in Central Bangka. All exhibited a distinctive dark spotted body pattern ("Dot Variant"), in contrast to the previously known population from South Bangka, which consistently displays a uniform reddish-brown coloration without markings ("Plain Variant").

1. Color variant comparison

Table 1. Comparison of *Betta burdigala* color variants between South and Central Bangka populations

Region	Variant name	Body pattern	Frequency (%)
South Bangka	Plain Variant	Uniform wine-red, no dots	100
Central Bangka	Dot Variant	Wine-red with a dark spot	100

2. Visual documentation

Photographic comparison of *Betta burdigala* color variants (Fig. 1):

Fig. 1. (A). South Bangka (Plain Variant): Uniform wine-red without spots. (B). Central Bangka (Dot Variant): wine-red with a distinct dark spot

3. Habitat

Fig. 2. (A). South Bangka Habitat (B). Central Bangka Habitat

4. Environmental parameters

Table 2. Environmental conditions in two peat swamp forest habitats of *Betta burdigala*

Parameter	Central Bangka	South Bangka
Water pH	3.9–4.6	4.0–4.6
Water Temperature	27–29°C	29–30°C
Dissolved Oxygen	2.4 ppm	2.0 ppm
Water Depth	15–30 cm	10–20 cm
Canopy Cover	~30%	~20%
Mining Impact	Moderate	Moderate to High
Palm Oil Plantation Impact	High	High

5. Distribution

The discovery of *Betta burdigala* in Central Bangka represents a new northernmost distribution record for the species, approximately 80 kilometers from the previously documented population in South Bangka. The newly identified Dot Variant population appears to be restricted to localized peat swamp forest habitats that are increasingly threatened by anthropogenic pressures, particularly from oil palm cultivation and tin mining activities.

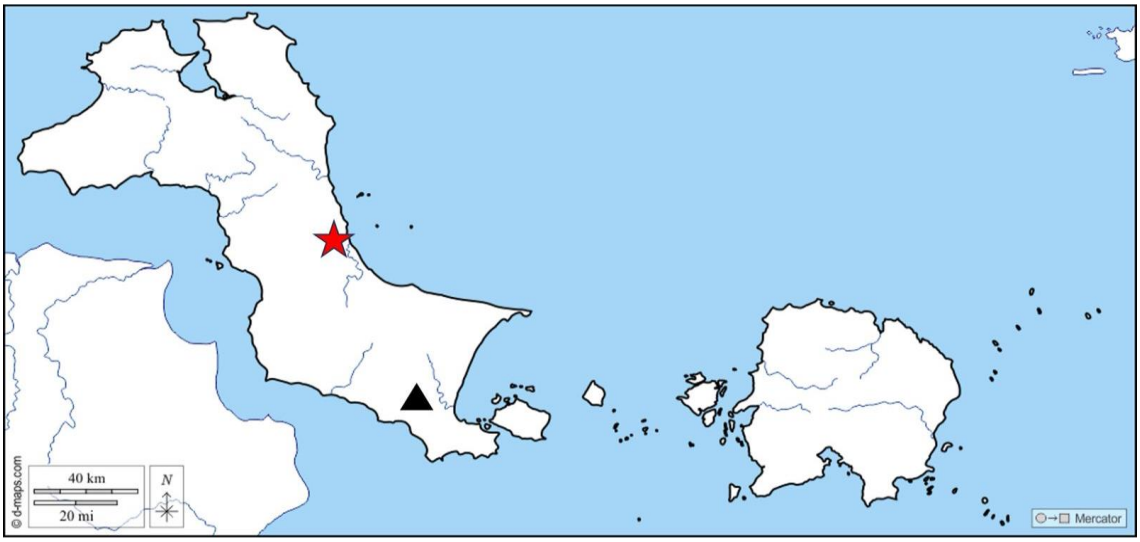

Fig. 2. Map of the known distribution of *Betta burdigala*. New record in Central Bangka (red star); published records (black triangle)

DISCUSSION

The discovery of *Betta burdigala* in the peat swamp forests of Central Bangka represents a significant northern extension of the species' known distribution. Previously, *B. burdigala* was only recorded in isolated pockets of peat swamp forest in South Bangka, where individuals consistently exhibited a uniform, reddish-wine body coloration without any distinct markings ("Plain Variant") **(Kottelat & Ng, 1994; Valen *et al.*, 2023a, b)**. In contrast, the newly identified population in Central Bangka displays a distinct morphological trait: one or more dark spots along the flank and dorsal region ("Dot Variant"). This phenotypic distinction suggests potential intraspecific differentiation between geographically separated populations **(Kottelat *et al.*, 2024; Syarif *et al.*, 2025)**.

