

The Potential of Hydronymy in Supporting a Sustainable Blue Economy in Coastal Areas of Riau Province

Imelda Yance^{1,2}, Damsar Damsar¹, Bob Alfiandi¹, Katubi²

¹Postgraduate Program of Social and Political Sciences, Andalas University, Padang, Indonesia

²National Research and Innovation Agency (BRIN), Indonesia

Abstract. The Riau Province has significant potential for sustainable blue economy development due to its extensive coastline and rich aquatic ecosystems. This study examines hydronyms—geographical names of water bodies such as rivers—in Bengkalis Regency and their role in supporting blue economy practices. Using toponymic analysis, the research identifies how river hydronyms encapsulate local biodiversity, cultural significance, and traditional livelihoods. These hydronyms serve as indicators for sustainable economic practices, including ecotourism, fisheries conservation, and ecosystem preservation. Additionally, hydronyms reflecting hydrological conditions, such as tidal patterns, provide valuable insights for environmental risk management, particularly in flood and erosion mitigation. This study underscores the strategic potential of hydronyms as both cultural and practical tools for sustainable economic development, ensuring a balance between ecological resilience and socio-economic well-being in coastal communities.

1 Introduction

The blue economy has emerged as a strategic framework for balancing economic development with marine resource sustainability. This concept integrates economic growth, social inclusion, and environmental preservation, ensuring that marine and coastal resources are utilized sustainably to benefit current and future generations. In many coastal and island regions, the blue economy plays a crucial role in enhancing community welfare through sectors such as fisheries, maritime tourism, and renewable energy. By promoting sustainability principles, the blue economy seeks to mitigate the negative impacts of human activities on marine ecosystems while addressing climate change challenges [1,2].

Rivers are essential components of the blue economy, serving as key resources for freshwater supply, nutrient distribution, and sediment transport, all of which support marine biodiversity. Additionally, rivers function as trade routes, connecting inland and coastal economies while providing crucial ecosystem services such as flood regulation and carbon sequestration. Effective river management contributes to sustainable fisheries, tourism, and energy production, ensuring long-term economic and environmental resilience [3,4,5].

In Indonesia, rivers play an indispensable role in sustaining coastal economies by supporting livelihoods, preserving biodiversity, and linking inland and marine environments. However, discussions on the blue economy often overlook the role of river systems and their toponymic significance in sustainable resource management. In Bengkalis Regency, hydronyms reflect local biodiversity, cultural traditions, and ecological features, yet their potential contributions to the blue economy remain underexplored.

Existing research on hydronyms has primarily focused on their linguistic, historical, and cultural aspects, as seen in studies by Muntele [6], Masfufah [7], and Yance [8]. However, there is limited exploration of how hydronyms can inform sustainable resource management within the blue economy framework. This study addresses this gap by analyzing how hydronyms can guide community-based conservation strategies, support ecotourism development, and enhance fisheries sustainability.

By integrating Nystrom's toponymic theory [9] and Gunter Pauli's blue economy principles [10], this research demonstrates the strategic value of hydronyms in shaping sustainable economic practices. Understanding hydronyms in this context not only enriches blue economy discourse but also highlights the importance of local knowledge in shaping sustainable development policies. The findings of this study provide critical insights into leveraging hydronyms for economic and environmental sustainability, ensuring that local communities benefit equitably from sustainable resource management.

2 Method

This study employs a qualitative methodology incorporating Nystrom's toponymic theory [9] and Gunter Pauli's blue economy framework [10] to analyze the significance of hydronyms in sustainable economic development. Data collection involved multiple sources, including historical maps, government records, and semi-structured interviews with local communities in Bengkalis Regency. Some data were drawn from Yance [11], which emphasized river conservation and preservation, while additional data were incorporated to address the blue economy's relevance, offering fresh perspectives on maritime resource management. This approach traced the origins and usage of water body names by adhering to Nystrom's multidimensional framework.

The study utilizes toponymic analysis to interpret the meanings and structures of hydronyms, assessing their ecological, cultural, and economic implications. The analysis follows Nystrom's multidimensional framework, which examines naming conventions, historical contexts, and environmental significance. Furthermore, a comparative approach was used to assess the consistency of hydronyms with blue economy principles, particularly in areas related to ecotourism, fisheries conservation, and climate adaptation strategies.

