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RESEARCH ARTICLE

Comparative Study of the Fixed Lift Net Fisheries in Wiritasi and Sarang Tiung, Indonesia

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Bagan tancap
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Abstract: This study compares the structural and operational characteristics of the fixed lift net fisheries in two fishing villages: Wiritasi (Tanah Bumbu) and Sarang Tiung (Kotabaru) in South Kalimantan, Indonesia. Field observations and qualitative interviews were conducted to document gear construction and fishing operations, while quantitative catch data were collected to analyze catch composition. The results revealed notable differences in material selection, CPUE, and catch composition between two sites. Wiritasi used lighter materials like bamboo and aniung wood for ease and efficiency, while Sarang Tiung's gear incorporated mangrove timber for durability in deeper waters. Wiritasi exhibited a higher mean CPUE (12.83 kg/haul) than Sarang Tiung (8.46 kg/haul), with the difference being statistically significant based on an independent samples t-test ($p < 0.05$). Catch composition also differed between sites and was dominated by small pelagic species, particularly *Sardinella fimbriata*, *Selaroides leptolepis*, and *Stolephorus* sp. Collectively, these findings are consistent with a possible trade-off between energy consumption and catch optimization, underscoring the relevance of cost-effective lighting strategies in small-scale lift-net fisheries. The use of LED lamps in Sarang Tiung highlights economic benefits and environmental considerations, while Wiritasi's mercury lamps demonstrate the need for sustainable transition. The key recommendations for local fishermen are also discussed.

Anahtar kelimeler:

Bagan tancap
Uygun maliyetli aydınlatma
Balık tutma verimliliği
Ekipman performansı
Sürdürülebilirlik

Wiritasi ve Sarang Tiung (Endonezya)'da Sabit Kaldırma Ağı Balıkçılığının Karşılaştırmalı Çalışması

Öz: Bu çalışma, Endonezya'nın Güney Kalimantan bölgesinde yer alan iki balıkçı köyünde—Wiritasi (Tanah Bumbu) ve Sarang Tiung (Kotabaru)—sabit kaldırma ağı (fixed lift net) balıkçılığının yapısal ve operasyonel özelliklerini karşılaştırmaktadır. Ağ yapısı ve balıkçılık faaliyetlerini belgelemek amacıyla arazi gözlemleri ve nitel görüşmeler gerçekleştirilmiş; av kompozisyonunu analiz etmek için nicel av verileri toplanmıştır. Bulgular, iki saha arasında kullanılan malzemeler, birim çaba başına av (CPUE) ve av verimliliği açısından belirgin farklılıklar olduğunu ortaya koymuştur. Wiritasi'de bambu ve aniung ağacı gibi daha hafif malzemeler kullanım kolaylığı ve verimlilik sağlarken, Sarang Tiung'da daha derin sularda dayanıklılığı artırmak amacıyla mangrov kerestesi tercih edilmiştir. Wiritasi'de ortalama CPUE (12,83 kg/çekim), Sarang Tiung'a (8,46 kg/çekim) kıyasla daha yüksek bulunmuş ve bu fark bağımsız örneklemler t-testi sonucuna göre istatistiksel olarak anlamlıdır ($p < 0,05$). Av kompozisyonu da sahalar arasında farklılık göstermiş olup, başlıca küçük pelajik türler olan *Sardinella fimbriata*, *Selaroides leptolepis* ve *Stolephorus* sp. baskın türler olarak belirlenmiştir. Bu bulgular birlikte değerlendirildiğinde, enerji tüketimi ile av optimizasyonu arasında olası bir denge (trade-off) bulunduğuna işaret etmekte ve küçük ölçekli kaldırma ağı balıkçılığında maliyet-etkin aydınlatma stratejilerinin önemini vurgulamaktadır. Sarang Tiung'da LED lambaların kullanımı ekonomik avantajlar ve çevresel hususları öne çıkarırken, Wiritasi'de kullanılan cıva lambaları sürdürülebilir bir geçiş ihtiyacını ortaya koymaktadır. Ayrıca yerel balıkçılar için temel yönetim ve uygulama önerileri de tartışılmaktadır.