Such variation may be the result of geographic isolation, ecological divergence, or a combination of both **(Ihwan *et al.*, 2020; Valen *et al.*, 2020; Hasan *et al.*, 2022; Robin *et al.*, 2023; Syarif *et al.*, 2023c)**. Despite the relatively modest straight-line distance (~90 km) between South Bangka and Central Bangka, extensive habitat fragmentation – primarily due to tin mining and oil palm plantation expansion – has likely disrupted gene flow between populations. Fragmentation of peat swamp forests creates ecological and physical barriers that can promote local adaptation and phenotypic divergence, a pattern also observed in other peat-swamp-dependent species, where even minor habitat discontinuities have led to rapid microgeographic variation and evolutionary differentiation **(Lu & Suen, 2023; Song & Li, 2023)**.

Environmental degradation at the Central Bangka site, particularly from adjacent oil palm plantations and tin mining operations, has altered the structure and quality of the habitat **(Hasan *et al.*, 2024; Valen *et al.*, 2024a)**. Observed disturbances include

deforestation, hydrological changes, increased sediment loads, and chemical runoff. These changes may have ecological consequences for *B. burdigala*, influencing selection pressures on traits such as coloration. In heterogeneous or disturbed substrates, the Dot Variant may confer better camouflage or adaptive value compared to the Plain Variant, although this hypothesis requires further ecological and behavioral validation.

Despite the presence of *B. burdigala* in Central Bangka, ongoing land-use conversion has already led to the loss of more than half of the area's suitable peat swamp habitat. Given the species' narrow ecological niche and fragmented distribution, continued degradation is likely to result in severe population declines **(Adla *et al.*, 2022)**. *Betta burdigala* is currently classified as Critically Endangered by the IUCN, with habitat loss recognized as the primary threat. The fragility of peat swamp ecosystems and their rapid decline under anthropogenic pressure emphasize the urgency of conservation action **(Posa *et al.*, 2011)**.

The morphological differentiation observed between Central and South Bangka populations highlights the importance of conserving not only the species but also its genetic and phenotypic diversity **(Denoël & Winandy, 2015)**. Conservation measures should prioritize habitat protection and restoration **(Piczak *et al.*, 2023; Pramono *et al.*, 2025)**, particularly in Central Bangka, where the population exhibits traits not documented elsewhere. Suggested actions include halting further peatland conversion, implementing reforestation programs, and establishing ecological corridors to enhance connectivity and maintain genetic exchange among isolated populations.

Future research should aim to assess the genetic divergence between the Plain and Dot variants using molecular techniques to clarify the taxonomic status and evolutionary history of these populations **(Insani *et al.*, 2022; Nurjirana *et al.*, 2022; Romdon *et al.*, 2024; Valen *et al.*, 2024b, c; Nazran *et al.*, 2025)**. Additionally, the *ex-situ* conservation protocols, particularly through captive breeding programs aimed at maintaining genetic diversity and establishing assurance colonies for potential reintroduction. The successful implementation of such programs could support both conservation and sustainable aquaculture initiatives **(Budi *et al.*, 2024; Priyadi *et al.*, 2024; Budi *et al.*, 2025)**. Furthermore, the application of *Betta burdigala* and other native labyrinth fish as bioindicators for environmental monitoring, especially in detecting sublethal effects of heavy metal contamination and microplastic through genotoxic and histopathological biomarkers represents a promising frontier **(Islamy *et al.*, 2025b, c)**. Lastly, investigations on nutritional requirements and disease susceptibility of *Betta burdigala* under controlled conditions will be essential to support effective captive management and health monitoring programs **(Islamy *et al.*, 2025e)**.

