



Stock Assessment of *Nemipterus marginatus* in Java Sea: Case Study on Batang Regency and Pati Regency

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Submitted: 5 November 2025; **Accepted:** 26 March 2026;

Published: 15 October 2026

To cite this article: Dian Wijayanto, Faik Kurohman, Hendrik A. Setyawan and Dita J. Kurnia. (2026). Stock assessment of *Nemipterus marginatus* in Java Sea: Case study on Batang Regency and Pati Regency. *Tropical Life Sciences Research* 37(3): 63–78. <https://doi.org/10.21315/tlsr2026.37.3.4>

To link to this article: <https://doi.org/10.21315/tlsr2026.37.3.4>

HIGHLIGHTS:

- Different exploitation status between Pati and Batang: In Pati, the exploitation rate ($E = 0.43$) indicates a sustainable condition and in Batang, the exploitation rate ($E = 0.52$) indicates overexploitation. This shows that fishing pressure is significantly higher in Batang waters.
- Most fish are caught before reaching sexual maturity: The length at first capture ($L_{C50\%}$) (10.90–11.61 cm) is smaller than the length at first maturity ($L_{M50\%}$) (~13–14 cm). This means that most individuals are harvested before they can reproduce.
- Stock is approaching optimal exploitation → management is needed: Production in Batang has exceeded MSY, while Pati remains below it. Recruitment occurs seasonally (main peak: February–July).
- Recommended management strategies include minimum catch size regulation, seasonal fishing restrictions and control of fishing effort.



Stock Assessment of *Nemipterus marginatus* in Java Sea: Case Study of Batang Regency and Pati Regency

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Abstract: This research examined the exploitation status of *Nemipterus marginatus* in the coastal waters of Pati and Batang Regencies, Central Java Province. Field surveys were conducted from April to September 2025 to measure the total length and body weight of 226 specimens collected from Pati and 391 specimens from Batang. The length–weight relationship of *N. marginatus* in Pati and Batang show negative allometric pattern, with $W = 0.134L^{2.15}$ and $W = 0.052L^{2.471}$, respectively. The $L_{c50\%}$ values were 11.61 cm in Pati and 10.90 cm in Batang. Growth parameters for *N. marginatus* in Pati were $L_{\infty} = 26.0$ cm, $K = 0.40$ year⁻¹, $M = 1.02$ year⁻¹, $F = 0.76$ year⁻¹, $Z = 1.78$ year⁻¹ and $E = 0.43$, indicating a sustainable level of exploitation. Meanwhile, in Batang, $L_{\infty} = 26.0$ cm, $K = 0.58$ year⁻¹, $M = 1.30$ year⁻¹, $F = 1.40$ year⁻¹, $Z = 2.70$ year⁻¹ and $E = 0.52$ (overexploitation). The estimated Maximum Sustainable Yield (MSY) was 3.286 tons (IDR29.574 million) in Pati and 3.589 tons (IDR32.302 million) in Batang. The recruitment season was estimated to occur from February to July in Pati and from February to June, with secondary peaks in September and November, in Batang. These findings indicate that *N. marginatus* populations in the northern waters of Central Java are approaching optimal exploitation levels. Hence, management strategies should consider the size limits and seasonal fishing regulations to promote stock sustainability.

Keywords: Central Java, Exploitation Rate, Maximum Sustainable Yield, MSY, *Nemipterus marginatus*

INTRODUCTION

Nemipterus marginatus (common name: red filament threadfin bream; local names: *kurisi*, *kurisi merah*, *kuniran*) is a demersal marine fish species of family Nemipteridae (Paul *et al.* 2018; Al-Buwaiqi *et al.* 2019; Ismaili *et al.* 2023; Gao *et al.* 2024; Murugesan *et al.* 2025). This species inhabits sandy or muddy substrates at depths ranging from shallow coastal waters to approximately 100 m, including in Indo-West Pacific region (El-Ganainy *et al.* 2018; Froese & Pauly 2019; 2025; Thao *et al.* 2022). The school of

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N. marginatus is frequently captured using bottom fishing gears such as trawls, gillnets and other demersal gear types (Pauly & Martosubroto 1980; Russell 1990; Ning et al. 2011; He et al. 2021).

