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Exploring the environmental and social impacts of shrimp farming: A literature review in the Southern Coastal Region of Java

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ABSTRACT
Background: Shrimp farming in the southern coastal areas of Java has expanded rapidly due to increasing global demand, contributing significantly to local economic growth. However, this development has generated ecological degradation and social inequality, including water pollution, mangrove loss, and uneven resource distribution. Addressing these challenges requires balancing economic benefits with environmental and social sustainability. **Methods:** This study employed a qualitative literature review, analyzing five scientific sources on the impacts of shrimp farming on ecotourism, water quality, mangrove ecosystems, and socioeconomic conditions in Bantul, Kulon Progo, and Kebumen Regencies. **Results:** The analysis reveals that while shrimp farming enhances local incomes and can support ecotourism, unmanaged practices lead to ecosystem damage, water pollution, and heightened social disparities. Integrated management combining eco-friendly technologies, mangrove rehabilitation, waste treatment, and community empowerment is essential for sustainable development. **Conclusion:** Sustainable shrimp farming in Java's coastal regions requires strict zoning, continuous monitoring, and policies that integrate environmental protection with community participation. Long-term development must prioritize economic productivity without sacrificing coastal ecosystem integrity. **Novelty/Originality of this article:** This study uniquely combines ecological and social perspectives, highlighting shrimp farming's dual role.

KEYWORDS: shrimp farming; environmental impact; coastal ecotourism; mangroves; sustainable management.

1. Introduction

Coastal areas are among the ecosystems with the highest levels of biodiversity and play an important role in providing various vital ecosystem services. These functions include protecting coastlines from erosion, storing carbon for climate change mitigation, and providing habitats for various aquatic and terrestrial species. In addition to their ecological value, coastal areas also play a strategic role in socio-economic aspects, particularly as a source of livelihood for local communities. One of the fastest growing economic activities in coastal areas is shrimp farming. This practice not only offers high economic returns in a relatively short period of time, but is also a key sector in coastal economic development. At the regional level, particularly in Southeast Asia, including Indonesia, the growth of this sector shows a consistent trend. According to the World Aquaculture Report (Bartley, 2022), farmed shrimp production in Asia is projected to increase at an average annual

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growth rate of 6–8% between 2020 and 2025. This fact confirms the strategic role of shrimp farming in supporting the economic resilience of coastal areas while integrating conservation efforts with local economic development.

The need to increase income and improve economic welfare has encouraged coastal communities to develop shrimp farming. High global demand, especially from developed countries, strengthens the incentive to expand new ponds (Macusi et al., 2022). Shrimp farming offers more competitive economic prospects than traditional sectors such as conventional agriculture and capture fisheries, whose productivity is declining due to climate change and ecosystem degradation (Bosma et al., 2014). Shrimp harvests are reported to generate higher incomes than traditional agricultural products such as rice (Hossain et al., 2013), making this form of aquaculture a rational economic adaptation strategy in given resource constraints. The flexibility of pond management and the potential for a quick return on investment further strengthen its appeal, although adequate initial capital and technical expertise are required. Land conversion, including mangrove forests and agricultural land, into shrimp ponds is rampant due to direct economic incentives in the form of increased household income (Ashton, 2008; Bosma et al., 2016).

Shrimp farming offers significant economic benefits, but uncontrolled practices have had serious negative impacts on coastal environments. The conversion of mangrove ecosystems into ponds has led to a decline in biodiversity, deteriorating water quality, increased coastal erosion, and increased vulnerability of coastal areas to natural disasters such as floods and storms (Alongi, 2002). Recent reports estimate that approximately 38% of global mangrove ecosystem damage is directly related to shrimp farming activities (Akber et al., 2020). Waste from inadequately managed pond activities reduces water quality below applicable environmental standards and threatens the survival of aquatic biota. The main waste comes from the accumulation of uneaten feed and shrimp excrement, forming deposits at the bottom of the ponds. The main components of this waste are organic compounds with high concentrations of nitrogen and carbohydrates (Hidayat et al., 2015), which require a long decomposition time. The composition of shrimp feed consists of 25% carbohydrates, 8% fat, 36–40% protein, and 1–2% vitamins and minerals (Banun et al., 2007). The degradation of protein from feed releases harmful nitrogen compounds, such as ammonia and ammonium, into the water, which in turn causes toxicity to aquatic organisms (Romadhona et al., 2016). The use of chemicals, antibiotics, and other inputs in ponds also contributes to environmental pollution, which impacts the decline in the quality of seawater and soil, with implications for public health and the sustainability of local livelihoods.

