

Original Research Article

ECOLOGICAL DOMINANCE AND ENVIRONMENTAL HEALTH IMPLICATIONS
OF INVASIVE *PTERYGOPLICHTHYS PARDALIS* IN DKI JAKARTARita Ramayulis¹⁾, Rosidi Roslan^{2)*}¹⁾ Universitas Faletahan²⁾ Balai Besar Kekarantinaan Kesehatan (BBKK) Surabaya & Universitas Terbuka*Corresponding Author, E-mail: rosidiroslan71@gmail.com

ABSTRACT

Introduction. Suckermouth catfish (*Pterygoplichthys pardalis*) is among the most prominent invasive exotic fish species in Indonesian urban waters, with its dominance in DKI Jakarta Province particularly evident along the Ciliwung River system subjected to sustained anthropogenic pressure. **Method.** This study employed a systematic narrative review of peer-reviewed journal articles, institutional reports, undergraduate theses, and official government documents, with sources selected against explicit inclusion criteria covering relevance, methodological clarity, and policy value. **Result & Analysis.** The dominance of suckermouth catfish in Jakarta is sustained by tolerance for degraded water quality, high reproductive fecundity, and dietary flexibility. A fish reinventory of the Ciliwung River between 2023 and 2024 identified the species among the five most abundant of 37 recorded, confirming that invasive dominance persists despite overall improvements in species richness. Microplastic particles were detected in the gills and digestive tract of specimens from South Jakarta, and ectoparasites were recorded in fish from the same urban habitat, indicating a layered environmental health risk associated with utilisation of the species as a food source. **Discussion.** Suckermouth catfish functions simultaneously as an invasive species and as an ecological indicator of urban river degradation. Effective control requires an integrated ecosystem-based approach prioritising water quality improvement, adaptive harvesting, habitat restoration, and cross-sectoral governance.

Keywords: *Ecosystem-Based Management, Environmental Health, Invasive Fish, Pterygoplichthys pardalis, Urban River Restoration*

INTRODUCTION

Urban aquatic ecosystems rank among the most ecologically vulnerable systems on Earth. In large metropolitan areas, this vulnerability is compounded by multiple simultaneous pressures, including domestic and industrial pollution, land-use change, river channelisation, declining riparian vegetation cover, sedimentation, and the introduction of non-native species. These pressures collectively alter the fundamental structure of aquatic biological communities, affecting species composition, dominance patterns, and ecological function. Within this context, the proliferation of suckermouth catfish in the waterways of DKI Jakarta Province represents more than an isolated biological anomaly; it reflects a broader pattern of ecosystem transformation driven by anthropogenic disturbance (Rushayati *et al.*, 2025).

Suckermouth catfish, principally *Pterygoplichthys pardalis*, belong to the family Loricariidae and originate from South America. Their introduction to Indonesian waters is widely attributed to the ornamental fish trade, through which individuals entered public waterways either by deliberate release or accidental escape. Across multiple studies, this group has been categorised as an invasive exotic species, defined by its capacity to establish, reproduce, and achieve dominance in new habitats while suppressing native biota. In the Indonesian context, the invasive status of suckermouth catfish has been affirmed in recent scientific literature, including a reinventory of the Ciliwung River that classified the species as an invasive exotic fish and linked its presence to national regulations governing the prohibition of

certain species introductions and distribution (Mujadid *et al.*, 2025).

DKI Jakarta provides a particularly instructive setting for examining this phenomenon. The province encompasses a complex network of rivers and drainage channels that have been subjected to chronic pollution for decades. Available evidence indicates that suckermouth catfish have long dominated specific segments of the Ciliwung River, particularly those traversing densely populated areas in South Jakarta. Discourse on this species in Jakarta extends beyond questions of invasiveness to encompass economic utilisation, nutritional composition, contamination risk, and environmental governance (Muthmainnah, 2019; Hasanah, Basalamah and Millaningtyas, 2021).

The most recent systematic evidence comes from a 2023–2024 fish reinventory of the Ciliwung River conducted by the National Research and Innovation Agency (BRIN), which identified 37 fish species, among which *P. pardalis* ranked among the five most abundant. Three exotic species were recorded in total, with suckermouth catfish representing the most ecologically significant in terms of abundance. This finding carries important implications: a higher total species count does not necessarily signal ecosystem recovery if tolerant non-native species continue to consolidate their dominance. The persistence of *P. pardalis* at high abundance, even within an inventory that recorded comparatively greater species diversity, indicates that native community recovery remains incomplete (Mujadid *et al.*, 2025). The Biodiversity Profile of DKI Jakarta further corroborates this, formally identifying suckermouth catfish as one of the invasive fish species present in the province, thereby elevating the issue from a

purely scientific concern to one of institutional conservation and biodiversity management (Rushayati *et al.*, 2025).

