ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 12| Issue: 3| March2026|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2026: 8.753 || ISI Value: 1.188

STATUS OF SQUID JIGGING FISHERY USING BIODEGRADABLE FADs IN PALK BAY AND GULF OF MANNAR

X. Agnes Pravina[1], Dr. R. Radhika[2]
[1]*Assistant Professor, Faculty of Management Studies, Noorul Islam Centre for Higher Education, Kanyakumari District. Tamilnadu, India. Orcid:0009-0006-6290-3514*
[2]*Associate Professor Faculty of Management Studies, Noorul Islam Centre for Higher Education, Kanyakumari District, Tamilnadu, India. Orcid:0000-0003-3896-7594*

ABSTRACT
The squid jigging fishery has emerged as an efficient and environmentally sustainable fishing method along the south-east coast of India. This paper reviews the status and performance of squid jigging operations using biodegradable fish aggregating devices (FADs). The study focuses on catch efficiency, production trends, species composition, and environmental sustainability. Results indicate higher production in the Gulf of Mannar, while Palk Bay shows better efficiency. Biodegradable FADs reduce marine pollution and support small-scale fisheries. However, challenges such as durability and lack of standardization persist. The study concludes that biodegradable FAD-based squid jigging is a sustainable fishing approach requiring policy and technological support.

KEYWORDS: *Squid Jigging, Biodegradable Fads, Sustainable Fisheries, Catch Efficiency, Cephalopods*

1. INTRODUCTION
Marine fisheries play a vital role in the economic and social development of coastal regions, particularly in India where a large population depends on fisheries for livelihood and food security. Among various fishing techniques, squid jigging has gained importance as a selective and eco-friendly fishing method that targets high-value cephalopods with minimal bycatch. Unlike trawling and other destructive fishing practices, squid jigging ensures resource sustainability and reduces habitat damage.

Squid jigging technology originated in Japan and later spread globally, including India, where it has been practiced since the early twentieth century . The technique involves the use of specialized jigs that attract squids through visual stimuli and movement, making it a highly efficient fishing method. In India, this practice has gained prominence along the south-east coast, particularly in **Palk Bay** and the **Gulf of Mannar**, where favorable ecological conditions support abundant cephalopod resources.

Fish aggregating devices (FADs) play a crucial role in enhancing squid jigging efficiency by attracting and concentrating fish and cephalopods. Traditionally, FADs have been constructed using synthetic materials such as plastic ropes and nets, which contribute to marine pollution and long-term ecological damage. These synthetic FADs can lead to ghost fishing and entanglement of non-target species, posing significant environmental concerns.

To address these issues, biodegradable FADs have been introduced as an eco-friendly alternative. These devices are constructed using natural materials such as plant branches, bamboo, and organic fibers, which degrade naturally in the marine environment. Studies have shown that biodegradable FADs significantly reduce the environmental impact of fishing while maintaining effectiveness in aggregating target species .The adoption of biodegradable FADs is particularly beneficial for small-scale fishers, as they are cost-effective and utilize locally available materials. However, challenges such as shorter durability, lack of standardized design, and limited awareness among fishing communities hinder their widespread adoption.

This paper aims to review the status of squid jigging fisheries using biodegradable FADs in Palk Bay and the Gulf of Mannar, focusing on catch trends, efficiency, species composition, and sustainability aspects, while also identifying challenges and future prospects.

2. REVIEW OF LITERATURE
Fish aggregating devices (FADs) have been widely recognized for their ability to enhance fish catch by attracting marine species. Sasikumar et al. (2006) reported that FAD-based jigging significantly improves cephalopod aggregation and catch rates. Similarly, Chellamanimegalai et al. (2019) observed that plant-based biodegradable FADs are effective and eco-friendly. These findings underline the dual economic and ecological benefits of FAD-assisted fisheries.

Species composition in squid fisheries has been found to vary based on habitat characteristics and environmental conditions. Venkatesan and Shanmugavel (2008**)** identified *Sepioteuthis lessoniana* as the dominant species in Palk Bay. Their study also highlighted the influence of seagrass ecosystems on species distribution. This indicates that fishery outcomes are strongly linked to ecological conditions.

Global studies have raised concerns regarding the ecological impacts of FAD usage. Dagorn et al. (2013) and Moreno et al. (2016) emphasized that unregulated FAD deployment can increase fishing pressure and affect spawning stocks. These studies highlight the risks of overexploitation despite improved catch efficiency. Therefore, sustainable management of FAD-based fisheries is essential.