The development of shrimp ponds has brought about complex social changes in coastal areas. This cultivation has opened up new economic opportunities for local communities, but in the long term, intensive production systems have exacerbated social inequality, triggered agrarian conflicts, and increased public health risks due to environmental pollution. Inequality arises because only a small portion of the community has access to the large capital and technology required for intensive cultivation, while the majority experience marginalization and loss of access to natural resources that were previously managed collectively. Tensions between farmers and traditional fishermen are one tangible form of this change in access to coastal resources (Muluk & Bailey, 1996). The intensive shrimp farming model exhibits a pattern of "boom and collapse," namely an explosion in production at the beginning of the cycle followed by land degradation and decreased productivity due to the accumulation of waste and disease outbreaks, thereby encouraging the clearing of new land and further ecosystem degradation (Van Wesenbeeck et al., 2015). In Indonesia, the expansion of ponds in coastal areas increases pressure on the sustainability of coastal ecosystems, exacerbates the problems of soil degradation and seawater intrusion, and reduces the capacity of mangroves to absorb carbon (Sampantamit, 2020). More in-depth studies are needed to comprehensively understand the multidimensional impacts of shrimp farming activities and to design management policies and strategies that balance economic, social, and environmental sustainability interests.

2. Methods

The research was conducted in April 2025 through a literature study focused on the southern coastal region of Java, covering the districts of Bantul, Kulon Progo, and Kebumen. This region was selected based on the intensity of shrimp farming activities and the relevance of their impact on ecological and socio-cultural aspects. Data were obtained from five scientific documents discussing the impact of shrimp farms on coastal ecotourism, water pollution, mangrove degradation, and social change.

The criteria for selecting sources included articles from accredited national journals, proceedings, and relevant theses in the southern coastal areas of Yogyakarta and Central Java. Information from each document was synthesized based on the study location, type of impact, and mitigation proposals, then organized into five main themes. The data analysis technique used was qualitative descriptive analysis, with stages including: (1) identification of key factors from each study, such as types of pollution, environmental degradation, land use change, and social transformation; (2) classification of findings based on impact categories; (3) interpretation of the causal relationship between shrimp farming activities and ecological and social changes in coastal areas; and (4) integration of findings across studies to develop a holistic narrative on the dynamics of the impacts of shrimp farming. This approach was used to generate a comprehensive understanding of the challenges and needs of sustainable management in coastal areas.

3. Results and Discussion

This section presents the results of a literature review focusing on the analysis of the impact of shrimp farming on the coastal environment in the southern region of the Special Region of Yogyakarta and Central Java. The research was conducted using a qualitative approach based on a literature study, through analysis of various secondary sources relevant to the local context. The results of the analysis were classified into several main themes to facilitate a comprehensive understanding of the relationship between shrimp farming activities and changes in environmental and socio-cultural aspects. The themes discussed include the impact on coastal ecotourism, water pollution in both rivers and the sea, the conversion of mangrove vegetation, and the socio-cultural dynamics of coastal communities. The data presented is a final synthesis of the results of a literature review, without displaying raw data, to sharpen the focus of the analysis on the meaning and implications of the findings. With this approach, the discussion is expected to provide a complete picture of the impact of shrimp farming on environmental sustainability and social welfare in the southern coastal region of Java.

3.1 The impact of shrimp farms on coastal ecotourism

Bantul Regency, Special Region of Yogyakarta, is one of the southern coastal areas of Java that has great potential for the development of the ecotourism sector. Parangtritis Beach, Goa Cemara Beach, and Kuwaru Beach are the main destinations that support tourism activities in this area. The development of shrimp farming, particularly vannamei shrimp (*Litopenaeus* vannamei), has introduced new dynamics in coastal zone management. This activity contributes to the economic improvement of coastal communities, but also poses potential risks to the sustainability of ecotourism if not balanced with effective environmental management (Suwito et al., 2020). Based on a literature review, the author argues that these dynamics highlight the importance of aligning fisheries-based economic activities with environmental conservation principles in coastal planning.