N. marginatus is carnivore that feed on small crustaceans (including shrimps), polychaetes, small mollusks and benthic fishes (Sululu et al. 2017; Tonnie et al. 2018; Paul et al. 2018; Vaisakh et al. 2019; Detcharoen et al. 2024). Its spatial distribution and population density are influenced by the availability of benthic prey and environmental parameters such as temperature, salinity and local hydrodynamics (Shafeeque et al. 2021; Ritonga et al. 2022; Mahmoud & Ibrahim 2024). The species migrate within local area for feeding, spawning or responding to environmental fluctuations (El-SiKaily 2024).

The use of demersal fisheries using trawls, gillnets and other bottom gears to capture *N. marginatus* puts the species on the risk of overexploitation (Hong et al. 2024). Although often regarded as a secondary catch, the widespread use of non-selective fishing methods poses risks of excessive bycatch and potential overfishing, especially in areas lacking effective stock management (Gilman et al. 2019; Schwermer et al. 2020; Wibisono et al. 2022). *N. marginatus* maintains the benthic food web dynamics within the ecosystem (Ahmad et al. 2015; Grgec et al. 2020). Prior researchers reported heavy exploitation of the fisheries in Java Sea which is closer to the critical thresholds (Dimarchopoulou et al. 2023; Nugroho et al. 2025). Unselective fishing practices may alter benthic community structures and reduce biodiversity (Ren & Liu 2020; Herwaty et al. 2023) that are detrimental to species with low recovery potential (Williams et al. 2013; Ernawati et al. 2024).

The use traditional demersal gears in Indonesia, such as *cantrang* (Danish trawl), has intensified fishing pressure on bottom-dwelling species (Taurusman et al. 2025). Unfortunately, the fishery resources at the northern coast of Central Java, including Pati and Batang Regencies are not sufficiently evaluated, thereby requiring re-evaluation. The potential influence of fishing intensity and environmental changes (e.g., rising sea temperatures, sedimentation and habitat degradation) on stock structure and long-term sustainability has been discussed in general fisheries literature (Goethel et al. 2019; Peltonen & Weigel 2022), although the direct relevance of these parameters to *N. marginatus* remains unclear due to limited species-specific evidence. This study aims to examine the current exploitation status and ecological condition of *N. marginatus* in the northern coastal waters of Central Java, particularly in Pati and Batang, as a basis for sustainable demersal fisheries management.

MATERIALS AND METHODS

Research Time and Location

This study was conducted in the coastal waters of Pati and Batang Regencies, Central Java Province, Indonesia (Fig. 1). Fish sampling and field data collection were carried out from April to September 2025 at major fish landing sites in both regencies.

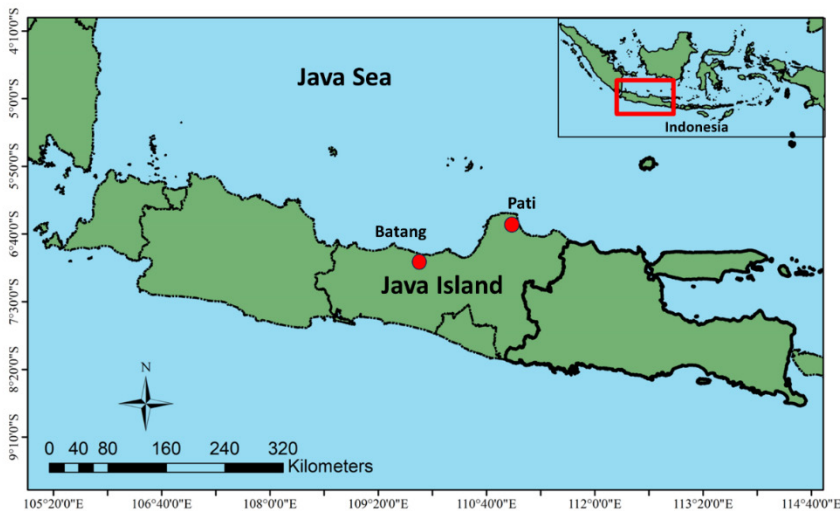


FIGURE 1: Research location (Source: Indonesia Information Geospatial Agency).

Data Collection and Analysis

Several biological parameters were observed, including body weight (g) and total length (TL, in cm) of *N. marginatus* (see Fig. 2). A total of 226 *N. marginatus* specimens were randomly selected from Pati Regency and 391 samples were collected from Batang.



FIGURE 2: Specimen of *N. marginatus*.