CONCLUSION

This study presents the first confirmed record of *Betta burdigala* in the peat swamp forests of Central Bangka, representing a substantial northward extension of the species'

known distribution. In addition to expanding its documented range, the research uncovered distinct morphological differentiation between populations: individuals from Central Bangka consistently exhibited a spotted body pattern ("Dot Variant"), in contrast to the uniform coloration ("Plain Variant") characteristic of the South Bangka population. These findings suggest potential intraspecific diversity within *B. burdigala*, likely shaped by geographic isolation and ecological variation across fragmented peat swamp landscapes. The newly discovered population in Central Bangka exists within a habitat increasingly threatened by environmental degradation linked to oil palm plantation expansion and tin mining activities. These pressures have already led to substantial habitat loss and hydrological alteration, posing serious risks to the long-term persistence of *B. burdigala* in the region. Given the species' ecological specialization, narrow habitat requirements, and limited geographic range, urgent conservation measures are warranted. Effective strategies should prioritize the protection and restoration of remaining peat swamp forests, particularly in Central Bangka. This includes enforcing land-use regulations, mitigating the ecological impacts of mining and agriculture, and establishing habitat corridors to maintain population connectivity. Furthermore, future research should focus on genetic characterization and ecological adaptability to better understand the extent of population divergence and inform targeted conservation actions. Safeguarding *B. burdigala* not only preserves a unique and potentially diverging lineage within a threatened species but also contributes to the broader conservation of Southeast Asia's peat swamp ecosystems – critical reservoirs of biodiversity and globally important carbon sinks.

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REFERENCES

Adla, K.; Dejan, K.; Neira, D. and Dragana, Š. (2022). Chapter 9-Degradation of ecosystems and loss of ecosystem services (JC Prata, AI Ribeiro, & TBT-OH Rocha-Santos.

Ayuningthias, N.; Nasrullah, H.; Soelistiyowati, D.T.; Kusrini, E. and Alimuddin, A. (2021). Gene Transmission, Growth, and Exogeneous Growth Hormone

Expression of G2 Transgenic Betta Fish (*Betta imbellis*). Jurnal Ilmiah Perikanan Dan Kelautan., 13(2): 181–189.

Budi, D.S.; Priyadi, A.; Permana, A.; Herjayanto, M.; Slembrouck, J.; Mubarak, A. S. and Mustofa, I. (2024). Sustainable captive breeding practices for native Indonesian freshwater fish. Animal Reproduction Science, 271: 107623.

Budi, D.S.; Suciyono.; Hasan, V.; Priyadi, A.; Permana, A.; Ismi, S.; Müller, T.; Bodur, T. and South J. (2025). The Sacred Waters and Fish: Traditional Practices and Fish Conservation in Indonesian Communities. Aquatic Conservation: Marine and Freshwater Ecosystems, 35 (6): e70163

Denoël, M. and Winandy, L. (2015). The importance of phenotypic diversity in conservation: Resilience of palmate newt morphotypes after fish removal in Larzac ponds (France). Biological Conservation, 192: 402-408.

Gallagher, B. K., & Fraser, D. J. (2024). Microgeographic variation in demography and thermal regimes stabilize regional abundance of a widespread freshwater fish. Ecological Applications, 34(2), e2936.

Gani, A.; Nurjirana.; Bakri, A.A.; Adriany, D.T.; Wuniarto, E.; Khartiono, L.D.; Satria, D.H.; Hasan, V.; Herjayanto, M.; Burhanuddin, A.I.; Moore, A.M. and Kobayashi, H. (2021). First record of *Stiphodon annieae* Keith & Hadiaty, 2015 (Teleostei, oxudercidae) from Sulawesi Island, Indonesia. Check List, 17(1): 261-267.

Gruneck, L.; Jinatham, V.; Therdtatha, P.; Popluechai, S. (2022) Siamese Fighting Fish (Betta splendens Regan) Gut Microbiota Associated with Age and Gender. Fishes, 7, 347

Hasan, V.; Kusumah, W.; Purnawan, M.; Nasidi.; Arianto; Wijaya, I.; Yusnandar, F.; Baptista, Y.; South, J. and Ottoni, F. P. (2024). First record of the fire-eyed loach *Barbucca diabolica* Roberts, 1989 (Cypriniformes: Barbuccidae) for Belitung Island, Indonesia. Cybium., 48(1): 71-74.