Introduction

The fixed lift nets, locally known as *bagan tancap*, are an essential fishing method widely used along Indonesia's coastal waters. These passive fishing gears rely on light attraction to aggregate pelagic fish near the surface during night time operations (Puspito et al., 2015; Fatmawati et al., 2020). Originating from South Sulawesi, the technology spread throughout Indonesia following cultural and trade exchanges among fishing communities (Sudirman et al., 2019). The lift net technique provides an efficient yet low-cost fishing approach suitable for artisanal fishers, contributing significantly to local livelihoods and food security (Krisnafi et al., 2020).

Despite widespread application, the technical design and efficiency of stationary lift nets vary across regions due to local adaptations in construction materials, water depth, and target species (Silitonga et al., 2014). Previous

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studies have shown that frame strength, light intensity, and mesh size strongly influence catch composition and total yield (Sudirman et al., 2020; Alamsah et al., 2021). However, comparative analyses across regions remain limited, particularly for South Kalimantan, where variations in environmental and socio-economic contexts may lead to differing fishing outcomes.

The fixed lift net fishery is a vital component of Indonesia's small-scale fishing sector, which supports regional food availability (FAO, 2024). As coastal fisheries face growing pressures from overfishing, habitat degradation, and climate change, sustainable fishing technologies have become increasingly important (Mardyani et al., 2020). The fixed lift nets rely on minimal fuel consumption compared to mobile fishing gears such as trawls or purse seines, positioning them as an eco-friendly option (Riyanto et al., 2017). Moreover, their stationary nature enables consistent fish aggregation, allowing for manageable exploitation and long-term planning by local fishers (Muna et al., 2023).

Technological innovation in light fishing, particularly through the use of LED lamps, has significantly transformed stationary lift net operations across Indonesia. LED systems reduce operational costs, increase light intensity efficiency, and lower emissions compared to traditional kerosene lamps or compact fluorescent lamps (Fauziyah et al., 2021; Musbir et al., 2021). However, the ecological effects of light-based attraction, such as species selectivity and behavioural changes among pelagic fish, remain an area of active research (Susanto et al., 2017; Nakiyende et al., 2025). In broader fisheries research, understanding how light configurations and environmental variables influence catch performance is, therefore, crucial for optimizing fishing efficiency without compromising ecosystem health (Solomon and Ahmed, 2016).

From a socio-economic perspective, stationary lift nets play a strategic role in supporting rural coastal economies. Many fishing households depend on the lift net operations as their primary source of income, employing family members and local workers in fishing, net maintenance, and post-harvest processing (Nasution et al., 2023). In regions such as Tanah Bumbu and Kotabaru, the development of fixed lift nets has contributed not only to employment generation but also to community cohesion and intergenerational knowledge transfer.

Nevertheless, differences in access to capital, materials, and supporting infrastructure often result in technological disparities among fishers, affecting catch rate and long-term viability (Krisnafi et al., 2020). For example, limited access to durable construction materials, reliable power sources, or energy-efficient lighting systems may constrain some fishers from adopting more efficient fishing technologies, thereby reducing catch stability, operational efficiency, and long-term sustainability of lift-net fisheries.

Environmental conditions also shape lift-net operations and performance. Variations in sea depth, turbidity, salinity, and plankton concentration can significantly influence the abundance and behaviour of target fish species (Fatmawati et al., 2020). The waters of Tanah Bumbu, characterized by shallower coastal areas with sandy-muddy substrates, provide different ecological dynamics compared to Kotabaru, which has deeper and more oceanic characteristics. These site-specific differences justify a comparative approach to assess how environmental and operational factors affect fishing success and sustainability.

This study aims to comparatively assess the fixed lift net fisheries in Wiritasi and Sarang Tiung fishing villages by examining gear structure, operational characteristics, and catch composition. The findings are expected to inform the development of appropriate fishing technology and management practices tailored to local ecological conditions. By identifying the key determinants of lift-net performance, this study contributes to broader efforts in advancing sustainable small-scale fisheries in Indonesia's coastal regions.