Environmental health considerations add a further dimension to this problem. A study conducted at two sites along the Ciliwung River in South Jakarta detected microplastic particles in the gills and digestive tract of *P. pardalis*, as well as in the surrounding water and sediment. Separately, several local studies have documented community utilisation of suckermouth catfish as a raw material for processed food products. The simultaneous presence of these two realities within the same socio-ecological landscape raises substantive questions about the safety of consuming fish harvested from heavily polluted urban waterways (Deriano, Nurdin and Patria, 2022; Elfidasari, Puspaningtias and Fahmi, 2022).

Despite a growing body of literature addressing individual aspects of this species in Jakarta, including fish community structure, reproductive biology, gut content analysis, parasite identification, nutritional composition, and microplastic accumulation, these lines of inquiry have rarely been integrated into a unified analytical framework capable of informing management decisions. The central questions that remain insufficiently addressed are: why has suckermouth catfish achieved and sustained dominance in Jakarta's waterways; what are the ecological and environmental health consequences of that dominance; and what control strategies are most appropriate for the urban riverine context of DKI Jakarta? (Sholihah, 2019; Fitriadi, 2021)

This article addresses those questions through a systematic narrative review of available scientific literature, institutional reports, and official government

documents. It situates suckermouth catfish simultaneously as an invasive species, an indicator of ecosystem degradation, and an organism embedded in a complex network of urban pollution, thereby integrating three analytical perspectives that have rarely been examined together in a single study: invasion ecology, environmental health, and urban river management. The objective is to synthesise existing evidence into a coherent explanatory framework and to derive evidence-based recommendations for ecosystem-oriented control strategies applicable to DKI Jakarta (Deriano, Nurdin and Patria, 2022; Rushayati *et al.*, 2025).

METHOD AND ANALYSIS

This study employed a systematic narrative review as its primary methodological approach. This design was selected because the research objectives required cross-disciplinary integration spanning fish biology, community ecology, environmental quality assessment, and policy analysis, a scope that is more appropriately addressed through the synthesis of existing knowledge than through primary field investigation. The systematic narrative review allowed for the structured identification, extraction, and analytical synthesis of relevant literature while retaining the interpretive flexibility necessary to build a conceptual and policy-oriented argument (Mujadid *et al.*, 2025).

Source materials were drawn from four categories: peer-reviewed national journal articles, scientific publications from BRIN, technical reports from the Ministry of Marine Affairs and Fisheries, undergraduate and postgraduate theses from Indonesian universities, and official documents issued by the Government of DKI Jakarta Province. Literature searches

were conducted using the following keywords, applied individually and in combination: "ikan sapu-sapu," "*Pterygoplichthys pardalis*," "Ciliwung," "Jakarta," "invasive fish," "microplastic," "reproductive aspects," "fish community," and "habitat." Searches were conducted across institutional repositories, national journal databases, and government document archives (Muthmainnah, 2019).

Inclusion criteria were applied systematically to ensure the relevance and analytical value of selected sources. A source was included if it met all of the following conditions: it addressed suckermouth catfish or invasive Loricariidae; it was relevant to Indonesia, and specifically to Jakarta or the Ciliwung River watershed; it demonstrated methodological clarity or carried substantive policy value; and it could contribute meaningfully to the synthesis of evidence regarding the species' status, ecological impact, or management options. Sources that did not satisfy these criteria were excluded from the analysis.

The analytical process followed four sequential stages. In the first stage, relevant documents were identified and screened against the inclusion criteria. In the second stage, key information was extracted from each source and organised into thematic categories: distribution and status, biological characteristics, community structure, environmental quality, contamination risk, and control options. In the third stage, findings across sources were compared to identify areas of convergence and divergence. In the fourth stage, a narrative synthesis was constructed to explain the relationship between the dominance of suckermouth catfish and the ecological condition of Jakarta's urban waterways. This staged approach enabled

the integration of dispersed evidence into a more complete and coherent explanatory framework (Deriano, Nurdin and Patria, 2022).