Recent research has focused on balancing fishing efficiency with sustainability in artisanal fisheries. FAO (2020) and Hilborn and Walters (2013) stressed the importance of ecosystem-based fisheries management (EBFM). These approaches advocate integrating ecological, economic, and social factors in fisheries governance. Such frameworks are crucial for ensuring the long-term sustainability of squid jigging fisheries.

Early research on cephalopod fisheries in India emphasized the growing importance of squid jigging as a selective and efficient fishing method. **Alagarswami and Meiyappan (1987)** highlighted the potential for expanding cephalopod production in Indian waters. Later, **Balasubramanian et al. (1995)** documented the emergence of hand jigging techniques along the southeast coast. These studies established squid jigging as a sustainable alternative to destructive fishing methods.

3. METHODOLOGY

This study adopts a **descriptive and analytical research design** based on secondary data to evaluate the status of squid jigging fisheries using biodegradable fish aggregating devices (FADs) along the south-east coast of India, specifically in **Palk Bay** and the **Gulf of Mannar**.

3.1 Data Sources

The study relies primarily on **secondary data** collected from multiple credible sources, including:

- Peer-reviewed journals such as *Indian Journal of Fisheries*
- Reports from fisheries research institutions (e.g., ICAR–CMFRI)
- Government publications and marine fisheries statistics
- Published articles on biodegradable FAD technology and squid jigging practices

The data covers a **time period from 2010 to 2021**, ensuring a comprehensive understanding of long-term trends in squid jigging fisheries.

3.2 Study Area Description

The study focuses on two major marine fishing regions:

- **Palk Bay**
  - Shallow coastal ecosystem
  - Depth range: 5–8 meters
  - Fishing distance: 4–6 nautical miles
  - Known for higher catch efficiency due to concentrated fishing zones
- **Gulf of Mannar**
  - Deeper marine ecosystem
  - Depth range: 13–25 meters
  - Fishing distance: 6–10 nautical miles
  - Characterized by higher total fish production

These contrasting environmental conditions allow comparative analysis of fishery performance.

4. ANALYSIS AND INTERPRETATION

Table 1 Showing Types of Crafts Used in Squid Jigging

Craft Type	Size (OAL)	Engine Power	Cost (₹)	Characteristics
Vathai (Non-mechanised)	5–12 m	Nil	Low	Traditional, nearshore fishing
FRP Boat	8–14 m	10–12 hp	Medium	Motorised, flexible operation
Vallam (Inboard)	13–15 m	14–20 hp	High	Offshore capable
Thermocol Float (Theppam)	~1.8 m	Nil	3,000–10,000	Used by low-income fishers
FRP-coated PUF Float	~2 m	Nil	25,000–30,000	Durable, long lifespan

Interpretation

The diversity of crafts used in squid jigging reflects a multi-layered artisanal fishery system characterized by technological heterogeneity. The dominance of low-cost crafts such as thermocol floats indicates strong participation from economically weaker fishing communities, highlighting the fishery's role in livelihood security. At the same time, the presence of motorised FRP boats and vallams suggests a gradual transition toward mechanization and increased fishing capacity. This dual structure creates disparities in operational efficiency and catch potential, where larger crafts can access deeper waters and exploit more resources. The cost–durability relationship further emphasizes that higher investments lead to improved fishing efficiency and sustainability. Overall, the coexistence of traditional and modern crafts illustrates a technologically dualistic system with implications for equity and resource distribution.

Table 2 Showing Catch Efficiency Indicators

Region	LPUE (kg/unit)	LPH (kg/hour)
Palk Bay	13.37	2.86
Gulf of Mannar	9.5	1.7

Table 3 Showing Average Annual Production (2010–2021)

Region	Average Annual Landings (tonnes)	% Contribution of Jigging
Palk Bay	413	8.5%
Gulf of Mannar	1948	11%

Interpretation

The production data indicates that the Gulf of Mannar contributes significantly higher squid landings compared to Palk Bay, primarily due to its larger geographical area and deeper waters that support greater biomass. However, the relatively lower contribution of squid jigging to total landings suggests that this method is still secondary compared to other fishing techniques. In Palk Bay, although total production is lower, the fishery operates more efficiently, indicating better resource utilization. These variations highlight the influence of spatial and ecological factors on fishery productivity. The data also suggests that squid jigging has considerable scope for expansion, provided it is supported by sustainable management practices and technological improvements.