Material and Methods

Study Sites

This study was conducted between September and October 2024 in two coastal fishing villages: Wiritasi and Sarang Tiung, South Kalimantan, Indonesia (Figure 1). Both locations are representative of their active small-scale lift net fisheries, which primarily target small pelagic fish species. Wiritasi is situated along the southeastern coast of Tanah Bumbu Regency (03°42′ S, 115°55′ E) with shallow coastal waters (3-10 m depth). The seabed consists mainly of muddy–sandy substrates, likely influenced by river outflows, where small pelagic species such as sardine and yellowstripe scads are commonly observed.

In contrast, Sarang Tiung, located on the northern side of Kotabaru Regency (03°37′ S, 115°55′ E), features relatively deeper coastal waters (10-20 m) and clearer visibility due to lower sediment input. The fishing grounds are more open and directly influenced by oceanic currents from the Makassar Strait, which supports a wider variety of pelagic species such as anchovy, sardine, and cephalopods. The local fishers generally construct larger and sturdier lift nets to withstand stronger currents and deeper mooring conditions compared to those used in Wiritasi.

Both sites are located within a tropical monsoon climate zone, with seawater temperature and salinity conditions generally characterized by warm waters (approximately 27–31 °C) and salinity levels typically ranging from 30 to 34 ppt, based on regional climatological and oceanographic information. The northeast monsoon typically enhances fishing activity from May to November, providing calm sea conditions suitable for stationary operations. The study was conducted in local fishing communities where lift-net operations are widely practiced and typically supported by family labor and long-established fishing knowledge.

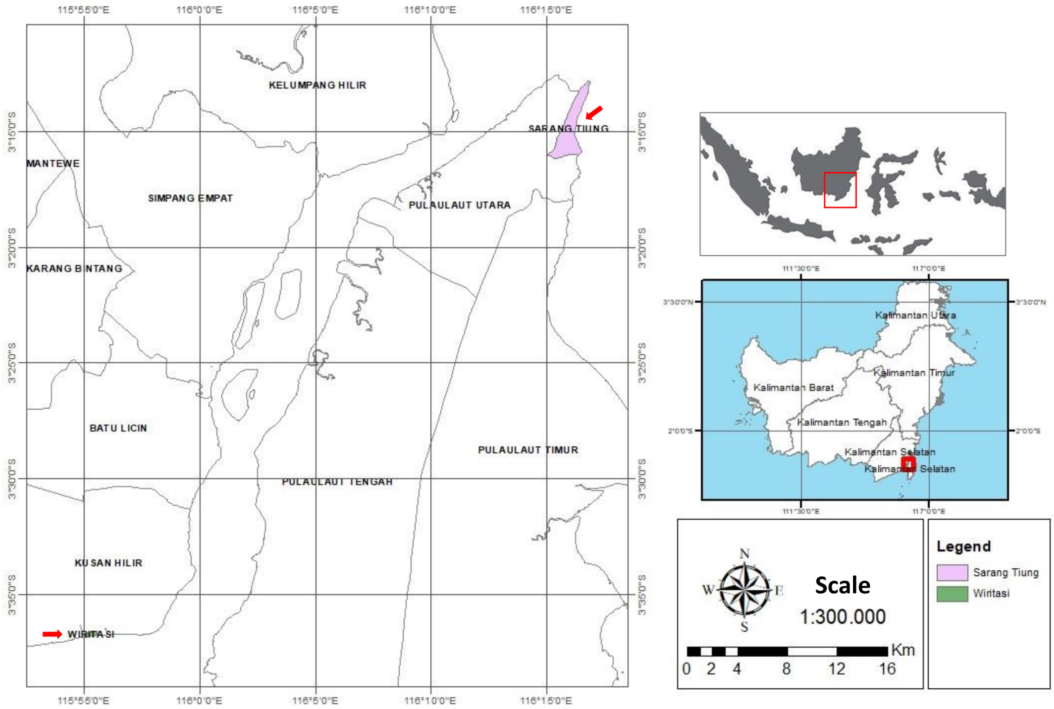

Figure 1. Map of Wiritasi and Sarang Tiung villages, where the fixed lift nets were studied

