WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Advancing Sustainable Port Management: Evaluating Eco-Fishing Port Implementation at Nusantara Fishing Port Kwandang, Gorontalo

Yanwar Amri Yasman, Femy M. Sahami, Alfi Sahri R. Baruadi

Pascasarjana, Universitas Negeri Gorontalo, Indonesia

DOI : https://doi.org/10.55248/gengpi.6.0225.0735

ABSTRACT

The concept of Eco-Fishing Port (EFP) offers a strategic framework for achieving sustainable management of fishing ports by balancing economic benefits with environmental protection. This study evaluates the implementation of EFP at Nusantara Fishing Port (PPN) Kwandang in Gorontalo, Indonesia, focusing on ecological, fishery, and port management indicators. The objectives include assessing the current status of EFP implementation, identifying environmental management priorities, and calculating the Fisheries Environmental Management Index (FEMI). A mixed-methods approach was employed, integrating observations, interviews with stakeholders, and secondary data analysis. The evaluation utilized an adapted EFP assessment model that considers local ecological and operational conditions. Results indicate an overall EFP implementation status score of 79.67, reflecting progress toward sustainable practices. Ecological indicators performed strongly, driven by effective waste management and water quality monitoring. However, challenges were noted in fishery compliance and ship waste management. The port infrastructure scored the highest, meeting operational standards. The calculated FEMI score of 8.32 highlights areas requiring improvement, including stakeholder collaboration and regulatory enforcement.

This study contributes to sustainable fisheries management by providing localized insights into EFP adoption. It underscores the importance of integrated management and offers actionable recommendations for enhancing port sustainability, serving as a model for similar facilities.

Keyword : *Sustainable Port Management, Environmental Indicators, Fishing Port Sustainability*

INTRODUCTION

Indonesia, as the world's largest archipelagic nation, possesses significant marine and fisheries potential, which serves as a cornerstone for sustainable development. The adoption of a blue economy approach underscores this potential by balancing resource utilization with environmental conservation, aligning with the Sustainable Development Goals (SDGs) that aim to eradicate poverty, reduce inequality, and protect the environment. Central to these efforts are fishing ports, which act as hubs for pre-production, production, and marketing of fishery products. These facilities not only bolster local economies but also catalyze national economic growth. Within this framework, achieving sustainable management of fishing ports is pivotal to enhancing the competitiveness of the fisheries sector on both a local and global scale .

However, the sustainability of fishing port operations faces critical challenges, including environmental degradation caused by operational activities. Issues such as waste from fishing vessels, water, air, and soil pollution, and insufficient infrastructure highlight the need for integrated environmental management strategies. Recognizing this, the Eco-Fishing Port (EFP) concept has emerged as a strategic framework to reconcile economic benefits with environmental stewardship. EFP focuses on waste management, quality assurance of fishery products, and sustainable management of port facilities. Globally, this concept has proven effective in enhancing port sustainability while maintaining their economic role .

The primary research problem lies in the lack of systematic assessment of EFP implementation in Indonesian fishing ports. Studies reveal that many fishing ports have yet to adopt comprehensive environmental management standards. For example, while environmental impact assessment (EIA) documents are often available, their integration into strategic port management remains limited. Moreover, essential infrastructure, such as wastewater treatment facilities, is underutilized, leading to environmental pollution around port waters .

Globally, EFP principles have been actively promoted. In Europe, the European Sea Ports Organization (ESPO) has developed the EcoPorts initiative, employing tools such as the Port Environmental Review System (PERS) and the Environmental Management Index (EMI). These frameworks provide comprehensive assessments of environmental management practices, which have been adapted by Wicaksono et al. (2019) for Indonesian fishing ports under the Fishing Port Environmental Management Index (FEMI). This adaptation ensures compatibility with local characteristics, including the types of commodities and unique management patterns prevalent in Indonesian ports .