Hasan, V.; Swarlanda.; Katz, A.M.; South, J.; Ottoni, F.P.; Nurjirana. and Gani, A. (2023a). First record of the uncommon spiny eel *Mastacembelus notophthalmus* Roberts, 1989 (Synbranchiformes: Mastacembelidae) for Bangka Island, Indonesia. Cybium., 47(2): 189-191.

Hasan, V.; South, J.; Katz, A. M. and Ottoni, F. P. (2022). First record of the Small-eyed loter Prionobutis microps (Weber, 1907) (Teleostei: Eleotridae: Butinae) in Java, Indonesia. Cybium., 46(1): 49-51.

Hasan, V.; Widodo, M.S.; Faqih, A.R.; Mahasri, G.; Arief, M.; Valen, F.S.; Tamam, M.B.; Yonarta, D.; Pratama, F.S. and Fitriadi, R. (2020). Presence of striped

flying barb *Esomus metallicus* (Teleostei, cyprinidae) from west Sumatra, Indonesia. Ecology, Environment and Conservation, 26: S73-S75.

Hasan, V.; Valen, F.S.; Islamy, R.A.; Widodo, M.S.; Saptadjaja, A.M. and Islam, I. (2021). Short communication: Presence of the vulnerable freshwater goby *Sicyopus auxilimentus* (gobiidae, sicydiinae) on Sangihe Island, Indonesia. Biodiversitas, 22(2): 571-579.

Hui, T. H., & Ng, P. K. (2005a). The labyrinth fishes (Teleostei: Anabantoidei, Channoidei) of Sumatra, Indonesia. The Raffles Bulletin of Zoology, 13, 115-138.

Insani, L.; Jatayu, D.; Valen, F.S.; Widodo, M.S. and Hasan, V. (2022). Comparing genetic *Mystacoleucus marginatus* and *Mystacoleucus padangensis* (Cypriniformes: Cyprinidae) based on Cythochrome C Oxidase sub unit I (COI) gene. Iranian Journal of Ichthyology, 9(4): 195-203.

Ihwan, Pratama, F. S., Yonarta, D., Faqih, A. R., Widodo, M. S., Valen, F. S., Tamam, M. B., & Hasan, V. (2020). Presence of asian catfish *clarias batrachus* (Siluriformes, clariidae) in Madura Island, Indonesia. AACL Bioflux., 13(2): 958-962.

Insani, L.; Jatayu, D.; Valen, F.S.; Widodo, M.S. and Hasan, V. (2022). Comparing genetic *Mystacoleucus marginatus* and *Mystacoleucus padangensis* (Cypriniformes: Cyprinidae) based on Cythochrome C Oxidase sub unit I (COI) gene. Iranian Journal of Ichthyology, 9(4): 195-203.

Islamy, R.A.; Mutmainnah, N.; Putri, R.T.; Valen, F.S.; Kamarudin, A.S. and Hasan, V. (2025sa). Cochineal powder as an eco-friendly carotenoid supplement to enhance coloration in Betta splendens. Journal of Ecological Engineering, 26(10).

Islamy, R.A.; Hasan, V.; Kamarudin, A.S.; Mamat, N.B.; Valen, F.S. and Mutmainnah, N. (2025b). Biomonitoring of heavy metal pollution in the Brantas River Using genotoxic and histopathological biomarkers in wild cyprinidae. Journal of Ecological Engineering., 26(10).

Islamy, R.A.; Hasan, V.; Kamarudin, A.S.; Mamat, N.B.; Valen, F.S. and Mutmainnah, N. (2025c). Assessment of microplastic accumulation, genotoxicity, and gill histopathological alterations in wild herbivorous fishes from the Brantas River, Malang, Indonesia. Journal of Ecological Engineering., 26(10).

Islamy, R.A.; Czech, M.; Kamarudin, A.S.; South, J.; Mutmainnah, N.; Valen, F.S. Hui, T.H. and Hasan, V. (2025d). Integrative Assessment of *Ficus septica* as a Functional Phytogenic Additive: Nutritional, Antioxidant, and

immunomodulatory Efficacy in *Betta picta* Challenged with *Aeromonas hydrophila*. Transactions of the Chinese Society of Agricultural Machinery., 56(6)

Kottelat, M. (2013). The fishes of the inland waters of southeast Asia: a catalogue and core bibliography of the fishes known to occur in freshwaters, mangroves and estuaries. Raffles Bulletin of Zoology Supplement No. 27: 1-663.