3.1.1 Positive impact of shrimp farms on ecotourism

Shrimp farming contributes significantly to the economy of coastal communities, especially in southern Java. According to Suwito et al. (2020), the average farmer on the southern coast of Java, especially in Bantul, can earn an average net profit of IDR 25,000,000 to IDR 30,000,000 per production cycle. With increased income, the community has the opportunity to improve tourism support facilities, such as homestays, restaurants, and transportation services. This condition encourages a multiplier effect, where economic growth in the primary sector (fisheries) also supports growth in the tertiary sector (tourism) (Setyowati, 2022). In addition to economic contributions, shrimp farms can also be developed into educational tourist attractions, namely edu-ecotourism, which teaches tourists about sustainable shrimp farming techniques. This activity adds variety to tourist attractions, extends the length of stay of tourists, and increases tourist spending in the area (Setyowati, 2022).

According to Suwito et al. (2020), shrimp farming contributes to the economy of coastal communities, with an average net profit of IDR 25,000,000 to IDR 30,000,000 per production cycle. This increase in income has implications for the development of tourism support facilities, including homestays, restaurants, and transportation services, which contribute to the growth of the local economy. This effect demonstrates the link between the aquaculture sector and the tourism sector, where growth in the primary sector triggers the development of the tertiary sector (Setyowati, 2022). In addition to its economic contribution, shrimp farming has the potential to be an object of environment-based educational tourism (edu-ecotourism), which provides tourists with an understanding of sustainable shrimp farming practices. This approach plays a role in enriching the diversification of tourist attractions, increasing the duration of tourist visits, and expanding the economic impact through increased tourist spending (Setyowati, 2022).

3.1.2 Negative impacts of shrimp farms on ecotourism

The conversion of coastal land for ponds often results in environmental damage. Coastal vegetation, such as casuarina and mangroves, is cut down to clear new land, reducing the ecological function of the area as a natural protection against abrasion and tsunamis (Pratama & Santoso, 2021). In addition, intensive shrimp farming activities produce waste in the form of ammonia, nitrites, and feed residues that can pollute the water. This waste worsens the quality of seawater and has a negative impact on coral reef ecosystems and fish habitats that are tourist attractions (Rahardjo et al., 2019).

The presence of ponds around coastal tourist sites changes the natural landscape into a monotonous and unattractive cultivation area. The dirty appearance of the ponds and the unpleasant smell of organic waste can reduce tourist comfort (Rahardjo et al., 2019). The massive growth of shrimp ponds also causes competition for land use. Several cases show that ponds have unofficially taken over land that should be public open space or conservation areas (Suharno, 2020).

3.2 The impact of shrimp farms on water pollution

Shrimp farming activities in coastal areas contribute significantly to water pollution, especially in rivers. The waste produced, both in the form of water and mud sediment, contains high concentrations of phosphate, nitrogen, and ammonia, which originate from feed residues, shrimp metabolic excretion, and shrimp decomposition (Airawati et al., 2023; Murti & Aurellia, 2024). Excessive nutrient content triggers eutrophication, which is the massive growth of aquatic plants and algae, which then has an impact on the decline in dissolved oxygen (DO) levels in the water. The decline in DO causes hypoxic conditions that potentially threaten the survival of aquatic biota (Murti & Aurellia, 2024).

A study conducted by Putri (2020) shows that the potential for ammonia pollution in Bantul Regency due to shrimp farming reaches 76,286 kg per maintenance period, with the majority of ponds classified as low pollution (green zone), while around 23 ponds are classified as high pollution (red zone). The potential for ammonia pollution in Kulon Progo Regency is recorded at 155,638 kg per maintenance period. Research by Anggraeni et al. (2007) found that pond waste at the mouth of the Bogowonto River increased the levels of total suspended solids, free carbon dioxide, organic matter, nitrate, and phosphate, and decreased the concentration of dissolved oxygen.

According to Mahaka et al. (2025), shrimp farming activities along the Telomoyo River in Kebumen Regency increase organic and inorganic pollution loads. The BOD_5 and COD values were recorded at 44,179.04 mg/L and 353,573.32 mg/L, respectively, which exceeded the class II water quality standard threshold. Based on the pollution index, the Telomoyo River is categorized as lightly polluted. This condition indicates the need for stricter shrimp farm waste management to maintain the quality of the river ecosystem in a sustainable manner.