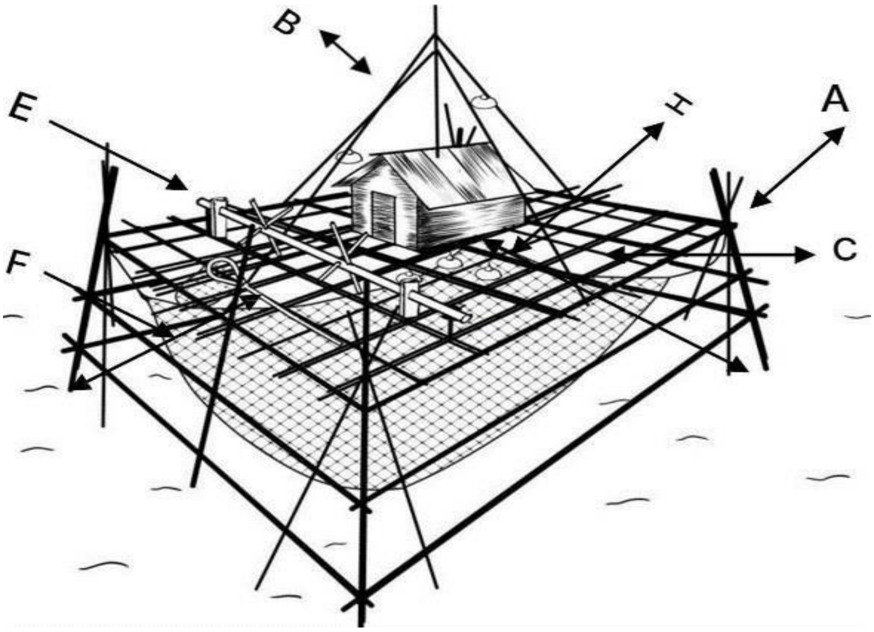

Figure 2. Schematic (not to scale) diagram of the fixed lift-net construction representative of the gear configuration used at both study sites. A. Main pole, B. Bugis pole, C. Deck platform, D. Lift-net house, E. Hauling roller, F. Net, G. Sinker, H. Lamp

Notes: Bugis pole refers to a locally used secondary support pole to stabilize the net frame and hauling mechanism. Diameter (mm) refers to the characteristic diameter of the primary structural element for each component (e.g., pole diameter for wooden and bamboo structures, rope diameter for roller rope, and twine diameter for netting). Number (n) indicates the total amount of each component. Each sinker weighs approximately 10 kg.

Table 1. Gear specification of the fixed lift net in Wiritasi, Tanah Bumbu Regency

Components	Materials	Length (m)	Width (m)	Diameter (mm)	Number (n)
Main pole	Aniung wood	10	-	120-200	30
Bugis pole	Aniung wood	5	-	80-150	6
Lift-net house	Wooden beam	2.5	2	-	1
Deck platform	Bamboo	15	15	60-90	1
Hauling roller	Iron Wood	10	-	145	1
Roller pole	Aniung wood	4	-	85	2
Roller rope	Polyethylene	30	-	6	12
Sinker	Paving Stone	-	-	-	13
Net	Polyethylene	15	15	4	1

Table 2. Gear specification of the fixed lift net in Sarang Tiung, Kotabaru Regency

Components	Materials	Length (m)	Width (m)	Diameter (mm)	Number (n)
Main poles	Mangrove wood	10-15	-	300-400	24
Bugis poles	Mangrove wood	6	-	150-200	5
Lift-net house	Wooden beam	3	2	-	1
Deck platform	Bamboo	15	15	60-90	1
Hauling roller	Mangrove wood	10	-	150	1
Roller pole	Mangrove wood	4	-	100	2
Roller rope	Polyethylene	40	-	6	8
Sinker	Paving Stone	-	-	-	14
Net	Polyethylene	15	15	4	1

Data Collection

The study employed a mixed-method approach combining direct observation, interviews, and participatory monitoring across six fishing operations at each site. Quantitative data were obtained from measurements of gear dimensions, operational characteristics, and catch composition, while qualitative information was derived from interviews and participatory observations to document fishing practices, operational procedures, and local knowledge.