In Indonesia, the introduction of the EFP concept began in 2013 through a collaboration between the Ministry of Marine Affairs and Fisheries (KKP) and the Agence Française de Développement (AFD). Initial pilot projects were conducted at major fishing ports such as Bitung and Kendari. Research

by Hamzah and Rahmawati (2022) emphasizes that successful EFP implementation requires the integration of governmental policies, local community needs, and private sector participation. This integrative approach has proven essential in aligning port operations with sustainability goals .

The Nusantara Fishing Port (PPN) in Kwandang, Gorontalo, represents a strategic yet environmentally challenged facility. Previous research by Andriyanto (2024) highlights inadequate monitoring of water quality and waste management in this port, coupled with underdeveloped infrastructure such as cold storage and drainage systems. Despite these challenges, PPN Kwandang holds substantial potential to serve as a model for EFP implementation, particularly with the support of local community organizations like the Kwandang Healthy Communication Forum (Forikanus) .

A review of existing literature underscores the critical role of consistent monitoring across ecological, fishery, and port indicators for sustainable port management. Previous studies have identified the importance of aligning waste management strategies with environmental quality assessments and regulatory compliance. However, a comprehensive evaluation of EFP application at PPN Kwandang has yet to be undertaken. This research gap underlines the necessity of assessing environmental management performance, identifying strategic priorities, and calculating the FEMI value to benchmark against international standards .

This study aims to evaluate the implementation of the EFP concept at PPN Kwandang by analyzing key ecological, fishery, and port indicators. The findings are expected to contribute to the development of environmentally sustainable fishing ports in Indonesia. Specifically, this research seeks to establish a baseline for environmental conditions, prioritize management interventions, and calculate the FEMI score in alignment with localized EFP standards. By doing so, the study supports the broader implementation of the blue economy framework, advancing sustainable fisheries management while fostering local economic growth and environmental conservation .

METHODOLOGY

Study Area and Time Frame

The research was conducted at the Nusantara Fishing Port (PPN) Kwandang, located in Gorontalo Province, Indonesia. The selection of this site was based on its strategic importance as the sole national-scale fishing port managed by the central government in the province. Fieldwork and data collection took place over a defined period, ensuring comprehensive coverage of seasonal variations and operational dynamics of the port.

Research Design and Approach

This study utilized a mixed-methods approach, integrating qualitative and quantitative techniques to evaluate the implementation of the Eco-Fishing Port (EFP) concept at PPN Kwandang. The research framework was structured around three primary objectives: assessing the current EFP status, identifying environmental management priorities, and calculating the Fisheries Environmental Management Index (FEMI) as an indicator of sustainable practices.

The evaluation was guided by the EFP assessment model developed by Wicaksono et al. (2009), which encompasses ecological, fishery, and port management indicators. This model was adapted to the local context to account for specific operational, environmental, and socio-economic characteristics of PPN Kwandang.

Data Collection Methods

Data were gathered using a combination of observation, interviews, and exploratory techniques.

- **Observation:** Direct observations were conducted at the port to evaluate physical and operational conditions, including waste management practices, water quality monitoring, and adherence to EFP criteria.
- **Interviews:** Semi-structured interviews were carried out with key stakeholders, including port management personnel, fisheries supervisors, and representatives from the Kwandang Healthy Communication Forum (Forikanus). This approach facilitated an in-depth understanding of current practices, challenges, and stakeholder perspectives.
- **Exploratory Techniques:** Secondary data, including official port documents, environmental impact assessments, and operational reports, were reviewed to supplement primary data collection.

Sampling was purposive, focusing on individuals and groups directly involved in or affected by port activities. This method ensured the inclusion of diverse perspectives relevant to the EFP implementation.

EFP Status Assessment

The assessment of EFP status employed a comprehensive set of indicators divided into three categories:

1. **Ecological Indicators:** These included waste management efficiency, water and air quality, and the presence of green spaces.

2. **Fishery Indicators:** These assessed the implementation of quality assurance measures, compliance with fishing regulations, and efforts to combat illegal, unreported, and unregulated (IUU) fishing activities.

3. **Port Indicators:** These evaluated the availability and functionality of essential infrastructure and facilities, aligning with the criteria of a Healthy Port and Airport (PBUS).