Intensive shrimp farming practices often pose significant environmental challenges. One crucial issue is the production of waste from shrimp ponds, which has the potential to pollute the surrounding ecosystem. Waste from shrimp ponds is usually wastewater from feed residues that has an unpleasant odor and is discharged directly into nearby rivers or open sea waters. The shrimp farming process produces wastewater that is rich in nutrients, sediments, organic matter, and even chemicals such as antibiotics and feed residues.

Drainage water from farms contains compounds from feed decomposition, feces containing N and P, some of which are soluble in water and some of which become sediment (Susetyaningsih et al., 2020), shrimp shells, and other particles (Astriana et al., 2023). Liquid waste contains high levels of nitrogen and carbohydrates, partly because it comes from shrimp pellets, which are organic substances. The decomposition of shrimp pellets contains high protein, around 40%, which can produce toxic nitrogen compounds in the water, such as ammonia and ammonium, which can have a significant negative impact on the aquatic environment, such as inhibiting the growth of aquatic organisms and causing death (Aini & Parmi, 2022). Ammonia toxicity can increase suddenly following changes in water quality factors such as pH, temperature, ion charge, salinity, and dissolved oxygen (Royan et al. 2019). In addition to protein and nitrogen content, feed also contains compounds of nitrate and phosphorus, which, if accumulated in water bodies, will trigger eutrophication, thereby increasing the pollutant load in these waters (Harianja et al., 2018). According to Pallavi & Kumari (2024), eutrophication is the process of excessive enrichment of nutrients and other organic materials in water bodies into aquatic ecosystems, which can cause oxygen depletion in the water. Excessive phosphorus content accompanied by nitrogen can encourage phytoplankton blooms in the water and affect dissolved oxygen in the water, causing other marine biota to die (Arizuna et al., 2014).

The massive shrimp farms on the southern coast of Java have a negative impact on the surrounding environment, as shown in a study by Susetyaningsih et al. (2020), in Trisik Beach Lagoon, Yogyakarta. The study was conducted at three sampling points located at different distances from the shrimp farm waste disposal site. The results showed that the lagoon closest to the waste disposal site had a temperature of 30 degrees, which could affect the oxygen level in the water. The higher the temperature, the lower the oxygen circulating in the water. Furthermore, there was a low dissolved oxygen value due to the use of oxygen in the water by microorganisms, indicating organic and inorganic pollution from shrimp farm waste. This is in line with the high ammonia value, which affects dissolved oxygen in the water. High ammonia values can also involve nitrification processes in water bodies due to high nitrate and nitrite values, which can cause toxicity in aquatic ecosystems. This is supported by the average Biochemical Oxygen Dissolved (BOD) value of 6 mg/L, which is higher than the normal value. Normal BOD is able to protect the aquatic ecosystem in water bodies. Therefore, it can be concluded that the water quality of Trisik Beach Lagoon has not reached the quality standard due to the accumulation of compounds in shrimp farm waste. Another thing to note about the existence of shrimp ponds is the probability of saltwater intrusion into groundwater and aquifers in the surrounding area. The concept of shrimp ponds is to provide saltwater to ponds on agricultural land. These shrimp ponds are usually irrigated to maintain the desired water depth and salinity, with salinity being one of the most important environmental factors for shrimp growth (Wei et al., 2021). Nutrient-rich salt water can seep from these ponds and salinize the surrounding soil (Payo et al., 2017) and aquifers below, as well as pollute the coastal environment through surface water runoff

(McKenzie et al., 2020). However, the occurrence of saltwater intrusion is also influenced by the type of shrimp produced and production management practices such as pond depth and width (Hou et al., 2021).

3.3 The impact of shrimp ponds on mangrove ecosystems

The conversion of sandy land along the southern coast of the Special Region of Yogyakarta/*Daerah Istimewa Yogyakarta* (DIY) and Central Java into shrimp ponds, particularly for the cultivation of vannamei shrimp (*Litopenaeus* vannamei), experienced rapid growth in 2013–2014 (Suadi & Saksono, 2014). This activity has made a significant economic contribution, but has the potential to cause degradation of mangrove ecosystems, which play an important role in maintaining coastal stability, supporting biodiversity, and protecting the coastline from abrasion. Sustainable cultivation practices, as emphasized by Hilborn (2005) in Bappenas (2014), must maintain ecosystem balance and long-term productivity. The development of ponds needs to pay attention to the principle of sustainability through an ecosystem-based approach in order to reduce negative impacts on the coastal environment.