A case study approach was applied to selected hydronyms that demonstrated clear ecological and economic relevance. These case studies illustrate how hydronyms inform local decision-making in natural resource governance, aiding in policy recommendations for integrating hydronyms into sustainable development planning. Triangulation of findings from multiple data sources ensures reliability and depth in the interpretation of results, reinforcing the broader applicability of hydronyms as tools for sustainable resource management.

3 Result and discussion

3.1 Hydronyms themes

The table below summarizes the findings from an analysis of hydronyms in Bengkulu Regency.

Table 1. Themes and examples of hydronyms in Bengkulu Regency.

Name Themes	Percentage (%)	Description	Examples of Hydronyms
Activity	4.8	Names derived from human activities carried out in or around rivers.	Mendulang, Empang, Malibur, Penebak, Ceruk
Tool	2.4	Names inspired by tools used by humans near rivers.	Kail, Titi
Direction	2.4	Names related to geographical orientation or direction.	Penuntun, Simpang
Object	5.6	Names associated with specific objects found near rivers.	Balung, Inpres, Jamban, Embuyut
Supernatural Entity	0.8	Names referring to supernatural beings or concepts.	Berembang
Fauna	4.8	Names referring to animals found in or near rivers.	Musuh, Punggur, Ketamputih, Gajahmati
Flora	26.4	Names inspired by plants growing in or around rivers.	Beringin, Cingam, Durian, Jangkang, Meranti, Serai, Tembusu
Village	8	Names derived from the villages or communities surrounding the rivers.	Bengkalis, Bukitbatu, Meskom, Tanjungdamai
Characteristics	15.2	Names based on the physical characteristics or perceived benefits of the rivers.	Air Godang, Airmasuk, Patah, Kolam, Sedekah, Aman
Man	16	Names associated with individuals or human groups related to the rivers.	Sair, Saka Kiri, Geming, Yap, Senderak, Sebauk
Season	0.8	Names referring to seasons or specific natural phenomena.	Mesim
Natural Topography	1.6	Names inspired by natural geographical features.	Tasik, Titideras
Place	6.4	Names linked to specific landmarks or locations.	Pekalar, Balairaja, Batupanjang, Pintugadang
Unknown	4.8	Names with unclear or indeterminate origins.	Manicililiang, Pesimsim, Mertas, Kepalarandupanjang

The table categorizes the river names into distinct themes, which reflect the various cultural, ecological, and human influences embedded in the naming practices. The hydronyms are classified under themes such as flora, fauna, human activities, tools, and

supernatural entities, each providing insights into the region's relationship with its natural environment. For instance, several hydronyms are derived from flora, with names like *Beringin*, *Cingam*, and *Meranti*, illustrating the importance of plants in the local landscape. Similarly, names such as *Sair*, *Saka Kiri*, and *Yap* are associated with humans or human groups, showing the cultural significance of individuals in the naming process. Other names, such as *Air Godang*, *Patah*, and *Sedekah*, fall under the theme of characteristics, referring to the physical traits or perceived benefits of the rivers.

The activity theme includes names like *Mendulang*, *Empang*, and *Penebak*, which are linked to human actions around the rivers. There are also fauna-related hydronyms, such as *Musuh*, *Punggur*, and *Gajahmati*, which reflect the animal life in the region. Furthermore, names like *Penuntun* and *Simpang* refer to directions, while *Balung*, *Inpres*, and *Jamban* are examples of object-based hydronyms associated with specific items found near the rivers.

Other themes include references to supernatural entities (e.g. *Berembang*), natural topography (e.g., *Tasik*, *Titideras*), and places (e.g., *Pekalar*, *Balaraja*). Some names, such as *Manicililiang* and *Kepalarandupanjang*, fall under the not known category, where the origin of the name remains unclear.

This classification not only categorizes the river names but also provides a deeper understanding of how these hydronyms reflect the cultural, ecological, and human relationships within the region. The table serves as a valuable resource for analyzing these relationships and their potential implications for sustainable management practices and the blue economy.