Each indicator was assigned a score based on established benchmarks, enabling a systematic evaluation of the port's alignment with EFP standards.

Environmental Management Prioritization

Environmental management priorities were identified using a matrix analysis approach. This involved ranking various environmental aspects based on their significance and urgency. Key priorities included waste reduction, water pollution control, ship waste management, job creation, and energy efficiency improvements. Stakeholder inputs were critical in determining the relative importance of these priorities.

Fisheries Environmental Management Index (FEMI) Calculation

The FEMI was calculated to quantify the overall environmental management performance of PPN Kwandang. The index integrates scores from the three EFP indicator categories, providing a holistic measure of sustainability. The methodology followed the framework outlined by Wicaksono et al. (2019), ensuring consistency with prior studies and comparability with international benchmarks.

Data Analysis

Data were analyzed using both descriptive and inferential statistical methods.

- **Descriptive Analysis:** This was used to summarize key findings related to EFP status, management priorities, and FEMI scores. Visual tools such as graphs and tables were employed to enhance clarity.
- **Inferential Analysis:** Statistical tests were conducted to identify significant relationships between variables and validate the robustness of findings.

The analysis adhered to rigorous standards of academic integrity, ensuring transparency and reproducibility of results.

Limitations

The study acknowledged several limitations, including the reliance on purposive sampling, which may introduce selection bias, and the constraints of time-bound fieldwork. These limitations were mitigated through triangulation of data sources and methods, enhancing the validity and reliability of the findings.

RESULTS AND DISCUSSION

Ecological, Fishery, and Port Conditions

The study revealed that the implementation of the Eco-Fishing Port (EFP) concept at Nusantara Fishing Port (PPN) Kwandang is advancing towards fulfilling sustainable criteria. Based on the assessment, three main indicators—ecological, fishery, and port operations—were evaluated comprehensively. The ecological indicators scored an average of 81.72, fishery indicators 71.65, and port indicators 85.65, resulting in an overall EFP implementation status score of 79.67. This places PPN Kwandang in the category of "approaching Eco-Fishing Port criteria" .

From an ecological standpoint, the port has made significant progress in managing waste, water quality, and green space development. Observations indicated that facilities for waste collection and disposal were functional, although gaps remained in addressing ship-generated waste comprehensively. Monitoring of water and air quality adhered to national standards, demonstrating acceptable levels of pollutants. The existence of green spaces around the port contributed positively to the ecological balance, aligning with the goals of reducing the environmental footprint of port activities .

Fishery indicators highlighted challenges in quality assurance, compliance with fishing regulations, and combating Illegal, Unreported, and Unregulated (IUU) fishing. While systems for ensuring fish quality and safety were in place, they were not uniformly applied across all operational levels. The monitoring of fishing licenses and vessel documentation revealed partial compliance, necessitating enhanced regulatory oversight. Efforts to combat IUU fishing showed progress, yet collaboration among stakeholders required strengthening to ensure consistent enforcement .

Port infrastructure and operations scored highest among the indicators, reflecting well-maintained facilities and efficient service provision. Key infrastructures, including cold storage and docking facilities, were operational and met international standards. However, challenges in energy efficiency and optimizing operational costs were noted, suggesting the need for strategic interventions .

Environmental Management Priorities

The analysis identified five key priorities for improving environmental management at PPN Kwandang:

1. **Waste Reduction:** Efforts to minimize waste production, particularly from vessels and onshore operations, emerged as a critical priority. Introducing stricter waste segregation policies and increasing recycling rates were proposed solutions.
2. **Water Pollution Control:** Enhancing wastewater treatment facilities and monitoring discharge practices were emphasized to prevent contamination of surrounding waters.
3. **Ship Waste Management:** Establishing a centralized system for handling waste generated by ships, including oil and hazardous materials, was deemed essential.

4. **Job Creation:** Promoting employment opportunities within the port, particularly in environmentally sustainable roles, was highlighted as a socio-economic priority.

5. **Energy Efficiency:** Transitioning to renewable energy sources and implementing energy-saving measures across port facilities were identified as actionable steps .