Field observations recorded the technical specifications of the fixed lift net, including dimensions, materials, net type, and lighting. Wiritasi's lift nets utilize lighter materials like aniung wood and bamboo for shallow water. In contrast, the Sarang Tiung lift net used mangrove timber to enhance structural stability under deeper-water conditions and stronger currents. The core fishing sequence (preparation, light deployment, fish aggregation, hauling, and handling) was generally consistent across sites, typically commencing around 18:00 and concluding at dawn. This standardized overnight operating period ensured comparable fishing effort among trials and was therefore, used as the basis for CPUE calculation. Both sites have similar net dimensions (15×15 m) but differ in hauling mechanisms, with Wiritasi using ironwood roller and Sarang Tiung employing mangrove wood roller, each adapted to specific environmental conditions.

In terms of lighting system (Figure 3), Wiritasi employed 15 white mercury lamps (38–100 W), while Sarang Tiung utilized 18 white LED lamps (30–100 W), each powered by portable generators (Yakusa 23850 W and Krisbow 1200 W, respectively). The reported wattage ranges reflect differences among individual lamps within each system, whereas the number, type, and configuration of lamps were kept consistent across all fishing operations at each site to ensure comparability of catch performance. The lamps were lowered through a hole in the floor of the lift net house (1×1 m) and positioned at a height of 2–3 m above sea level. Wiritasi operated 7 miles offshore, necessitating a 1.5-hour trip with a larger 4.5 GT vessel, whereas Sarang Tiung's closer 5-mile nearshore location required only a 1-hour trip using a smaller 1.3 GT boat.

Figure 3. Lighting system performance and portable generators used in study sites

Catch assessment were conducted for each haul over the six fishing operations. The net was hauled two times per night during each fishing trip (total of 12 hauls per site). The catches were removed from the net using a scoop-net (a 5-mm mesh), sorted and identified by species using the guide by White et al. (2013). Each specimen was then counted, weighed to the nearest 0.1 kg using a calibrated digital scale. The recorded data were standardized and aggregated to derive total and mean catch per trip (kg), providing a quantitative basis for comparative analysis between fishing operations.

Semi-structured interviews were conducted with lift-net fishers at each site to obtain socio-economic and technical information, including fishing experience, material selection, maintenance practices, operational challenges, and perceptions of fish stock changes. The results were cross-checked with field observations.

Statistical Analysis

An independent samples *t*-test was applied to compare catch number and mean CPUE between the two fishing gears, with statistical significance evaluated at the 95% confidence level ($\alpha = 0.05$). The analysis was based on six fishing operations per site, comprising a total of 12 hauls per site (24 hauls in total). Each fishing operation was defined as a single analytical unit, corresponding to a separate night of fishing activity. The t-test was considered appropriate given the independence of observations and the comparable variance structure between groups. Prior to hypothesis testing, data normality was examined using the Shapiro–Wilk test, and homogeneity of variances was evaluated using Levene’s test. Microsoft Excel was used for data processing and graphical visualization, whereas SPSS (version 18.0; IBM Corp., Armonk, NY, USA) was used for inferential statistical analyses, including independent samples *t*-test. The statistical outcomes were subsequently integrated with the quantitative results to enable a comprehensive comparison of lift-net fisheries between the two study sites.

Results

Catch composition

The total catch composition from six fishing trips across Wiritasi and Sarang Tiung study sites showed significant site-specific differences in species dominance (Table 3). Wiritasi’s total catch reached 154 kg, primarily dominated by *Sardinella fimbriata* (64.29%), and secondarily by *Selaroides leptolepis* (35.71%). Based on direct length measurements, *S. fimbriata* specimens (50-110 mm) were relatively smaller than *S. leptolepis* (80-140 mm). Meanwhile, Sarang Tiung produced 101.5 kg, featuring a more varied composition of *S. fimbriata* (47.29%), *Stolephorus* sp. (37.44%), and *Loligo sp.* (15.27%). The total catch differed between sites, with Wiritasi exceeding Sarang Tiung by 52%. Comparatively, the total catch at Wiritasi was 1.5 times higher than that at Sarang Tiung, and this difference was statistically significant based on an independent samples *t*-test comparing total catch between sites ($p < 0.05$).

CPUE

Wiritasi exhibited a higher CPUE than Sarang Tiung (Table 4). Under a comparable total fishing effort of 12 hauls per site, mean CPUE at Wiritasi was 12.83 kg/haul, compared with 8.46 kg/haul at Sarang Tiung, and this difference was statistically significant based on an independent samples *t*-test ($p < 0.05$). Higher CPUE at Wiritasi was largely attributable to increased catches of *S. fimbriata* and *S. leptolepis*.