Data analysis was performed using Microsoft Excel and FiSAT II software. The growth function was modeled using the von Bertalanffy's growth equation, while the L_{∞} and K values were measured using the ELEFAN I (Electronic Length Frequency Analysis) method in FiSAT II. The t_0 value was estimated using the logarithmic equation of Gulland (1983). Total mortality (Z) was calculated through the length-converted catch curve module in FiSAT II. Natural mortality (M) was estimated using Pauly's empirical equation. Fishing mortality (F) was then measured based on the gap between Z and M ($F = Z - M$). The exploitation ratio or exploitation rate (E), length-weight relationship (allometric model) and length at first capture ($L_{c50\%}$) were also examined (Gulland 1965; Sparre & Venema 1998; FAO 1998; Gayanilo et al. 2005; Badrudin et al. 2011; Kindong et al. 2018; Wang et al. 2020; Sarr et al. 2023; Tirtadanu et al. 2023; Bhakta et al. 2024; Wijayanto et al. 2025; Riza et al. 2026). The formulas used in the analysis are as follows:

$$W = a L^b \quad (1)$$

$$\ln W = \ln a + b \ln CL \quad (2)$$

$$Lt = L_{\infty}(1 - e^{-k(t-t_0)}) \quad (3)$$

$$\text{Log}(-t_0) = -0.3922 - 0.2752 \text{Log } L_{\infty} - 1.038 \text{Log } K \quad (4)$$

$$\begin{aligned} \text{Log}(M) = & -0.0066 - 0.279 \text{Log } L_{\infty} \\ & + 0.6543 \text{Log } K \\ & + 0.4634 \text{Log } T \end{aligned} \quad (5)$$

$$F = Z - M \quad (6)$$

$$E = \frac{F}{Z} \quad (7)$$

$$E_{MSY} = 0.5 \quad (8)$$

$$F_{MSY} = 0.5 Z \quad (9)$$

$$C_{MSY} = \frac{F_{MSY}}{F} C \quad (10)$$

Where W = fish weight (g); L_t = total length at age t (cm); a and b = length-weight relationship constants; L_∞ = asymptotic length (cm); K = growth coefficient (per year); t = fish age (years); t_0 = theoretical age at which length equals zero (years); T = water temperature (assumed 28°C); Z = total mortality; M = natural mortality; F = fishing mortality; E = exploitation rate; E_{MSY} = the optimal exploitation rate under the MSY conditions; F_{MSY} = fishing mortality under the MSY conditions; C_{MSY} = fish production under the MSY conditions.

RESULTS

The analysis of the length-weight relationship of *N. marginatus* in the two study locations (Pati and Batang Regencies) is presented in Table 1. The b values for both locations were less than 3, namely 2.157 in Pati and 2.471 in Batang, indicating a negative allometric growth pattern, where weight increases at a slower rate than body length. The coefficients of determination (R^2) were 70.3% for Pati and 86.5% for Batang, suggesting a positive relationship between fish length and weight in both study areas. However, the R^2 value of 70.3% should be interpreted with caution and does not necessarily indicate a strong relationship.

TABLE 1. Length-weight relationship of *Nemipterus* spp.

Species	Location	a	b	Growth pattern	References
<i>N. marginatus</i>	Pati, Indonesia	0.134	2.16	Negative allometric	This study
<i>N. marginatus</i>	Batang, Indonesia	0.052	2.47	Negative allometric	This study
<i>Nemipterus</i> spp.	Java Sea, Indonesia	0.00006	2.65	Negative allometric	Hartati et al. (2017)

The total length (TL) composition of *N. marginatus* caught by local fishers is presented in Table 3 and Fig. 3. The size distribution of fish in Pati Regency ranged from 9.01 to 21.00 cm TL, with dominant size classes found at intervals of 10.51 cm–12.00 cm (26%) and 12.01 cm–13.50 cm (16%). Meanwhile, in Batang Regency, the captured fish exhibited a wider size range of 6.00 cm–21.00 cm TL, dominated by individuals measuring 13.51 cm–15.00 cm (24%) and 9.01 cm–10.50 cm (23%). 80% of individuals in Pati and 88% in Batang had total length size under 15 cm, indicating that the fish caught were mostly juvenile fish. The size distribution pattern further confirms that the fishing activities largely targeted young individuals (Zhang et al. 2022b), with significantly higher proportion of small-sized fish (6 cm–10 cm TL) was recorded in Batang.