Table 4 Showing Species Composition (%)

Region	Squid (%)	Cuttlefish (%)	Octopus (%)
Palk Bay	52.06	41.8	6.06
Gulf of Mannar	47.2	51	1.8

Interpretation

The species composition reveals distinct ecological differences between the two regions. Palk Bay is predominantly squid-oriented, while the Gulf of Mannar shows a higher proportion of cuttlefish. These variations are closely linked to habitat characteristics, with seagrass ecosystems in Palk Bay favouring squid populations and reef ecosystems in the Gulf of Mannar supporting cuttlefish abundance. The relatively low proportion of octopus in both regions reflects the selective nature of jigging gear, which primarily targets squids and cuttlefish. This distribution pattern highlights the importance of habitat-specific fisheries and emphasizes that species composition is largely determined by ecological conditions rather than fishing effort alone.

Table 5 Showing Fishing Effort Trends (2010–2021)

Parameter	Palk Bay	Gulf of Mannar
Decline in Unit Effort	16.5%	47–52%
Decline in Fishing Hours	33.6%	13.26%

Interpretation

The declining trend in fishing effort across both regions indicates potential stress in the fishery system. The significant reduction in unit effort in the Gulf of Mannar suggests either declining resource availability or reduced fishing participation, possibly due to economic or environmental factors. In Palk Bay, the sharper decline in fishing hours may reflect reduced catch availability or changes in fishing behaviour. These patterns are indicative of a maturing or possibly declining fishery, where initial expansion phases are followed by stabilization and reduction. Such trends raise concerns about overexploitation and highlight the need for monitoring and regulation to ensure long-term sustainability.

Table 6 Showing Seasonal Fishing Pattern

Parameter	Details
Peak Seasons	April–May, July–September
Fishing Time	03:00 AM – 11:00 AM
Duration	5–7 hours

Interpretation

The seasonal pattern of squid jigging demonstrates a strong dependence on environmental and biological cycles. Peak fishing periods coincide with favourable climatic conditions and increased squid aggregation, likely linked to breeding and feeding behaviour. The reliance on daytime fishing reflects regulatory

ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 12| Issue: 3| March2026|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2026: 8.753 || ISI Value: 1.188

restrictions and the natural behaviour of squids, which respond to light conditions. Seasonal variability also influences the income stability of fishers, making them vulnerable to fluctuations in resource availability. These findings emphasize the importance of incorporating seasonal dynamics into fisheries management strategies.

Table 7 Showing FAD Characteristics and Performance

Parameter	Details
Aggregation Time	Within 24 hours
Materials Used	Coconut fronds, bamboo, plant branches
Lifespan	2–3 months

Interpretation

Biodegradable FADs play a crucial role in enhancing squid aggregation and improving fishing efficiency. The rapid aggregation of squids within 24 hours demonstrates the effectiveness of these devices in exploiting the natural behavioural tendencies of cephalopods. The use of plant-based materials ensures environmental sustainability by reducing marine pollution and eliminating ghost fishing risks. However, the short lifespan of these materials necessitates frequent replacement, increasing operational effort. Additionally, excessive deployment of FADs may lead to localized overfishing and pressure on spawning stocks. Therefore, while FADs offer significant benefits, their use must be carefully regulated to ensure ecological balance.

5. FINDINGS

- **The squid jigging** fishery in Palk Bay shows higher catch efficiency, whereas the Gulf of Mannar exhibits higher total production.
- Biodegradable FADs significantly enhance squid aggregation, with catch improvement observed within 24 hours of deployment.
- A declining trend in fishing effort (up to 52%) indicates possible resource stress and overexploitation.
- Species composition varies regionally, with squid dominance in Palk Bay and cuttlefish dominance in the Gulf of Mannar.
- The fishery is highly dependent on seasonal cycles, with peak activity during April–May and July–September.
- The use of low-cost crafts such as thermocol floats highlights the livelihood dependence of small-scale fishers.
- **Biodegradable FADs reduce environmental impacts but may increase** localized fishing pressure**.**

6. SUGGESTIONS

- Regulate the number and spacing of biodegradable FADs to prevent excessive aggregation and localized overfishing.
- Introduce limits on fishing effort and monitor declining trends to avoid resource depletion.Controlled effort will ensure long-term sustainability of squid resources.
- Restrict fishing during peak spawning seasons to protect breeding populations.
  This will enhance stock regeneration and improve future catch stability.
- Develop standardized and durable biodegradable FAD designs for uniform adoption.
  This will improve efficiency while reducing frequent replacement costs.
- Provide financial assistance and training to low-income fishers using traditional crafts.
  This will enhance livelihood security and promote equitable resource utilization.
- Strengthen data collection systems for continuous monitoring of catch, effort, and species composition. Reliable data will support evidence-based fisheries management decisions.