Over the six fishing operations, Wiritasi exhibited a wider range of daily catch (0–60 kg), with a mean of 25.67±23.80 kg/trip, whereas Sarang Tiung showed a narrower range (0–24 kg) and a lower mean catch of 16.92±8.73 kg/trip. Each daily fishing trip was treated as an independent observational unit in the analysis, as catches were obtained from separate nights with no overlap in fishing effort. The highest single-day catch at Wiritasi (60 kg) was primarily composed of *Sardinella fimbriata* (16.50±16.05 kg/trip) and *Selaroides leptolepis* (9.17±12.81 kg/trip). Zero-catch days coincided with periods of strong currents at both sites (Figure 4).

Table 3. Total catch composition over six fishing trips across Wiritasi and Sarang Tiung

Species	Wiritasi		Sarang Tiung		Total Catch	
	(kg)	(%)	(kg)	(%)	(kg)	(%)
Selaroides leptolepis	55	35.71	0	0	55	21.53
Stolephorus sp.	0	0	38	37.44	38	14.87
Sardinella fimbriata	99	64.29	48	47.29	147	57.53
Loligo sp.	0	0	15.5	15.27	15.5	6.07
Total	154	100	101.5	100	255.5	100

Table 4. Comparative CPUE for the fixed lift nets in Wiritasi and Sarang Tiung

Study Sites	Total Catch (kg)	Total Effort (haul)	CPUE (kg/haul)
Wiritasi	154	12	12.83
Sarang Tiung	101.5	12	8.46

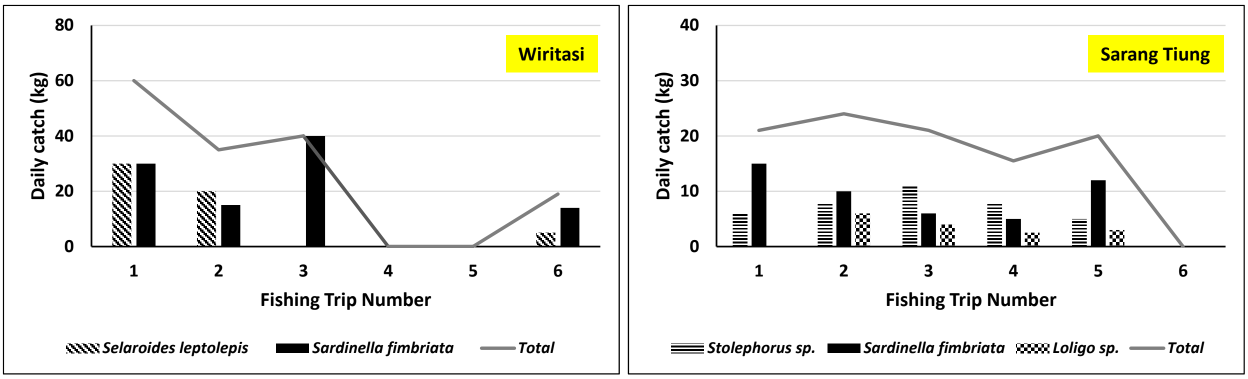

Figure 4. Daily catch trends of the fixed lift nets in Wiritasi and Sarang Tiung. Grey lines represent total daily catch summed across all species

Discussion

The differences in construction and operation of the fixed lift nets in Wiritasi and Sarang Tiung reflect adaptations to local marine environments and resource availability. Comparable observations have been reported in other geographical regions (Susanto et al., 2020; Fatma et al., 2022), showing that local fishers provided technical insights on material selection, maintenance, operational challenges, and environmental factors affecting fish aggregation, complementing observational data.

