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

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Abstract. This study looks at how hydronyms—names given to rivers and other water bodies—have the potential to support the development of a sustainable blue economy in Bengkalis Regency, Riau Province. Using a toponymic approach, the research explores how these names often carry meaningful insights into local biodiversity, cultural traditions, and community livelihoods. This knowledge can inform sustainable practices such as ecotourism, responsible fisheries, and ecosystem preservation. By recognizing the value embedded in hydronyms, we can better connect traditional knowledge with present-day planning—offering a locally grounded resource to help guide blue economy initiatives in coastal areas.

1 Introduction

The blue economy is an approach that links economic development with the sustainable management of marine resources. This approach involves sectors such as fisheries, marine-based tourism, and renewable energy to enhance the welfare of coastal communities. Small states have the opportunity to capitalize on these sectors to drive economic growth and resilience, both by developing existing sectors and emerging ones like marine-based renewable energy [1]. Despite facing challenges such as overfishing and climate change, the blue economy makes a significant contribution to the global economy [2]. By applying sustainability principles, the blue economy has the potential to reduce the negative impacts of human activities on marine ecosystems and support climate change mitigation efforts. A similar concept can also be applied to the management of river resources, where sustainability principles can support a river-based economy that is both profitable and capable of preserving freshwater ecosystems.

Rivers are a fundamental part of the blue economy, offering essential sources of freshwater, helping with nutrient distribution, and supporting marine biodiversity. They also serve as important trade routes, connecting inland and coastal economies, while providing key ecosystem services like flood regulation and carbon sequestration. Managing rivers effectively is crucial for the sustainability of fisheries, tourism, and energy production, which in turn helps maintain long-term economic and environmental resilience. Recent studies emphasize how important freshwater systems are for maintaining these ecosystem services, particularly in regulating floods and storing carbon [3].

In addition to being rich in linguistic, historical, and cultural information, hydronyms also reveal their potential for river conservation [4] and water resource management [5]. Hydronyms have been recognized for their role in natural resource management by integrating local knowledge into conservation and resource management at the community level. However, their potential contribution to the blue economy remains underexplored.

By integrating Nystrom's toponymic theory [6] and Gunter Pauli's blue economy principles [7], 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 [6] and Gunter Pauli's blue economy framework [7] 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 [4], who 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 Bengkalis Regency.

Table 1. Themes and examples of hydronyms in Bengkalis 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, Tembuyut
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 derived from individuals or communities historically linked 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*, *Balairaja*). 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 initiatives. 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 places 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 *Balung* (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 This study demonstrates the potential of hydronyms—names of rivers and other water bodies—as valuable indicators for sustainable blue economy practices in Bengkalis Regency, Riau Province. Toponymic analysis reveals that hydronyms encapsulate ecological, cultural, and hydrological knowledge that can support ecotourism, fisheries conservation, and ecosystem preservation. Additionally, hydronyms reflecting tidal and hydrological patterns offer insights for environmental risk management, particularly in flood and erosion mitigation. Despite their potential, hydronyms remain underutilized in policy and planning. Greater integration of hydronymic knowledge into blue economy strategies is essential for achieving ecological sustainability and socio-economic resilience in coastal areas.

5 Recommendation

To make better use of the potential that hydronyms offer, several practical steps can be taken to support a more sustainable blue economy. One important step is to include knowledge from hydronym analysis in water management and regional planning, so that traditional insights about the environment are not overlooked in modern decision-making. Communities can also be encouraged to develop ecotourism based on the cultural and ecological meanings carried by local water names—turning heritage into an economic opportunity while protecting the environment. Hydronyms can also help identify key fishing areas and sensitive habitats, making them useful for designing more sustainable and locally grounded fisheries practices. In addition, names that reflect patterns like tidal movements or flood-prone zones can serve as early warning tools in disaster planning and help guide how land is used in vulnerable coastal areas. To ensure long-term impact, further research should be carried out in other regions, supported by collaboration between researchers, policymakers, and local communities who know these landscapes best.

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