3.1.1 Flora and fauna

Hydronyms related to flora and fauna, such as *Beringin* (banyan tree) and *Ketamputih* (white crab), highlight the ecological diversity of Bengkalis' rivers. These names not only serve as geographical markers but also indicate areas rich in biodiversity. For example, *Ketamputih* reflects habitats supporting species with economic and ecological significance, making it a potential site for conservation and ecotourism. The preservation of such areas aligns with blue economy principles, emphasizing sustainable use and protection of natural resources.

3.1.2 Human activities and tools

Names like *Mendulang* (gold mining) and *Kail* (fishing hook) reflect traditional activities and tools used by local communities. These hydronyms illustrate the sustainable practices historically adopted by the community, such as small-scale gold panning and eco-friendly fishing methods. By integrating these traditional practices into modern blue economy frameworks, these hydronyms can guide policies that balance economic growth with environmental stewardship.

3.1.3 Geographical characteristics and natural features

Hydronyms such as *Air Godang* (high tide) and *Tasik* (lake) provide insights into the physical and hydrological features of the rivers. These names are valuable for environmental risk management and climate adaptation, offering natural indicators of flooding or tidal patterns. For instance, *Air Godang* can inform strategies for flood resilience, while *Tasik* highlights areas suitable for water resource management initiatives.

3.1.4 Cultural and supernatural connections

Some hydronyms, like *Saka Kiri* (associated with local legends) and *Berembang* (linked to supernatural entities), reflect the cultural and spiritual values of the local community. These names symbolize the community's connection to their environment and can serve as focal points for cultural tourism, further enriching the socio-economic aspects of the blue economy.

3.1.5 Special place and settlements

Hydronyms such as *Pekalar*, *Balairaja*, and *Batupanjang* highlight the importance of particular places in the community's daily life or history. These names can signify villages, settlements, or notable features in the landscape, further illustrating how the local environment and human habitation are intertwined in the naming of natural features. The place category thus encompasses names that are closely tied to specific landmarks or locations, emphasizing the cultural and geographical significance of these areas within the region.

This thematic classification of hydronyms underscores their multifunctional role in ecological, cultural, and economic contexts. By leveraging these insights, policymakers and stakeholders can integrate hydronyms into sustainable blue economy initiatives that balance conservation with community well-being.

3.2 Linking hydronyms to blue economy opportunities

From the hydronym themes of rivers in Bengkalis Regency presented in Table 1, it is evident that the river names reflect diverse ecological, cultural, and human activities. Themes such as flora, fauna, and human activities highlight the close relationship between local communities and their surrounding environment, manifested through sustainable resource use and cultural practices rooted in local wisdom. These patterns provide crucial insights into how hydronyms can serve as indicators of sustainable blue economy potential.

The hydronyms found in Bengkalis Regency offer significant insights that align with the principles of the blue economy, which focuses on sustainable economic development through the responsible use of marine and freshwater resources. These river names reflect the region's diverse aquatic and coastal ecosystems, providing valuable information that can be applied to various sectors. Specifically, these hydronyms can play a crucial role in advancing ecotourism, promoting sustainable fisheries, conserving unique local species, and enhancing environmental risk management and climate adaptation strategies. The following discussion explores how hydronyms contribute to these four areas, ensuring that local economic practices are both environmentally sustainable and aligned with broader blue economy goals.

3.2.1 Ecotourism

Hydronyms play a crucial role in the development of ecotourism by highlighting natural and cultural heritage sites that can attract visitors. Many hydronyms in Bengkalis Regency are associated with ecological and historical significance, making them valuable assets for sustainable tourism initiatives. The use of hydronyms in ecotourism planning can enhance visitor engagement, promote local narratives, and support conservation efforts.

Hydronyms such as *Pekalar* (fishing place) and *Musuh* (enemy, referring to crocodiles) signify locations with ecological and cultural importance. These sites can serve as focal points for eco-friendly tourism activities such as wildlife observation, guided heritage tours, and community-led conservation projects. By integrating hydronyms into ecotourism

marketing and destination planning, local stakeholders can foster environmental awareness while generating sustainable economic benefits for communities.