Sintawati et al. (2024) in their research on the analysis of the impact of shrimp ponds on the marine ecosystem in Kebumen Regency revealed that unsustainable shrimp farming practices have the potential to cause coastal degradation. Previously, this area was dominated by casuarina forests, but now most of it has been converted into pond areas, causing a decline in forest area and the associated mangrove ecosystems around it. Tawari (2021) also reported that the mangrove vegetation at this location had a density of 3,153 trees per hectare, a plankton density of 33,655 individuals per liter, a nekton density of one individual per square meter with a diversity index (DI) of 0.34, dissolved oxygen levels of 8.29 mg/L, pH of 7.5, salinity of 34‰, mud thickness of 48.8 cm, mangrove vegetation thickness of around 100 meters, and is inhabited by six types of biota, namely birds, shrimp, fish, crabs, mollusks, and reptiles. Shrimp pond expansion has also been found in the coastal area of Kulon Progo, DIY, which is the estuary of three major rivers, namely the Progo River, Serang River, and Bogowonto River. According to Djohan (2007), the potential for mangrove growth in the estuary area can reach 95%, making this area very potential for mangrove ecosystem conservation. However, the existence of shrimp ponds along this coast poses a real threat to the sustainability of mangroves. Special Region of Yogyakarta Regional Regulation No. 16 of 2011 does stipulate aquaculture zones, but specific zoning for mangroves has not been regulated in detail, so that overlapping land use still occurs (Tanjung et al., 2017).

Fig. 1. Expansion of shrimp ponds around the Pandansimo Beach mangrove forest conservation area, Yogyakarta

A similar condition has also been identified in Bantul Regency, specifically in the Baros Beach Mangrove Forest conservation area. This area functions as a nature reserve to reduce the negative impacts of human activities in coastal areas (Purwaningrum, 2020). Rahmadhani et al. (2021) stated that the mangrove vegetation at Baros Beach is divided into four zones, where the outer zone, dominated by Avicennia lanata, is highly vulnerable to disturbance due to the expansion of shrimp ponds. In addition, Cahyaningrum et al. (2017) noted the development of intensive technology vaname shrimp ponds (*Litopenaeus* vannamei) around Pandansimo Beach, with an average pond area of 1,000 m^2, raising concerns about the potential invasion of ponds into conservation areas.

These three case studies show that the expansion of shrimp ponds along the southern coast of Java Island contributes to the degradation of mangrove ecosystems. The ecological impact is significant, as mangroves serve as the main habitat for various types of aquatic biota such as fish, shrimp, and mollusks (Kathiresan & Bingham, 2001; Kalor et al., 2019). Fisheries resources in mangrove ecosystems are generally classified into target fish, major fish, and indicator fish (English et al., 1997; Edrus & Hadi, 2020). In addition to supporting fisheries productivity, mangrove ecosystems also protect coastlines from abrasion and erosion, a role that is now increasingly threatened by the high rate of degradation (Paulangan et al., 2019).

3.4 The impact of shrimp farms on social and economic effects

The development of shrimp ponds on the southern coast of Yogyakarta and Kebumen has had significant ecological and socio-economic impacts. Ecologically, the degradation of mangrove ecosystems due to land conversion reduces important habitats for fishery biota. Haryanto et al. (2023) revealed that the loss of mangrove vegetation has led to a reduction in habitats for the growth and reproduction of fishery biota, which in turn has resulted in a decline in fishermen's catches. The study shows that catch rates are higher in areas with good mangrove density compared to degraded areas.

Shrimp pond development also triggers social conflicts, both between communities (horizontal) and between communities and investors or the government (vertical). These conflicts are triggered by inequality in access to land, capital, and information. A study by Alkausar et al. (2022) in Sangiang Village, Bima Regency, found that the conversion of agricultural land to shrimp ponds caused local farmers to lose their livelihoods, while the ponds were controlled by investors from outside the area. A similar phenomenon occurred in Andulang Village, Sumenep Regency (Rasyid, 2020), with increased social jealousy due to the influx of workers from outside the area.