RESULTS

Distribution and Dominance Status in DKI Jakarta Waters

Suckermouth catfish have established a sustained and substantial presence in the waterways of DKI Jakarta, with the highest recorded abundances concentrated along Ciliwung River segments traversing densely populated and heavily polluted areas of South Jakarta. Research on fish community structure and habitat use consistently places *P. pardalis* among the dominant species in these zones, while studies from the middle reaches of the river confirm that its distribution extends beyond the most severely degraded segments (Muthmainnah, 2019; Hariyanta, 2024).

The most systematic quantitative evidence comes from the BRIN fish reinventory of the Ciliwung River conducted between 2023 and 2024, which recorded 37 species, of which three were exotic. Among all species documented, *P. pardalis* ranked within the five most abundant, retaining its dominant position despite the comparatively higher species richness recorded in this survey relative to earlier inventories. This pattern is ecologically significant: an increase in total species count does not constitute evidence of ecosystem recovery when tolerant invasive species continue to hold the highest abundance ranks (Mujadid *et al.*, 2025). The Biodiversity Profile of DKI Jakarta formally corroborates this status by listing suckermouth catfish among the province's invasive fish species, situating

the issue within regional conservation governance (Rushayati *et al.*, 2025).

Biological Characteristics Supporting Invasive Persistence

The ecological success of *P. pardalis* in Jakarta reflects a combination of biological traits that confer competitive advantages under the degraded conditions typical of urban rivers. Its tolerance for low dissolved oxygen and high pollution loads, documented in heavily contaminated Ciliwung segments where the species nonetheless achieves very high abundance, allows it to occupy ecological space vacated by native species unable to persist under equivalent conditions (Hasanah, 2019). Reproductive output further reinforces population persistence, with fecundity recorded between 737 and 3,820 eggs per female in Ciliwung populations, a range that renders localised mortality or moderate harvesting pressure insufficient to produce meaningful population-level reductions (Elfidasari, Puspaningtias and Fahmi, 2022; Hariyanta, 2024). Gut content analyses additionally indicate dietary flexibility, enabling the species to exploit locally available food resources across varying habitat conditions (Sholihah, 2019). Collectively, these traits interact with the degraded state of the receiving environment to produce and sustain dominance: habitat deterioration functions as an ecological gateway for invasion by removing the competitive buffering that native communities would otherwise provide (Mujadid *et al.*, 2025).

Microplastic Accumulation and Environmental Health Considerations

A study conducted at two sampling sites along the Ciliwung River in South Jakarta detected microplastic particles in

the gills and digestive tract of *P. pardalis*, as well as in the water column and sediment at both locations. The presence of microplastics in gill tissue and the gastrointestinal system indicates direct exposure through respiratory and alimentary pathways, consistent with the species' benthic feeding behaviour and continuous contact with contaminated substrates. While this finding does not in itself establish definitive clinical risk to human consumers, it provides sufficient empirical basis to warrant precautionary treatment of suckermouth catfish from urban polluted waters as a food source (Deriano, Nurdin and Patria, 2022).

Ectoparasite identification studies conducted on *P. pardalis* specimens from the Ciliwung River add a further dimension to the environmental health risk profile. The detection of parasitic organisms on fish inhabiting urban waterways indicates that biological risk factors compound the chemical and physical contamination already documented for this system. Although the precise level of transmission risk to humans requires further investigation, the presence of parasitological evidence reinforces the conclusion that suckermouth catfish in Jakarta exist within a complex network of environmental risk factors that cannot be reduced to a single contaminant category (Fitriadi, 2021).

Taken together, the microplastic and parasitological findings indicate that any policy framework promoting the utilisation of suckermouth catfish as a food source or local economic resource must be contingent upon rigorous contaminant testing and food safety verification. The principle that abundance does not imply safety must be made explicit in both scientific communication and public health

messaging directed at communities that harvest fish from urban waterways (Deriano, Nurdin and Patria, 2022; Elfidasari, Puspaningtias and Fahmi, 2022).