The development of hydronym-based ecotourism aligns with blue economy principles by balancing economic growth with ecosystem preservation. Ecotourism initiatives that emphasize the historical and environmental value of hydronyms can create new economic opportunities, strengthen local identities, and encourage responsible tourism practices. Additionally, incorporating hydronyms into regional tourism policies ensures that cultural and ecological heritage is safeguarded, supporting long-term sustainability for both the environment and local livelihoods.

3.2.2 Sustainable fisheries

Hydronyms provide valuable insights into the ecological characteristics of riverine and coastal environments, playing a crucial role in the sustainable management of fisheries. In Bengkalis Regency, many hydronyms reflect the presence of important fish species and aquatic habitats, offering guidance for responsible fishing practices and resource conservation.

Names such as *Ketamputih* (white crab) and *Baling* (associated with fish spawning grounds) indicate ecologically significant areas that support fisheries productivity. Recognizing these hydronyms allows local communities to identify key breeding and fishing zones, ensuring the sustainability of fish populations and preventing overexploitation. By integrating hydronyms into fisheries management strategies, policymakers can designate protected areas, implement seasonal fishing regulations, and promote traditional, eco-friendly fishing techniques.

Additionally, hydronyms can contribute to the development of community-based fisheries initiatives, where local knowledge and historical understanding of water bodies inform conservation efforts. Aligning fisheries policies with hydronymic insights ensures that traditional ecological wisdom is preserved while enhancing the sustainability of aquatic resources. This approach supports blue economy principles by fostering economic resilience through environmentally responsible fishing practices.

3.2.3 Conservation of unique local species

Hydronyms offer significant insights into the presence and conservation of unique local species by identifying areas with ecological importance. In Bengkalis Regency, many hydronyms are linked to native flora and fauna, serving as markers for biodiversity-rich environments that require sustainable management.

Names such as *Beringin* (banyan tree), *Cingam* (*Bischofia javanica*), *Durian* (*Durio zibethinus*), and *Ketamputih* (white crab) indicate regions that support critical ecosystems. These hydronyms highlight the habitats of species that are vital for local biodiversity, making them important references for conservation planning. Protecting these areas ensures the preservation of genetic resources, maintains ecosystem balance, and safeguards traditional ecological knowledge.

Integrating hydronyms into conservation policies can aid in identifying priority zones for habitat protection and restoration. By recognizing the ecological significance of hydronyms, conservation efforts can be more effectively targeted, supporting both environmental sustainability and community livelihoods. Additionally, leveraging hydronyms in conservation education initiatives can enhance public awareness and local participation in biodiversity preservation, aligning with the broader goals of the blue economy framework.

3.2.4 Environmental risk management

Hydronyms provide critical information about the hydrological characteristics of an area, making them valuable tools for environmental risk management. In Bengkalis Regency, certain hydronyms reflect patterns of water movement, tidal fluctuations, and seasonal flooding, offering essential insights for climate adaptation and disaster mitigation strategies.

For example, names like *Air Godang* (high tide) and *Airmasuk* (incoming water) indicate areas prone to tidal surges and flooding. These hydronyms can be utilized in the development of early warning systems, flood mapping, and land-use planning to minimize the impacts of climate change and extreme weather events. By incorporating traditional knowledge embedded in hydronyms with scientific data, policymakers can create more effective risk management frameworks that align with local environmental realities.

Furthermore, integrating hydronyms into climate adaptation strategies supports community resilience by improving preparedness and response measures. Local authorities can use these names to guide infrastructure planning, ensuring that developments consider natural water flow and potential flood-prone zones. This approach not only enhances environmental sustainability but also aligns with blue economy principles by safeguarding both ecological and economic assets against environmental hazards.

4 Conclusion

The analysis of hydronyms in Bengkalis Regency highlights their crucial role in supporting sustainable blue economy practices. These geographical names encapsulate ecological, cultural, and hydrological insights that inform sustainable strategies in key areas, including ecotourism, fisheries management, conservation, and environmental risk mitigation.

Hydronyms linked to the region's biodiversity present opportunities for promoting ecotourism, offering eco-friendly tourism initiatives that integrate local heritage and environmental conservation. In fisheries management, hydronyms that reflect aquatic species and habitats can guide sustainable resource utilization and ensure long-term economic benefits for fishing communities. Similarly, hydronyms serve as indicators for the conservation of unique local species, providing essential data for habitat protection and biodiversity preservation.