Social tensions are exacerbated by government policies that favor industry without involving the community in the planning process. In Karimunjawa, Jepara, allegations of marine pollution caused by ponds have divided the community into two groups: those who support and those who oppose. In Buniwangi Village, Sukabumi, the community firmly rejected the construction of ponds due to concerns about environmental damage and previous negative experiences. The construction of shrimp ponds in coastal areas contributes to environmental damage while exacerbating social and economic injustice, which leads to conflict.

3.5 Strategies for shrimp farm management in the Southern Coastal Region of Java

The management of shrimp ponds in the southern coastal region of Java, particularly in the Special Region of Yogyakarta and Kebumen, requires an integrated and sustainability-based approach to maintain a balance between economic productivity and environmental sustainability. This management strategy can be reviewed from two main aspects, namely ecological and socio- economic. From an ecological perspective, the application of environmentally friendly technology-based cultivation innovations is one strategic step. The biofloc system, for example, has been proven effective in increasing the production efficiency of vaname shrimp while improving pond water quality by reducing the need for antibiotics (Pratama & Santoso, 2021). In addition, pond waste management plays an important role in minimizing negative impacts on the environment. Purnomo et al. (2022) argue that the construction of a Wastewater Treatment Plant (WWTP) with sedimentation and oxygenation stages can reduce the concentration of pollutants such as BOD and H_2S odor produced from aquaculture activities. Sedimentation of solid waste also has the potential to produce by-products in the form of organic fertilizer, which can increase economic added value. Efforts to rehabilitate the coastal environment through mangrove planting around ponds are a crucial additional ecological strategy. Mangrove vegetation functions as a natural biofilter that can absorb heavy metals and reduce the levels of ammonia, nitrite, nitrate, and total suspended solids in water (Anton et al., 2020; Juwita et al., 2015 in Fitriana et al., 2022), thereby helping to gradually restore the quality of the coastal environment.

Meanwhile, from a socio-economic perspective, management strategies are directed at integrating the fisheries and community-based tourism sectors. Empowering local communities through the formation of Tourism Awareness Groups/*Kelompok Sadar Wisata* (Pokdarwis) involving farmers and tourism operators is an important step to optimize the economic benefits of shrimp farming while preserving the coastal environment (Setyowati, 2022). In addition, the establishment of clear zoning between aquaculture, conservation, and tourism areas by local governments is necessary to avoid conflicts over land use and support more sustainable resource management (Suharno, 2020). Regulation and supervision of farming practices are also key factors, with the government and non-governmental organizations (NGOs) expected to actively provide information, technical training, and guidance on the application of sustainable aquaculture principles. With this approach, it is hoped that shrimp farming activities on the south coast will not only contribute to local economic growth but also be in line with coastal ecosystem conservation efforts.

4. Conclusions

Shrimp farming in the southern coastal region of Java Island is a major driver of local economic growth, but it also poses serious challenges to environmental sustainability and social justice. Unsustainable farming practices cause coastal ecosystem degradation, water pollution, and unequal distribution of resources within the community. Balancing economic interests and environmental sustainability requires the application of environmentally friendly technologies, effective waste management, mangrove ecosystem rehabilitation, and strengthening community participation in coastal management. Coastal spatial planning through strict zoning and intensive monitoring of farming practices are necessary to prevent land use conflicts and ensure long-term sustainability. The future of shrimp farming development in Indonesia must be directed towards supporting local economic growth without compromising the integrity of coastal ecosystems.

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References
Aini, M., & Parmi, H. J. (2022). Analisis tingkat pencemaran tambak udang di sekitar perairan laut desa padak guar kecamatan sambelia kabupaten lombok timur. *Aquacoastmarine: Journal of Aquatic and Fisheries Sciences*, *1*(2), 67-75. https://doi.org/10.32734/jafs.v1i2.9025

Airawati, M. N., Fauzi, I., Mardiatno, D., & Khakhim, N. (2023). Analisis Kebijakan Keberlanjutan Budidaya Udang Vaname di Kabupaten Purworejo, Jawa Tengah. *Jurnal Kebijakan Sosial Ekonomi Kelautan dan Perikanan*, *13*(2), 155-165. http://dx.doi.org/10.15578/jksekp.v13i2.12487

Akber, M. A., Aziz, A. A., & Lovelock, C. (2020). Major drivers of coastal aquaculture expansion in Southeast Asia. *Ocean & Coastal Management*, *198*, 105364. https://doi.org/10.1016/j.ocecoaman.2020.105364

Anggraeni, D., Tandjung, S. D. (2007). *The Effect of Shrimp Farm Waste Disposal on the Density and Distribution Pattern of Fish Larvae and Juveniles at the Bogowonto River Estuary in Kulon Progo Regency*. Universitas Gadjah Mada.