TABLE 2. Size composition of *N. marginatus* caught in Pati and Batang.

Interval of TL (cm)	Middle value	Frequency		Percentage (%)		Cumulative percentage (%)	
		Pati	Batang	Pati	Batang	Pati	Batang
6.00–7.50	6.75	0	29	0	7	0	7
7.51–9.00	8.25	0	17	0	4	0	12
9.01–10.50	9.75	48	88	20	23	20	34
10.51–12.00	11.25	64	80	26	20	46	55
12.01–13.50	12.75	38	37	16	9	62	64
13.51–15.00	14.25	43	94	18	24	80	88
15.01–16.50	15.75	19	33	8	8	88	97
16.51–18.00	17.25	13	4	5	1	93	98
18.01–19.50	18.75	5	6	2	2	95	99
19.51–21.00	21.00	12	3	5	1	100	100

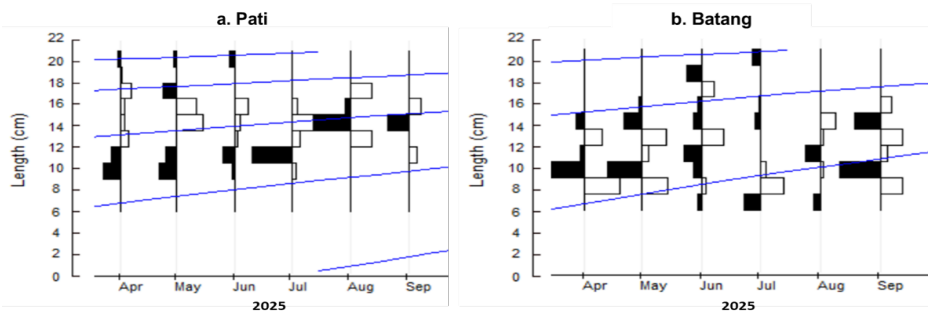


FIGURE 3: Size distribution of *N. marginatus*.

Table 2 presents the results of the $L_{C_{50\%}}$ analysis, in which the estimated $L_{C_{50\%}}$ value in Pati Regency was 11.61 cm and 10.90 cm in Batang Regency. Both values were smaller than the length at first maturity ($L_{m_{50\%}}$) that ranged between 13 cm–14 cm for *N. japonicus* as proposed by Lisamy *et al.* (2023). The finding shows that most *N. marginatus* individuals in both locations were caught before reaching sexual maturity, which raises the risk of overfishing (Link & Watson 2019; Zhang *et al.* 2022a).

TABLE 3. $L_{C_{50\%}}$ vs. $L_{m_{50\%}}$ of *N. marginatus*.

Location	$L_{C_{50\%}}$	Reference
Pati Regency	11.61	This study
Batang Regency	10.90	This study
	$L_{m_{50\%}}$	
Tangerang, Banten	14.4	Hartati <i>et al.</i> (2017)

The growth parameters of *N. marginatus* in Pati and Batang Regencies are presented in Table 4. The asymptotic length (L_{∞}) values were relatively similar, at 26 cm, indicating a comparable maximum body size of the population in both locations. However, the growth coefficient (K) between sites differed, with higher value ($K = 0.58 \text{ year}^{-1}$) in Batang compared to Pati ($K = 0.40 \text{ year}^{-1}$). Both natural mortality (M) and total mortality (Z) were also higher in Batang ($M = 1.30 \text{ year}^{-1}$; $Z = 2.70 \text{ year}^{-1}$) than in Pati ($M = 1.02 \text{ year}^{-1}$; $Z = 1.78 \text{ year}^{-1}$). The fishing mortality ($F = Z - M$) reached 1.40 year^{-1} in Batang, resulting in an exploitation rate (E) of 0.52, indicating an over-exploited condition. Conversely, the E value of 0.43 in Pati suggests that the fishery in this area remains within sustainable limits.

TABLE 4. Growth, mortality and exploitation parameters.