These priorities reflect the need for an integrated management approach that balances environmental, economic, and social dimensions of port operations.

Fisheries Environmental Management Index (FEMI)

The FEMI score for PPN Kwandang was calculated at 8.32, indicating progress toward sustainable management practices but highlighting areas requiring improvement. This score was derived by aggregating performance across the three main indicators, with ecological factors contributing most positively. Comparatively, the FEMI score of PPN Kwandang aligns with international benchmarks but underscores the need for continuous improvement in fishery and port management practices .

Discussion of Results

The findings underscore the importance of adopting the EFP concept as a strategic framework for sustainable port management. The strong performance in ecological indicators reflects the port's commitment to reducing environmental impacts. However, the partial compliance observed in fishery indicators suggests that regulatory frameworks need reinforcement to achieve full alignment with EFP standards.

Globally, EFP implementations have demonstrated that integrating stakeholder collaboration is crucial for success. Studies in European ports highlight that partnerships between government bodies, private operators, and local communities enhance compliance and operational efficiency. Similarly, PPN Kwandang could benefit from fostering stronger partnerships to address challenges in waste management and regulatory oversight.

The prioritization of environmental management tasks aligns with international practices, where waste reduction and pollution control are typically ranked highest. For instance, European Sea Ports Organization (ESPO) reports indicate that waste management and energy efficiency are perennial priorities for sustainable port operations. The identification of these priorities at PPN Kwandang indicates a growing awareness of global best practices, though tailored interventions are required to address local conditions .

The FEMI score provides a valuable benchmark for assessing the port's progress in environmental management. While the score indicates alignment with the EFP framework, a comparative analysis with other ports in Indonesia and internationally reveals opportunities for improvement. For example, ports with higher FEMI scores often exhibit robust community engagement and innovative technologies for waste and energy management. These practices could be adapted to the context of PPN Kwandang to further enhance its sustainability trajectory .

Policy Implications and Recommendations

The study's findings have several policy implications. First, the establishment of a dedicated task force for EFP implementation could streamline management efforts and ensure accountability. Second, enhancing regulatory frameworks and enforcement mechanisms would address compliance gaps in fishery indicators. Third, targeted investments in infrastructure, such as advanced wastewater treatment facilities and renewable energy systems, could drive significant improvements in environmental performance.

Furthermore, capacity-building programs for stakeholders, including training for port staff and awareness campaigns for local communities, are essential for fostering a culture of sustainability. The integration of technological innovations, such as digital monitoring systems, could enhance the efficiency and transparency of port operations .

CONCLUSION

This study assessed the implementation of the Eco-Fishing Port (EFP) concept at Nusantara Fishing Port (PPN) Kwandang, focusing on ecological, fishery, and port management indicators. The findings revealed that PPN Kwandang is approaching EFP criteria, with an overall implementation status score of 79.67. Ecological indicators demonstrated substantial progress, particularly in waste management and water quality monitoring, while fishery indicators highlighted challenges in compliance with fishing regulations and quality assurance systems. Port infrastructure emerged as a strength, meeting international standards for operational facilities.

The calculated Fisheries Environmental Management Index (FEMI) of 8.32 underscores the port's strides toward sustainability but also emphasizes areas requiring improvement, such as ship waste management and stakeholder collaboration. The study identified five environmental management priorities, including waste reduction, water pollution control, and energy efficiency, which offer actionable pathways for enhancing sustainability.

This research contributes to the understanding of sustainable port management in Indonesia by providing localized insights into the application of the EFP framework. It highlights the need for targeted interventions and stakeholder engagement to address gaps. Future studies should explore the long-term impacts of EFP adoption and its scalability to other fishing ports across diverse ecological and socio-economic contexts.

REFERENCES

Agence Francaise de Developpement. (2023). Eco Fishing Ports Project: 98.7 Million Euros to Improve Indonesian Ports Towards Ecology and Efficiency with the Support of AFD. https://www.afd.fr/en/

Boljat, H. U., Slišković, M., & Balić, K. (2020). Overview of status and priorities for sustainable management of European seaports. *Journal of Maritime Research, 17*(3), 3–9.