DISCUSSION

The results of this review converge on a single analytical conclusion: the dominance of *P. pardalis* in DKI Jakarta's waterways is not a species-level problem with a species-level solution. It is a symptom of urban ecosystem degradation, and it will persist for as long as the environmental conditions that sustain its competitive advantage remain unaddressed. The high abundance of suckermouth catfish in the most polluted segments of the Ciliwung River, the mass mortality event at Kalibaru Timur triggered by acute water quality fluctuation, and the species' formal recognition as an invasive organism in provincial biodiversity documents all point to the same underlying dynamic: *P. pardalis* thrives precisely where Jakarta's rivers are most compromised (DLH Jakarta, 2024; Mujadid *et al.*, 2025; Rushayati *et al.*, 2025).

This positioning has direct implications for how control strategies are designed. Approaches that target the species through harvesting alone, without concurrent improvement of water quality and habitat conditions, are unlikely to produce lasting results. Invasive populations remain robust as long as the environmental pressures conferring their competitive superiority persist, and the reproductive capacity documented for Ciliwung populations means that even sustained harvesting effort may not outpace natural recovery of the population under unchanged ecological conditions (Elfidasari, Puspaningtias and Fahmi, 2022;

Hariyanta, 2024). Harvesting can serve as a legitimate instrument for localised biomass reduction and for relieving competitive pressure on native fish communities, but it functions most effectively as one component of an integrated strategy rather than as its centrepiece.

The environmental health dimension adds a further layer of complexity to utilisation-based approaches. The detection of microplastics in the gills and digestive tract of *P. pardalis*, combined with the presence of ectoparasites in specimens from urban habitats, indicates that fish harvested from Jakarta's polluted waterways carry a contamination risk profile that is not adequately addressed by abundance alone (Fitriadi, 2021; Deriano, Nurdin and Patria, 2022). Any policy that promotes economic or dietary utilisation of suckermouth catfish without mandatory contaminant screening and food safety verification risks transferring an ecological problem into the domain of public health.

An ecosystem-based management framework is therefore the only approach with the structural capacity to address both the invasive dominance and its underlying drivers. Such a framework must prioritise water quality improvement and pollution load reduction as its foundational intervention, integrate standardised population monitoring as a feedback mechanism, incorporate targeted adaptive harvesting where ecologically justified, and pursue habitat restoration to rebuild conditions that support native species recovery. Public education directed at preventing reintroduction through ornamental fish release, and regulatory oversight of any utilisation activities, complete the framework. The critical institutional implication is that none of these components can be delivered by a

single sector: effective management requires coordinated engagement across agencies responsible for environmental quality, watershed governance, food safety, public health, and scientific research (Rushayati *et al.*, 2025).

Finally, while the existing evidence base is sufficient to support this framework, targeted research gaps remain. Population biomass estimation, seasonal distribution mapping, quantification of competitive interactions with native species, heavy metal accumulation studies, and controlled evaluation of harvesting effectiveness would substantially strengthen the precision of future management decisions in DKI Jakarta (Deriano, Nurdin and Patria, 2022; Mujadid *et al.*, 2025).

CONCLUSION AND SUGGESTION

Suckermouth catfish (*Pterygoplichthys pardalis*) has established itself as one of the dominant fish species in the waterways of DKI Jakarta Province, particularly within the Ciliwung River system. Its persistence and abundance reflect the intersection of strong biological traits, including tolerance to polluted conditions, high reproductive output, and dietary flexibility, with a receiving ecosystem that has been substantially degraded by decades of anthropogenic pressure. In this respect, the species functions not only as an invasive organism but as an ecological indicator of urban river deterioration, its dominance signalling the extent to which native community integrity has been compromised.

The environmental health implications of its presence are equally significant. Evidence of microplastic accumulation in gill and digestive tissue, alongside the detection of ectoparasites in

specimens from urban habitats, establishes that suckermouth catfish in Jakarta's waterways carry a layered contamination risk profile. Utilisation of the species as a food or economic resource cannot be responsibly pursued without rigorous safety verification, and public understanding of this distinction between biological abundance and consumption safety requires active reinforcement.

Controlling suckermouth catfish in DKI Jakarta demands an integrated, ecosystem-oriented response. Water quality improvement and pollution reduction form the indispensable foundation, as no species-level intervention can produce lasting outcomes while the environmental conditions sustaining the species' dominance remain intact. Targeted harvesting, standardised population monitoring, habitat restoration, and cross-sectoral institutional coordination are the complementary components through which meaningful and measurable progress can be achieved. Addressing suckermouth catfish as a symptom of ecosystem degradation, rather than as an isolated management target, is the conceptual shift upon which effective long-term governance of Jakarta's urban rivers must be built.

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