Environmental differences determine structural requirements. Sarang Tiung's use of mangrove wood provides greater resistance to wave motion and marine borers, extending the structure's lifespan. In contrast, Wiritasi's lighter construction facilitates easier installation in shallower waters but resulting in shorter lifespans. While Wiritasi employs 30 aniung poles of smaller diameter, Sarang Tiung’s lift net incorporate 24 mangrove poles with larger diameters and increased strength for heavy-duty use. Meanwhile, fishermen in Pangandaran, West Java, utilized “betung” bamboo as the primary material for constructing their lift-nets, owing to its strength and resistance to strong currents, reflecting disparities in local resource accessibility. These findings align with the principle that local material selection impacts the durability and efficiency of stationary fishing platforms (Alamsah et al., 2021; Husniati and Ghaffar, 2023). Socio-economic imbalances should be considered in regional fisheries management policies aiming to promote equitable development (Ramadhan et al., 2016).

The observed differences in catch variability between Wiritasi and Sarang Tiung likely attributed to environmental and operational factors. Wiritasi's offshore location, characterized by shallow and turbid waters, may be associated with stronger currents and variable plankton conditions, which are likely to influence fish aggregation around the lift-net lighting systems. The mercury lamps used in Wiritasi were effective in attracting pelagic species such as sardines and scads, although catch intensity appeared more variable compared to the LED-based system. In contrast, Sarang Tiung's nearshore setting was characterized by relatively more stable fishing conditions, which was associated with more consistent daily catches during the study period. The clearer and deeper waters allow light to disperse effectively, attracting a wider variety of pelagic species, including sardine, anchovy, and squids (Husniati and Ghaffar, 2023; Notanubun et al., 2024). Sarang Tiung benefits from nearshore fishing grounds requiring less travel and smaller boat, while Wiritasi incurs higher travel costs due to its offshore location and reliance on larger vessel. Distance from shore, depth, lamp type, and local productivity jointly affect the spatial and temporal stability of stationary lift-net fisheries (Sulaiman et al., 2015; Sudirman et al., 2019). The catch composition at both sites dominated by small pelagic species exhibiting positive phototactic responses to artificial light. *S. fimbriata* was consistently the most abundant species across fishing operations.

Light configurations significantly impact catch efficiency and aggregation behavior. Wiritasi uses mercury lamps suitable for shallow waters but with less predictability and high costs, while Sarang Tiung employes LED lamps offering higher luminous efficiency and deeper attraction ranges. Currently, there is no specific restriction on the use of LED lighting in the study area; however, national regulations impose technical limits on fishing lights. The lamp power applied in both fishing grounds was substantially lower than the maximum threshold stipulated in Regulation of the Minister of Marine Affairs and Fisheries of the Republic of Indonesia No. 36/2023 (≤ 2,500 W), indicating compliance with existing regulatory provisions. Nevertheless, the increasing adoption of high-efficiency LED systems highlights the need for clearer, LED-specific management guidelines to ensure that technological gains do not translate into excessive fishing pressure.

Consistent with our findings, higher light intensity can enhance fish attraction and increase catches, but this is often accompanied by increased operational costs related to fuel consumption and equipment maintenance, reflecting the socio-economic constraints shaping technological adoption in small-scale fisheries (Rudin et al., 2017; Sudirman et al., 2020). This trade-off between energy consumption and catch optimization underscores the need for cost-effective lighting strategies that improve efficiency without disproportionately increasing operating costs (Solomon and Ahmed, 2016). In this context, the adoption of energy-efficient LED lighting systems, coupled with modular lift-net frame designs, offers a practical approach to improving operational flexibility and reducing long-term expenses. The effectiveness of LED-based lighting for fixed lift-net fisheries has been consistently reported in previous studies (Lebong et al., 2021; Susanto et al., 2020; Fatma et al., 2022), supporting their broader application under appropriate management frameworks.

While CPUE differed significantly between sites ($p < 0.05$), this finding should be interpreted in light of the limited number of fishing operations and associated statistical assumptions. Wiritasi outperformed Sarang Tiung with a higher CPUE of 12.83 kg/haul, compared to Sarang Tiung's 8.46 kg/haul. Catch variability likely correlated with site-specific environmental conditions and gear configurations. Differences in mean daily catches (25.67 kg at Wiritasi vs. 16.92 kg at Sarang Tiung) were statistically validated, highlighting the impact of construction material and lighting system on fish aggregation and efficiency. Overall, Wiritasi contributed about 60.27% of the total catch, which may be associated with the proximity of Wiritasi's fishing ground to primary migratory routes or schooling aggregations of dominant clupeids such as sardines and scads (Fatmawati et al., 2020). While Wiritasi's offshore lift-net fishery achieves higher catches under favorable conditions, Sarang Tiung offers more predictable performance under stable environmental setting, ensuring consistent catch patterns. The CPUEs in the present study was comparatively higher than the CPUEs (1.57–5.92 kg/haul) for fixed lift nets in Pangkajene Islands (Fatimah et al., 2022).