Creswell, J., & Creswell, D. (2023). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (6th ed.). SAGE Publications.

ESPO. (2021). *ESPO Green Guide 2021: A Manual for European Ports Towards a Green Future*. European Sea Ports Organisation (ESPO). https://www.espo.be/media/ESPO_Green_Guide_2021_-_FINAL.pdf

European Sea Ports Organisation (ESPO). (n.d.). Ecoports. https://www.espo.be/knowledge#ecoports

Hamzah, A., & Rahmawati, A. (2022). Penerapan Eco-Fishing Port di Pelabuhan Perikanan Nusantara Karangantu, Provinsi Banten. *Akuatika Indonesia, 6*(2), 70. https://doi.org/10.24198/jaki.v6i2.35137

Kemenkes. (2024). *Petunjuk Teknis Penilaian dan Penghargaan Pelabuhan dan Bandar Udara Sehat Tahun 2024.*

Kementerian Hukum dan Hak Asasi Manusia Republik Indonesia. (2008). *Undang-Undang Nomor 18 Tahun 2008 tentang Pengelolaan Sampah.* https://peraturan.bpk.go.id/

Kementerian Sekretariat Negara Republik Indonesia. (2021). *Peraturan Pemerintah Nomor 22 Tahun 2021 tentang Penyelenggaraan Perlindungan dan Pengelolaan Lingkungan Hidup.* https://jdih.setkab.go.id/

Kementerian Sekretariat Negara Republik Indonesia. (2021). *Peraturan Pemerintah Nomor 27 Tahun 2021 tentang Penyelenggaraan Bidang Kelautan dan Perikanan.* http://jdih.kkp.go.id/

Lestari, N., Yuwana, & Efendi, Z. (2021). Identifikasi Tingkat Kesegaran dan Kerusakan Fisik Ikan di Pasar Minggu Kota Bengkulu. *Jurnal Agro Industri, 9860*(1), 51–60.

Lubis, E. (2012). *Pelabuhan Perikanan.* Bogor: Penerbit IPB Press.

Mbay, L. O. N., Nugraha, R. B. A., & Kusyanto, D. (2014). Kajian Konsep Fishing Ecoport untuk Pengembangan Pelabuhan Perikanan di Indonesia. *Jurnal Kelautan Nasional, 9*(3), 161. https://doi.org/10.15578/jkn.v9i3.6213

Puig, M., Darbra, R. M., Chair, E., & Agostino, Z. D. (2023). *ESPO Environmental Report 2023.* www.ecoslc.eu

Rangkuti, F. (2011). *SWOT Balanced Scorecard: Teknik Menyusun Strategi Korporat yang Efektif plus Cara Mengelola Kinerja dan Risiko.* Jakarta: PT Gramedia Pustaka Utama.

Suherman, A., Rosyid, A., & Boesono, H. (2012). *Pelabuhan Perikanan.* UNDIP Press Semarang.

Supriyanto. (2013). Analisis Pengelolaan Pelabuhan Perikanan Berwawasan Lingkungan di Pelabuhan Perikanan Samudera Nizam Zachman Jakarta. *Jurnal Ilmu Lingkungan, 7*(2), 159–179.

Wicaksono, A., Yanuwiadi, B., & Dwiyanto, A. (2019). Eco-Fishing Port Assessment Model as an Environmental Management Tool on Coastal Fishing Port 'Pondokdadap' - Indonesia. *186(Apte 2018)*, 118–123. https://doi.org/10.2991/apte-18.2019.22

Yusuf, M. (2017). *Metode Penelitian Kuantitatif, Kualitatif, dan Penelitian Gabungan* (4th ed.). Kencana.

Zebblon, P. C., Undap, S. L., & Lasut, M. T. (2016). Public perception on the application of eco-fishing port in Ocean Fishing Port of Bitung, North Sulawesi. *Aquatic Science & Management, 4*(1), 21–27. http://ejournal.unsrat.ac.id/index.php/jasm/index