6.1 DISCUSSION

The present findings align with earlier studies on squid jigging fisheries in India. Alagarswami and M. M. Meiyappan (1987) emphasized the potential for expanding cephalopod fisheries in India, which is evident in the current growth of squid jigging practices. Similarly, **T. S. Balasubramanian et al. (1995) reported the emergence of hand jigging along the Tuticorin coast, supporting the present observation of widespread artisanal adoption.

The role of FADs in enhancing catch efficiency has been widely documented. Studies by S. Sasikumar et al. (2006) and P. Chellamanimegalai et al. (2019) confirmed that plant-based FADs attract cephalopods effectively, consistent with the current study's finding of rapid aggregation within 24 hours. Furthermore, research by P. Venkatesan and S. Shanmugavel (2008) identified *Sepioteuthis lessoniana* as a dominant species in Palk Bay, which is also supported by the present analysis.

The observed decline in fishing effort and catch trends is consistent with global concerns regarding overexploitation of marine resources. Studies have indicated that unregulated FAD use can lead to increased fishing pressure on spawning stocks, thereby affecting long-term sustainability (Dagorn et al., 2013; Moreno et al., 2016). The current findings also support the concept of **ecosystem-based fisheries management**, where habitat characteristics strongly influence species composition and fishery performance.

However, unlike earlier studies that primarily focused on production, the present study highlights the **sustainability paradox**, where eco-friendly technologies such as biodegradable

FADs may inadvertently increase fishing intensity. This adds a new dimension to existing literature by integrating ecological, technological, and socio-economic perspectives.

7. CONCLUSION

The study provides a comprehensive evaluation of squid jigging fisheries using biodegradable FADs in **Palk Bay** and the **Gulf of Mannar**, highlighting significant regional variations in efficiency, production, and species composition. While biodegradable FADs offer an environmentally sustainable alternative to synthetic devices, their role in enhancing fish aggregation may lead to increased fishing pressure and potential resource depletion.

The findings indicate that sustainability in squid jigging fisheries requires a balanced approach that integrates technological innovation, ecological conservation, and socio-economic considerations. The declining trends in fishing effort and productivity underscore the urgency for regulatory interventions and adaptive management strategies.

In conclusion, biodegradable FAD-based squid jigging represents a promising model for sustainable artisanal fisheries; however, its long-term success depends on **effective governance, controlled usage, and continuous scientific monitoring**.

REFERENCES

1. *Alagarswami, K., & Meiyappan, M. M. (1987).* Prospects for increasing cephalopod production of India. *CMFRI Bulletin.*
2. *Balasubramanian, T. S., Rajapackiam, S., Kasim, H. M., & Hamsa, K. M. (1995). Emergence of hand jigging for cephalopods along Tuticorin coast.* Marine Fisheries Information Service*, 137, 13–16.*
3. *Chellamanimegalai, P., et al. (2019). Traditional fishing knowledge in Kombuthurai along the Gulf of Mannar.*
4. *Dagorn, L., Holland, K. N., Restrepo, V., & Moreno, G. (2013). Is it good or bad to fish with FADs?* Fish and Fisheries*, 14(3), 391–415.*
5. *FAO. (2020).* The state of world fisheries and aquaculture. *Food and Agriculture Organization.*
6. *Hilborn, R., & Walters, C. J. (2013).* Quantitative fisheries stock assessment. *Springer.*
7. *Moreno, G., Dagorn, L., & Sancho, G. (2016). Is FAD use sustainable?* Ocean & Coastal Management*, 120, 1–9.*
8. *Sasikumar, G., et al. (2006). Cephalopod fishery using FADs.*
9. *Venkatesan, P., & Shanmugavel, S. (2008). Cephalopod fishery resources in Palk Bay.*
10. *Kumarakannan, A., & Krishnan, A. R. (2021). Techniques to squid jigging in India: A review. Journal of Entomology and Zoology Studies, 9(3), 415–422.*
11. *Lipton, A. P., Rao, P. V., Ganapathy, A., & Thillairajan, P. (1990). Emerging squid jigging fishery along the Palk Bay coast of Tamil Nadu. Fishing Chimes, 10(9), 28–31.*
12. *Sundaram, S., & Sawant, D. D. (2013). Emerging light and hand jigging fishery for cephalopods along Ratnagiri coast, Maharashtra. Marine Fisheries Information Service, 215, 1–3.*
13. *Sundaram, S., & Deshmukh, V. D. (2011). Emergence of squid jigging in India. Fishing Chimes, 30(12), 18–20.*
14. *Paulose, S. K., & Chakraborty, K. (2024). Nutritional properties of commercially important cephalopods from the south-west coast of India. Indian Journal of Fisheries, 71(3), 1–14.*