Location	L_{∞} (cm)	K	M	F	Z	E	Notes	References
Pati (<i>N. marginatus</i>)	26.0	0.40	1.02	0.76	1.78	0.43	Under-exploited	This study
Batang (<i>N. marginatus</i>)	26.0	0.58	1.30	1.40	1.02	0.52	Over-exploited	This study
Suez Gulf, Red Sea (<i>N. japonicus</i>)	31.66	0.24	0.61	1.14	1.74	0.65	Over-exploited	El-Ganainy <i>et al.</i> (2018)
Suez Gulf, Red Sea (<i>N. bipunctatus</i>)	29.55	0.26	0.67	1.05	1.72	0.61	Over-exploited	El-Ganainy <i>et al.</i> (2018)

(Continued on next page)

Table 2 (Continued)

Location	L_{∞} (cm)	K	M	F	Z	E	Notes	References
Suez Gulf, Red Sea (<i>N. zysron</i>)	24.68	0.38	0.82	0.91	1.73	0.53	Over-exploited	El-Ganainy et al. (2018)
Java Sea (<i>Nemipterus</i> spp.)	25.8	0.45	0.90	0.84	1.74	0.48	Under-exploited	Hastuti et al. (2017)

The estimated Maximum Sustainable Yield (MSY) of *N. marginatus* in both sites is presented in Table 5. The actual production in Pati Regency was estimated to remain below the MSY level of 3.286 tons per year within the sustainably exploited or underexploited stock categories. The actual production in Batang Regency slightly exceeded the estimated MSY of 3.589 tons per year, indicating potential overfishing (Link & Watson 2019).

TABLE 5. MSY estimation.

Location	Production assumption (ton)	Production estimation at MSY (ton)	Economic value at MSY (IDR)
Pati Regency	2.806	3.286	29.574 million
Batang Regency	3.722	3.589	32.302 million

Note: Economic valuation was calculated based on an assumed market price of IDR 9,000 per kilogram.

The estimated economic value of *N. marginatus* production at the MSY level reached IDR 29.574 million per year in Pati Regency and IDR 32.302 million per year in Batang Regency (market price of IDR 9,000 per kilogram). Although the economic value in Batang was higher, the fishing pressure on the stock was also greater, where long-term economic benefits may decline due to the lower stock biomass.

The recruitment season of *N. marginatus* was estimated to occur from February to July and from February to June in Pati Regency. Meanwhile, the recruitment season in Batang Regency occurs in September and November (Fig. 4). In Pati, the recruitment peaked in July (20.3%), while in Batang, the peak recruitment occurred in May (17.5%) with a secondary peak in September (12.4%). It can be inferred that the regeneration of young individuals into the stock occurs twice a year, with the main peak taking place during the first transitional season (March–July).

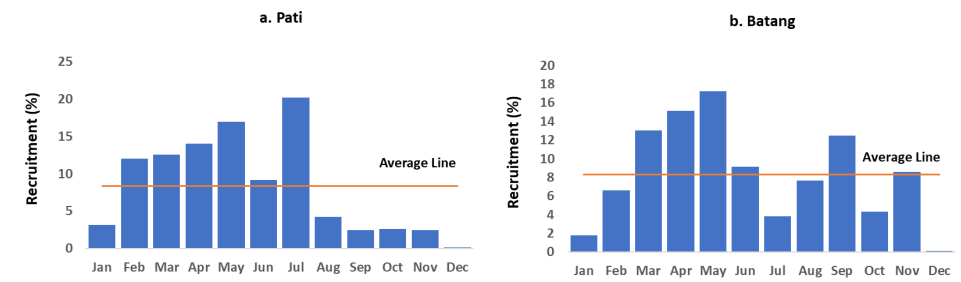


FIGURE 4: Recruitment pattern.

DISCUSSION

This research showed a negative allometric growth pattern in *N. marginatus* as found in by previous researchers in the Java Sea and adjacent waters. Hartanti *et al.* (2017) also noticed a similar pattern for *Nemipterus* spp. in the Java Sea, with a b value of 2.65. Variations in b values may be influenced by environmental factors such as water depth, food availability and physiological conditions of the fish. Intrinsic factors (sex, fishing season and gonadal maturity stage) also affect the length-weight relationship (Ning *et al.* 2011; Huynh *et al.* 2019; Hapsari *et al.* 2023). The negative allometric growth indicates that *N. marginatus* populations in the northern coastal waters of Central Java is categorised normal. However, signs of fishing pressure and benthic habitat degradation were also observed. Therefore, size-based fisheries management and restrictions on fishing effort should be imposed to ensure the sustainable growth of demersal fish stocks (Halim *et al.* 2020; Melnychuk *et al.* 2021).