Arizuna, M., Suprapto, D., & Muskanonfola, M. R. (2014). Kandungan nitrat dan fosfat dalam air pori sedimen di Sungai dan Muara Sungai Wedung Demak. *Management of Aquatic Resources Journal (MAQUARES)*, *3*(1), 7-16. https://doi.org/10.14710/marj.v3i1.4281

Astriana, B. H., Putra, A. P., & Ali, I. (2023). Peningkatan produksi udang dan potensi pencemaran perairan laut di Kabupaten Sumbawa. *Jurnal Tambora*, *7*(3), 53-59. https://doi.org/10.36761/jt.v7i3.2923

Bappenas. (2014). *Study on Sustainable Fisheries Management Strategies*. Bappenas.

Banun, S., Arthana, W., & Suarna, W. (2008). Kajian ekologis pengelolaan tambak udang di Dusun Dangin Marga Desa Delodbrawah Kecamatan Mendoyo Kabupaten Jembrana Bali. *Ecotrophic*, *3*(1), 379287. https://ojs.unud.ac.id/index.php/ECOTROPHIC/article/view/2482

Bartley, D. M. (2022). *World Aquaculture 2020 – A Brief Overview*. FAO Fisheries and Aquaculture Circular No. 1233.

Bosma, R. H., Nguyen, T. H., Siahainenia, A. J., Tran, H. T., & Tran, H. N. (2016). Shrimp-based livelihoods in mangrove silvo-aquaculture farming systems. *Reviews in Aquaculture*, *8*(1), 43-60. https://doi.org/10.1111/raq.12072

Cahyaningrum, C. D., Gunawan, W., & Rosmiati, M. (2017). Conditions and Potential of the Coastal Area of Bantul Regency as a Center for Sustainable Shrimp Farming on the South Coast of Indonesia. *Journal of Agribusiness and Agricultural Socioeconomics, 2*(1), 205-290. https://jurnal.unpad.ac.id/agricore/article/view/15072

Djohan, T. S. (2007). Distribusi Hutan Bakau Di Laguna Pantai Selatan Yogyakarta (Mangrove Distribution at the Lagoons in the Southern Coast of Yogyakarta). *Jurnal Manusia dan Lingkungan*, *14*(1), 15-25. https://journal.ugm.ac.id/JML/article/view/18659/11952

Edrus, I. N., & Hadi, T. A. (2020). Struktur komunitas ikan karang di perairan pesisir Kendari Sulawesi Tenggara. *Jurnal Penelitian Perikanan Indonesia*, *26*(2), 59-73. http://dx.doi.org/10.15578/jppi.26.2.2020.59-73

Fitriana, F., Sari, W. P., and Pramesti, D. (2022). Empowering Coastal Communities in Overcoming Shrimp Farm Waste Through Environmental Rehabilitation. *Independent Community Journal, 6(*6), 4814-4825. http://dx.doi.org/10.20473/.v9i2.2025.193-203

Haryanto, R., Suwondo, S., Juandi, J., & Siregar, S. H. (2023). Dampak Degradasi Mangrove Terhadap Hasil Perikanan Masyarakat. In *Prosiding Seminar Nasional SATI, 1*(1) pp. 187-195. https://ojs.unkriswina.ac.id/index.php/semnas-FST/article/view/427

Hidayat, S. S., Nirmala, K., Djokosetiyanto, D., & Mulyaningrum, S. R. H. (2015). Dominant Factors Affecting Sediment Oxygen Consumption Rates in Intensive Vaname Shrimp Ponds (*Litopenaeus* vannamei). 7(2), 639–654. https://journal.ipb.ac.id/index.php/jurnalikt/article/view/11031