Kottelat, M. and P. K. L. Ng. (1994). Diagnoses of five new species of fighting fishes from Banka and Borneo (Teleostei: Belontiidae). Ichthyological Exploration of Freshwaters v. 5 (no. 1): 65-78.

Kottelat, M.; Hui, T.H. and Hasan, V. (2024). *Kapuasia falaris*, a new species of nemacheilid loach from Borneo (Teleostei: Nemacheilidae). Raffles Bulletin of Zoology., 72: 479-487.

Kusumah, W.; Hasan, V. and Samitra, D. (2023). Rediscovery of the Billiton Caecilian, *Ichthyophis billitonensis* Taylor, 1965, on Belitung Island, Indonesia, after more than five decades. Herpetology Notes., 16: 95-97.

Langerhans, R. B. (2008). Predictability of phenotypic differentiation across flow regimes in fishes. Integrative and Comparative Biology, 48(6), 750-768.

Lu, Y.-S.; Suen, J.-P. (2023) Intraspecific and Interspecific Variations in Habitat Usage by Hemimyzon formosanus and Sinogastromyzon nantaiensis in Riffle Areas of a Mountain Stream. Water, 15, 3959.

Maftukhah, R.; Kral, R.M.; Mentler, A.; Ngadisih, N.; Murtiningrum, M.; Keiblinger, K.M.; Gartner, M.; Hood-Nowotny, R. (2023) Post-Tin-Mining Agricultural Soil Regeneration Using Local Resources, Reduces Drought Stress and Increases Crop Production on Bangka Island, Indonesia. Agronomy, 13, 50.

Nazran.; Syofriani.; Ulfauza.; Valen, F.S.; Oktaviandi, D.; Prayoga, A.; Ilmia, M.; Czech, M.; Kamarudin, A.S. and Hasan, V. (2025). DNA Barcoding of *Rasbora sp.* from Bangka Island: A Genetic Identification Basis and Its Potential Application in Aquaculture. Egyptian Journal of Aquatic Biology and Fisheries., 29(3): 213-226.

Ndobe, S.; Gani, A.; Bakri, A.A.; Adriany, D.T.; Wuniarto, E.; Khartiono, L.D.; Herjayanto, M.; Hasan, V. and Moore, A.M. (2022). First and recurrent records of *Stiphodon surrufus* Watson & Kottelat, 1995 (Gobiiformes, Gobiidae, Sicydiinae), a naturally rare amphidromous goby, in Sulawesi, Indonesia. Check List., 18(2): 253-260.

Nur, F. M.; Batubara, A.S.; Fadli, N.; Rizal, S.; Siti-Azizah, M.N. and Muchlisin, Z. A. (2022). Elucidating species diversity of genus Betta from Aceh waters

Indonesia using morphometric and genetic data. Zoologischer Anzeiger., 296: 129-140.

Nurjirana.; Burhanuddin, A.I.; Keith, P.; Haris, A.; Moore, A.M.; Afrisal, M.; Gani, A.; Hasan, V.; Wuniarto, E.; Bakri, A.A. and Adriany, D. T. (2022). Additional records of *Sicyopus discordipinnis* (Watson, 1995) (Oxudercidae: Sicydiinae) in Central Sulawesi, Indonesia. Cybium., 46(1): 41-43.

Piczak, M.L.; Perry, D.; Cooke, S.J.; Harrison, I.; Benitez, S.; Koning, A.; ... and Creed, I.F. (2023). Protecting and restoring habitats to benefit freshwater biodiversity. Environmental Reviews., 32(3): 438-456.

Posa, M.R.C.; Wijedasa, L.S. and Corlett, R.T. (2011). Biodiversity and Conservation of Tropical Peat Swamp Forests. BioScience., 61 (1): 49–57.

Pramono, T.B.; Valen, F.S.; Oktaviandi, D.; Prayoga, A.; Ilmia, M.; Purnama, F.; Hidayat, R.; Amru, T.J.; Czech, M.; Islamy, R.A.; Kamarudin, A.S. and Hasan, V. (2025). First Record of *Mystus singaringan* from Bangka Island, Indonesia: A New Insight into Its Distribution. Egyptian Journal of Aquatic Biology and Fisheries, 29(3), 2707-2719.