The comparison between the length at first capture ($L_{C50\%}$) and the length at first maturity ($L_{m50\%}$) reflects population sustainability. $L_{C50\%}$ that is smaller than $L_{m50\%}$ implies that most individuals are caught before they have a chance to reproduce, which can reduce the stock's regenerative capacity. The relatively small $L_{C50\%}$ values observed in this study are likely associated with the use of small-mesh fishing gears such as mini trawls, *arad* and *cantrang*, as well as high fishing intensity in shallow coastal areas (Hartati *et al.* 2017; Sreekanth *et al.* 2017).

Different growth coefficients (K) and mortality rates reflect the variation in fishing pressure. Greater K value in Batang indicates faster growth but a shorter lifespan with greater exploitation intensity. High fishing intensity tends to cause populations to be dominated by smaller individuals (Pauly & Munro 1984; Amorim *et al.* 2020). Furthermore, the E value in Batang Regency reached 0.52 (over-exploitation) and reached $E = 0.43$ in Pati

(within sustainable limits). Likewise, Hartuti *et al.* (2017) and Kindong *et al.* (2018) reported that *Nemipterus* spp. stocks in the Java Sea are under pressure from unselective demersal gears such as trawls.

The analysis of recruitment patterns also revealed distinctive dynamics, with peak in the first transitional season (March–July), when environmental conditions favour increased temperature and primary productivity (Camp *et al.* 2021). The differences in recruitment peaks between Pati and Batang are likely influenced by local variations such as water depth, substrate composition, and fishing intensity (Balachandran *et al.* 2024).

Overall, *N. marginatus* populations in Pati and Batang waters are reaching the threshold of sustainable fishing. Therefore, adaptive management strategies require biotechnical considerations, including the need to set minimum catch size in accordance with L_m , limit the fishing based on recruitment peaks (March–July and September), and set the ideal number of demersal fishing gears. The implementation of a Total Allowable Catch (TAC) near the Maximum Sustainable Yield (MSY) level is recommended to balance economic benefits with stock sustainability in the northern Java coastal region (Harford *et al.* 2018; Retnoningtyas *et al.* 2021; Osathanunkul & Suwannapoom 2023).

CONCLUSION

The length-weight relationship of *N. marginatus* in Pati Regency and Batang Regency are both indicating a negative allometric growth pattern, with $W = 0.134L^{2.157}$ and $W = 0.052L^{2.471}$, respectively. The $L_{C50\%}$ values for Pati and Batang were 11.61 cm and 10.90 cm, respectively. Growth parameter analysis showed that in Pati, *N. marginatus* had $L_\infty = 26.0$ cm, $K = 0.40 \text{ year}^{-1}$, $M = 1.02 \text{ year}^{-1}$, $F = 0.76 \text{ year}^{-1}$, $Z = 1.78 \text{ year}^{-1}$, and $E = 0.43$, indicating a sustainably exploited condition. Whereas in Batang Regency, the $L_\infty = 26.0$ cm, $K = 0.58 \text{ year}^{-1}$, $M = 1.30 \text{ year}^{-1}$, $F = 1.40 \text{ year}^{-1}$, $Z = 2.70 \text{ year}^{-1}$, and $E = 0.52$ (over-exploited). The estimated MSY was 3.286 tons (equivalent to IDR 29.574 million) in Pati and 3.589 tons (equivalent to IDR 32.302 million) in Batang. Recruitment peaks occur from February to July in Pati and from February to June, with additional peaks in September and November, in Batang. *N. marginatus* populations in the northern coastal waters of Central Java are approaching their optimum exploitation level. To ensure long-term sustainability, future studies should be conducted over longer periods (one year or more) and integrate both analytical and surplus production models. Biological and habitat-based research is also needed to determine key parameters such as L_m (length at first maturity), fishing grounds, spawning grounds, nursery grounds and migration routes.

ACKNOWLEDGEMENTS

Gratitude is expressed to the Institute for Research and Community Services (LPPM), Universitas Diponegoro for funding this research under Contract No. 222-646/UN7.D2/PP/IV/2025 (RPIBT scheme). Gratitude is extended to all colleagues and enumerators who contributed to the completion of this study.

AUTHOR'S CONTRIBUTIONS

Dian Wijayanto: Conceptualisation, statistical analysis, writing-review and editing.