The stark contrast in mean CPUE between Wiritasi and Sarang Tiung warrants a deeper look into the economics of effort. While Wiritasi demonstrates superior catch rates under favorable conditions, the higher operational costs associated with powerful mercury lamps and the shorter lifespan of its construction materials introduce a trade-off. Sarang Tiung, despite a lower CPUE, potentially benefits from greater operational predictability and lower input costs due to its more durable infrastructure and consistent, albeit lower, daily catches. This suggests that high CPUE does not always equate to higher profitability or sustainability. Furthermore, the significantly higher CPUE observed in the present study compared to regional benchmarks (e.g., Fatimah et al., 2022) indicates that both sites are currently exploiting relatively productive fishing grounds. However, sustaining these high catch rates requires careful monitoring to prevent localized overfishing, especially of fast-growing clupeids. This highlights the urgent need to balance the high efficiency suggested by Wiritasi's CPUE with resource conservation and economic viability, emphasizing the strategic value of incorporating energy-efficient LEDs to maintain catch rates while mitigating operational expenditure and environmental impact (FAO, 2024).

The comparative results detailing differences in technology, operation, and performance of lift net fisheries underscore the necessity of site-specific management strategies that integrate ecological, technological, and socio-economic dimensions. This evidence provides critical support for transitioning away from conventional 'one-size-fits-all' approaches toward spatially differentiated fisheries policies. For instance, Sarang Tiung's use of durable mangrove wood offers a structural model for increasing gear lifespan, whereas Wiritasi's high-intensity luring technique demonstrates a method for maximizing catch in specific ecological niches. Therefore, policy recommendations should prioritize subsidizing energy-efficient LED lighting for Wiritasi fishers, accompanied by strict regulatory measures such as catch quotas, limits on light intensity and operating duration, and standardized technical specifications (Ministry of Marine Affairs and Fisheries 36/2023), to decouple high catch rates from high operational costs and to mitigate the risk of overfishing arising from unregulated LED application.

Addressing underlying socio-economic imbalances is essential to ensure equitable access to technology transfer and productive fishing grounds. Based on the findings of this study, several key management and operational recommendations emerge. Fishers are encouraged to selectively adopt proven gear designs, construction materials, and operational practices that enhance efficiency and durability. Optimization of LED light intensity and configuration should be prioritized to balance energy consumption with catch performance while minimizing environmental impacts. The use of modular lift-net frames may further reduce maintenance costs and improve operational flexibility.

In addition, exploratory adjustments in fishing locations, depths, and timing, aligned with periods of higher fish aggregation, may improve catch outcomes. While sardines remain the primary target species due to their economic importance, maintaining catch diversity including squid, can enhance resilience to market fluctuations and stock variability. Finally, strengthening inter-site knowledge exchange among fishing communities, particularly through the sharing of ecological knowledge and net-handling practices, could help standardize and improve fishing performance across the region.

These strategies should be informed by CPUE data and socio-economic indicators to build adaptive capacity against environmental uncertainty, ensuring the long-term viability of the fixed lift-net fisheries.

Conclusion

This study demonstrates that lift-net output varies substantially between fishing grounds, reflecting interactions among species composition, gear configuration, and lighting systems. While Wiritasi achieved higher catch efficiency, the contrast with LED-based operations in Sarang Tiung underscores the importance of transitioning toward more energy-efficient practices while balancing production with sustainability. For fishers and fisheries managers, promoting energy-efficient lighting, adaptive gear design, and equitable access to technology offers a practical pathway to enhance economic returns while reducing environmental impacts.

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Conflicts of Interest

The authors declare no conflicts of interest.

Author Contributions

The first author designed the study, analyzed the data, and wrote the manuscript. The second and third authors collected data and conducted measurements. All authors reviewed and approved the final version.

Ethics Approval

No ethics committee approval is required for this study.

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