Priyadi, A.; Permana, A.; Kusrini, E.; Hayuningtyas, E.P.; Nur, B.; Lukman.; South, J.; Cindelaras, S.; Rohmy, S.; Ginanjar, R.; Yamin, M.; Said, D.S.; Kadarini, T. and Budi, D.S. (2024). Captive breeding of endangered betta fish, Betta rubra, under laboratory conditions. Fisheries and Aquatic Sciences, 27(4): 213-224.

Robin, R.; Valen, F.S.; Ramadhanu, D.; Nomleni, A.; Turnip, G. and Insani, L. (2023a). A new distributional record of flying barb, *Esomus metallicus* (Actinopterygii: Cyprinidae), from Kapalo Banda River, West Sumatra, Indonesia. International Journal of Aquatic Biology, 11(1): 59–68.

Robin.; Insani, L.; Swarlanda.; Prananda, M. and Valen, F.S. (2022). Range extension of Spanner barbs, *Barbodes lateristriga* (Valenciennes, 1842) (Cypriniformes: Cyprinidae) to Bangka Island, Indonesia. Iranian Journal of Ichthyology, 9(3): 149–157.

Romdon, A.; Simanjuntak, C.P.H.; Sulistiono. and Syahailatua, A. (2024). Genetic Diversity and Population Structure of Amphidromous Goby (*Stiphodon semoni*) in Western Part of Southern Java Waters. Jurnal Ilmiah Perikanan Dan Kelautan, 16(2): 461–472.

Schindler, I. and H. Linke (2013). *Betta Hendra*, a new species of fighting fish (Teleostei: Osphronemidae) from Kalimantan Tengah (Borneo, Indonesia). Vertebrate Zoology v. 63 (no. 1): 35-40.

Song, W. H. and Li, J. J. (2023). The effects of intraspecific variation on forecasts of species range shifts under climate change. Science of the Total Environment, 857, 159513.

Supriatna, J.; Djumarno, D.; Saluy, A.B.; Kurniawan, D. (2024) Sustainability Analysis of Smallholder Oil Palm Plantations in Several Provinces in Indonesia. Sustainability, 16, 4383.

Serdiati, N.; Nurdin, M.S.; Hasan, V.; Mokodongan, D.F. and Safir, M. (2023). Population dynamic of endemic ricefish in Lake Poso implications for conservation. International Journal of Conservation Science, 14(1): 301-314.

Syarif A.F., Hafidz A.M., Valen F.S., Herjayanto M., Robin R. A new distributional record of spanner barbs, Striuntius lateristriga (Valenciennes, 1842) (Cypriniformes: Cyprinidae) in Belitung Island, Indonesia (2023c) IOP Conference Series: Earth and Environmental Science, 1289 (1), art. no. 012011,

Syarif, A.F.; Kurniawan, A.; Robin. and Valen F.S. (2023b). First genetic record and phylogenetic relationship of *Rasbora einthovenii* (Bleeker, 1851) (Cyprinidae : Danioninae) from Bangka Island, Indonesia. IOP Conference Series: Earth and Environmental Science., 1260 (1): 012002.

Syarif, A.F.; Valen, F.S. and Herjayanto M. (2023a). First DNA barcoding and phylogenetics of wild Betta edithae (Anabantiformes: Osphronemidae) from Belitung Island, Indonesia. AACL Bioflux., 16 (5): 2626 – 2636

Syarif, A.F.; Valen, F.S.; Herjayanto, M. and Aisyah S. (2023d). First record and phylogenetic relationship of the endangered species *Betta foerschi* (Vierke, 1979) (Anabantiformes: Osphronemidae) from Belitung Island, Indonesia. IOP Conference Series: Earth and Environmental Science, 1289 (1): 012010,

Syarif, A.F.; Valen, F.S.; Kurniawan, A.; Rudiansyah.; Herjayanto, M.; Mamat, N.B.; Ottoni, F.P.; Andriyono, S. and Hasan V. (2025). Unveiling the First DNA Barcoding of *Betta* cf. *uberis* Fish (Anabantiformes: Osphronemidae) from Belitung Island, Indonesia. Egyptian Journal of Aquatic Biology and Fisheries, 29 (1): 2023 – 2036

Tan, H. H. and P. K. L. Ng (2005b). The fighting fishes (Teleostei: Osphronemidae: genus Betta) of Singapore, Malaysia and Brunei. Raffles Bulletin of Zoology Suppl. no. 13: 43-99.