Moreover, hydronyms reflecting hydrological conditions, such as tidal patterns and seasonal flooding, provide valuable information for environmental risk management. Incorporating hydronyms into climate adaptation and disaster mitigation strategies can enhance regional resilience to climate change and natural hazards.

Despite their potential, the integration of hydronyms into policy frameworks and sustainable development initiatives remains limited. Future research should focus on strengthening interdisciplinary approaches that combine linguistic, ecological, and socio-economic perspectives. Additionally, greater collaboration between local governments, researchers, and community stakeholders is essential to maximize the role of hydronyms in sustainable development.

By recognizing the strategic value of hydronyms, Bengkalis Regency can establish a sustainable blue economy framework that not only preserves environmental integrity but also enhances socio-economic resilience. Ensuring that traditional knowledge embedded in hydronyms is systematically incorporated into modern planning will be key to fostering sustainable and inclusive growth in coastal regions.

5 Recommendation

To enhance the contribution of hydronyms to sustainable blue economy initiatives, local governments should integrate hydronym analysis into water resource management and policy-making, ensuring that traditional ecological knowledge is systematically incorporated into decision-making processes. Community-driven ecotourism initiatives that utilize hydronyms as cultural and environmental assets should be developed to generate sustainable economic opportunities while fostering environmental conservation. Additionally, hydronyms that indicate biodiversity hotspots must be prioritized in marine and freshwater conservation planning, with policies that support sustainable fishing practices and habitat protection based on local ecological wisdom. Given their relevance in identifying flood-prone areas and tidal patterns, hydronyms should also be incorporated into climate adaptation strategies, guiding the development of early warning systems and sustainable land-use planning to mitigate environmental risks. Future research should expand the documentation and analysis of hydronyms in other regions, with interdisciplinary collaboration between researchers, policymakers, and indigenous communities playing a crucial role in advancing the understanding and application of hydronyms in sustainable development. By implementing these measures, hydronyms can serve as a bridge between traditional knowledge and contemporary sustainability efforts, ensuring ecological resilience and long-term socio-economic benefits for coastal communities.

References

1. WWF, Principles for a Sustainable BLUE ECONOMY (2016).
2. World Bank & United Nations, The potential of the blue economy: Increasing long-term benefits of the sustainable use of marine resources for small island developing states and coastal least developed countries (2017).
3. A.A. Adeyemi, A.J. Abiodun. Ilmu Sosiologi Dialektika Kontemporer, **11**, 2 (2023).
4. BAPPENAS, Indonesia blue economy roadmap 2023-2045, Perpustakaan BAPPENAS (2023).
5. OECD, The blue economy in cities and regions: A territorial approach, OECD Urban Studies (2024).
6. I. Muntele, *Diaconia*, **8** (2018).
7. N. Masfufah, *Sainska*, **16**, 93 (2020).
8. J. Yance, A Study of the Toponyms of Natural Topography in Siak, Riau Province, *Kapata Arkeologi*, **17**, 1 (2021).
9. S. Nyström, Names and Naming, in C. Hough (Ed.), *The Oxford Handbook of Names and Naming* (Oxford University Press, 2016).
10. G. Pauli, *The Blue Economy, 10 Years, 100 Innovations, 100 Million Jobs*, (Paradigm Publication, Mexico, 2010).
11. J. Yance, A. Zalmansyah, A. Supriadi, R. Novita, E. Maha Kastri, Jahdiah, ... Y. F. Wajayatiningsih, *Cogent Arts Humanit.*, **11**, 1 (2024).
12. R. Costanza, R. de Groot, P. Sutton, S. van der Ploeg, S. J. Glob. Environ. Change, **26**, 152-158 (2014).
13. M.R. Lauder, T. Bachtiar, C. Sobarna, Geographical Names as Indicators of the Environment: Case Study in Bandung Basin, West Java, Indonesia, in *Place Naming, Identities and Geography: Critical Perspectives in a Globalizing and Standardizing World*, Springer (2023).
14. IPCC, *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, ed. by H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K.

Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (Cambridge University Press, 2022).

RETRACTED