Hou, Y., Yang, J., Russoniello, C. J., Zheng, T., Wu, M. L., & Yu, X. (2022). Impacts of coastal shrimp ponds on saltwater intrusion and submarine groundwater discharge. *Water Resources Research*, *58*(7), e2021WR031866. https://doi.org/10.1029/2021WR031866

Juwita, E., Soewardi, K., & Yonvitner, Y. (2015). Kondisi habitat dan ekosistem mangrove kecamatan simpang pesak, belitung timur untuk pengembangan tambak udang (Habitat Conditions and Mangrove Ecosystem in Simpang Pesak District, East Belitung for Development of Shrimp Pond). *Jurnal Manusia dan Lingkungan*, *22*(1), 59-65. https://doi.org/10.22146/jml.18725

Kalor, J. D., Indrayani, E., & Akobiarek, M. N. (2019). Fisheries resources of mangrove ecosystem in Demta Gulf, Jayapura, Papua, Indonesia. *Aquaculture, aquarium, conservation & legislation*, *12*(1), 219-229. https://bioflux.com.ro/docs/2019.219-229.pdf

Mahaka, T. Y., Haeruddin, H., & Rudiyanti, S. Analisis Daya Tampung Beban Pencemaran Sungai Telomoyo Kabupaten Kebumen, Jawa Tengah. *Jurnal Pasir Laut*, *9*(2), 21-30. https://doi.org/10.14710/jpl.2025.69127

Macusi, E. D., Estor, D. E. P., Borazon, E. Q., Clapano, M. B., & Santos, M. D. (2022). Environmental and socioeconomic impacts of shrimp farming in the Philippines: A critical analysis using PRISMA. *Sustainability*, *14*(5), 2977. https://doi.org/10.3390/su14052977

McKenzie, T., Holloway, C., Dulai, H., Tucker, J. P., Sugimoto, R., Nakajima, T., ... & Santos, I. R. (2020). Submarine groundwater discharge: A previously undocumented source of contaminants of emerging concern to the coastal ocean (Sydney, Australia). *Marine Pollution Bulletin*, *160*, 111519. https://doi.org/10.1016/j.marpolbul.2020.111519

Muluk, C., & Bailey, C. (2019). Social and environmental impacts of coastal aquaculture in Indonesia. In *Aquacultural Development* (pp. 193-209). Routledge.

Murti, A. K., & Aurellia, S. A. (2024, December). Pengelolaan Lingkungan Pada Program Shrimp Estate Guna Pemenuhan Hak Atas Lingkungan Yang Baik dan Sehat. In *Prosiding Seminar Hukum Aktual Fakultas Hukum Universitas Islam Indonesia* (pp. 129-137). https://journal.uii.ac.id/psha/article/view/37442

Ngabito, P. A., Bialangi, N., and Kunusa, W. R. (2024). Analysis of Shrimp Farm Wastewater Quality in Mananggu District Using a UV-Vis Spectrophotometer. *Journal of Chemistry Education and Chemistry, 7*(3), 229-240. http://dx.doi.org/10.31602/dl.v7i3.16657

Pallavi, & Kumari, S. (2024). Eutrophication: Understanding and Mitigating Eutrophication in Pond Water. *International Journal of Current Microbiology and Applied Sciences, 13*(11), 21-25. https://doi.org/10.20546/ijcmas.2024.1311.003

Paulangan, Y. P. (2014). Potensi ekosistem mangrove di taman wisata teluk youtefa kota jayapura papua. *Jurnal Kelautan: Indonesian Journal of Marine Science and Technology*, *7*(2), 60-68. https://journal.trunojoyo.ac.id/jurnalkelautan/article/view/798

Payo, A., Lázár, A. N., Clarke, D., Nicholls, R. J., Bricheno, L., Mashfiqus, S., & Haque, A. (2017). Modeling daily soil salinity dynamics in response to agricultural and environmental changes in coastal Bangladesh. *Earth's Future*, *5*(5), 495-514. https://doi.org/10.1002/2016EF000530

Pratama, D. R., & Santoso, D. (2021). Environmental Impacts of Intensive Shrimp Farms in Coastal Areas. *Journal of Coastal Ecology, 15*(2), 75-86. https://ijaseit.insightsociety.org/index.php/ijaseit/article/download/14181/pdf_2100/40599

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