Tan, S. N.; Kotaki, Y.; Teng, S. T.; Lim, H. C.; Gao, C.; Lundholm, N., ... and Leaw, C. P. (2025). Intraspecific genetic diversity with unrestricted gene flow in the domoic acid-producing diatom Nitzschia navis-varingica (Bacillariophyceae) from the Western Pacific. Harmful Algae, 141, 102769.

Valen, F.S.; Bidayani, E.; Alfian, R.A.; Prananda, M.; Notonegoro, H.; Susilo, N.B.; Ardi, W.D.; Swarlanda.; Aziz, M.A.; Puryoso.; Widodo, M.S.; Faqih, A.R. and Hasan V. (2023a) Unveiling the close relationship between *Betta burdigala* and *Betta uberis* through DNA barcoding based on COI Gene. IOP Conference Series: Earth and Environmental Science, 1267(1): 012066

Valen, F.S.; Hasan, V.; Ottoni, F.P.; Nafisyah, A.L.; Erwinda, M.; Annisa, A.N. and Adis, M.A. (2022a). First country record of the bearded gudgeon *Pogoneleotris heterolepis* (Günther, 1869) (Teleostei: Eleotridae) from Indonesia. IOP Conference Series: Earth and Environmental Science, 1036(1): 012074.

Valen, F.S.; Notonegoro, H.; Pamungkas, A.; Swarlanda, and Hasan, V. (2023b). Revolutionary Breakthrough: Unveiling the first DNA Barcoding of the Endemic wild *Betta burdigala* (Kottelat and Ng 1994) (Anabantiformes: Osphronemidae): A Critically Endangered Wild Betta from Bangka Island, Indonesia. International Journal of Agriculture and Biology, 30(4): 269-275.

Valen, F.S.; Soemarno.; Widodo, M.S.; Wiadnya, D.G.R. and Hasan, V. (2020). Contemporary distribution records of yellow finned barb *Mystacoleucus marginatus* (Valenciennes, 1842) in Brantas basin, Indonesia. Ecology, Environment and Conservation, 26: S40-S43.

Valen, F.S.; Widodo, M.S.; Islamy, R.A.; Wicaksono, K.P.; Soemarno.; Insani, L. and Hasan, V. (2022b). Molecular phylogenetic of silver barb *Barbonymus gonionotus* (bleeker, 1849) (cypriniformes: Cyprinidae) in Java, Indonesia. IOP Conference Series: Earth and Environmental Science, 1036(1): 012011.

Valen, F.S.; Mamat, N.B.; South, J.; Ottoni, F.P.; Vieira, L.O.; Kamarudin, A.S.; Afandi, A.Y. and Hasan, V. (2024b). Unveiling the occurrence of vulnerable Sisorid catfish (Teleostei: Sisoridae) in Bangka based on morphological and molecular evidence. Biodiversitas, 25(11): 4543-4550.

Valen, F.S.; Syaputra, D.; Mohd Hasmadi, I.; Swarlanda.; Kamarudin, A.S.; Hasan, V. and Itaya, I. (2024c). Unveiling the Enigmatic Dwarf Horseface Loach *Acanthopsoides molobrion*: A Groundbreaking Discovery in Indonesia. Biosaintifika, 16(2), 265-272.

Valen, F.S.; Alfian, R.A.; Prananda, M.; Hasmadi, M.; Gani, A. and Hasan, V. (2024). DNA Barcoding of the Endemic Freshwater Catfish *Encheloclarias tapeinopterus* (Bleeker, 1853) (Siluriformes:Clariidae) from Bangka Island, Indonesia. IOP Conference Series: Earth and Environmental Science, 1392(1): 012034.

Wang, Z., Wang, T., Zhang, X., Wang, J., Yang, Y., Sun, Y. and Kuca, K. (2024). Biodiversity conservation in the context of climate change: Facing challenges and management strategies. Science of The Total Environment, 173377.

Yunus, M., Pagdee, A. and Baral, H. (2025). Local Livelihoods and Determinants of Peatland Protection in Indonesia. Trees, Forests and People, 100800.