Faik Kurohman and Hendrik A. Setyawan: Conceptualisation and review.

Dita J. Kurnia: Writing-review and editing.

All authors have read and agreed to the published version of the manuscript.

REFERENCES

- Ahmad N I, Noh M F F M, Mahiyuddin W R W, Jaafar H, Ishak I, Azmi W N F W A, Veloo Y and Hairi M H. (2015). Mercury levels of marine fish commonly consumed in Peninsular Malaysia. *Environmental Science and Pollution Research* 22: 3672–3686. <https://doi.org/10.1007/s11356-014-3538-8>
- Al-Buwaiqi B, Al-Abdali F S H, Al-Kindi A S M, Ambuali A, Borsa P, Carpenter K E, Russel B and Govender A. (2019). *Nemipterus japonicus*. In *IUCN Red List Threat, Species* 2019: e.T46086928A46664764.
- Amorim P, Sousa P, Jardim E, Azevedo M and Menezes G M. (2020). Length-frequency data approaches to evaluate snapper and grouper fisheries in the Java Sea, Indonesia. *Fisheries Research* 229: 105576. <https://doi.org/10.1016/j.fishres.2020.105576>
- Badrudin, Aisyah and Ernawati T. (2011). Abundance of demersal resources stocks in the waters of the Java Sea sub-region. [Kelimpahan stok sumber daya ikan demersal di perairan sub area Laut Jawa]. *Jurnal Penelitian Perikanan Indonesia* 17(1): 11–21. [in Indonesian].
- Balachandran R, Zacharia P U, Purushottama G B, Sudarsan K S, Shageeque M, Kumar R R, Varghese E, Joseph A, Rahul R, Kishore N, Bright R P, Seetha P K and George G. (2024). Assessing the sustainability of threadfin bream fishery along south-eastern coast of the Arabian Sea: A comprehensive analysis of climate change impact and fishing frontiers. *Regional Studies in Marine Science* 71: 103418. <https://doi.org/10.1016/j.rsma.2024.103418>
- Bhakta D, Das B K, Kamble S P, Solanki S, Solanki J K, Sahoo A K and Samanta S. (2024). Reproductive biology of estuarine migrants *Mugil cephalus* from Narmada estuary, west coast of India. *Regional Studies in Marine Science* 70: 103371. <https://doi.org/10.1016/j.rsma.2024.103371>

- Camp E V, Ahrens R N M, Collins A B and Lorenzen K. (2021). Fish population recruitment 2: Stock recruit relationships and why they matter for stock assessment. FA234. *EDIS* 2021(5). <https://doi.org/10.32473/edis-fa234-2021>
- Detcharoen M, Khrueakaew P, Sukkapat P, Benjakul S and Saetang J. (2024). Metabarcoding for authentication of fish species in surimi-based product by nanopore sequencing. *Food Bioscience* 61: 104628. <https://doi.org/10.1016/j.fbio.2024.104628>
- Dimarchopoulou D, Wibisono E, Saul S, Carvalho P, Nugraha A, Mous P J and Humphries A T. (2023). Combining catch-based indicators suggests overexploitation and poor status of Indonesia's deep demersal fish stocks. *Fisheries Research* 268: 106854. <https://doi.org/10.1016/j.fishres.2023.106854>
- El-Ganainy A A, Khalil M T, El-Bokhty E E E, Saber M A and Abd El-Rahman F A A. (2018). Assessment of three nemipterid stocks based on trawl surveys in the Gulf of Suez, Red Sea. *Egyptian Journal of Aquatic Research* 22: 45–49. <https://doi.org/10.1016/j.ejar.2018.02.005>
- El-Sikaily. (2024). Biomarkers in aquatic system: Advancements, applications and future directions. *Egypt Journal of Aquatic and Research* 20: 169–182. <https://doi.org/10.1016/j.ejar.05.002>
- Ernawati T, Boer M, Kamal M M, Butet N A, Satria F and Perdanahardja G H. (2024). Length-based stock assessment for Malabar blood snapper in Makassar Strait, Indonesia: Status and recommendation for sustainability. *Regional Studies in Marine Science* 73: 103485. <https://doi.org/10.1016/j.rsma.2024.103485>
- FAO. (1998). *FAO-ICLARM Stock Assessment Tools II (FiSAT II). Reference manual. FAO Computerized Information Series (Fisheries), No. 8.*
- Froese R and Pauly D. (Eds). 2019. FishBase, version 05/2019. World Wide Web electronic publication. www.fishbase.org
- Froese R and Pauly D. (Eds.). (2025). FishBase *Nemipterus marginatus* species summary. (accessed on 15 October 2025)
- Gao Y L, Yoshida A, Liu J Y, Yuan J, Maeda S, Wang Y, Jiang Y R, Sun X M, Chen C P and Wang Y. (2024). Quality improvement of threadfin bream (*Nemipterus virgatus*) surimi gel using soy protein as a natural food additive. *Food Chemistry* 460: 140423. <https://doi.org/10.1016/j.foodchem.2024.140423>
- Gayanilo F C Jr, Sparre P and Pauly D. (2005). *FAO-ICLARM Stock Assessment Tools (FiSAT II): User's guide (ver. 1.0). FAO Computerized Information Series (Fisheries), No. 8.*
- Gilman E, Chaloupka M, Dagorn L, Hall M, Hobday A, Musyl M, Pitcher T, Poisson F, Restrepo V and Suuronen P. (2019). Robbing Peter to pay Paul: Replacing unintended cross-taxa conflict with intentional tradeoffs by moving from piecemeal to integrated fisheries bycatch management. *Reviews Fish Biology Fisheries* 29: 93–123. <https://doi.org/10.1007/s11160-019-09547-1>
- Goethel D R, Lucey S M, Berger A M, Giachas S K, Karp M A, Lynch P D and Walter III J F. (2019). Recent advances in management strategy evaluation: Introduction to the species issue "Under pressure: Addressing fisheries challenges with management strategy evaluation. *Canada Journal of Fisheries & Aquatic Science* 76: 1689–1969. <https://doi.org/10.1139/cjfas-2019-0084>
- Grgec S A, Kljakovic-Gaspic Z, Orct T, Ticina V, Sekovanic A, Jurasovic J and Piasek M. (2020). Mercury and selenium in fish from the eastern part of the Adriatic Sea: A risk-benefit assessment in vulnerable population groups. *Chemosphere* 261: 1–9. <https://doi.org/10.1016/j.chemosphere.2020.127742>

- Gulland J A. (1965). Estimation of mortality rates. In P H Cushing (ed.), *Key papers on fish populations*. 231–241.
- Gulland J A. (1983). *Fish stock assessment: A manual of basic methods*. FAO/Wiley Series on Food and Agriculture. Chichester: John Wiley & Sons.
- Halim A, Loneragan N R, Wiryawan B, Horduk A R, Sondita M F A and Yulianto I. (2020). Evaluating data-limited fisheries for grouper (*Serranidae*) and snapper (*Lutjanidae*) in the coral triangle, eastern Indonesia. *Regional Studies in Marine Science* 38: 101388. <https://doi.org/10.1016/j.rsma.2020.101388>
- Hapsari A D, Zairion, Kamal M M, Kosasih G and Saputra A. (2023). Population dynamic parameters and length based spawning potential ratio (LB-SPR) of red snapper (*Lutjanus malabaricus*) in the eastern Java Sea. *IOP Conference Series: Earth Environmental Science* 1137(1): 012062. <https://doi.org/10.1088/1755-1315/1137/1/012062>
- Harford W J, Sagarese S R and Karnauskar M. (2018). Coping with information gaps in stock productivity for rebuilding and achieving maximum sustainable yield for grouper-snapper fisheries. *Fish and Fisheries* 20(2): 303–321. <https://doi.org/10.1111/faf.12344>
- Hartati K S, Yonvitner and Boer M. (2017). Indicators parameters population for the management of threadfin bream (*Nemipterus* spp.) in the inshore Java Sea, Indonesia. *International Journal of Sciences: Basic and Applied Research* 32(3): 35–51.
- He P, Chopin F, Surronen P, Ferro R S T and Lansley J. (2021). Classification and illustrated definition of fishing gears. *FAO Fisheries and Aquaculture Technical Paper No. 672*. Rome: FAO. <https://doi.org/10.4060/cb4966en>
- Herwaty S, Mallawa A and Zainuddin M. (2023). Age, growth, mortality, and population characteristics of the red snapper (*Lutjanus malabaricus*) in the Timor Sea waters, Indonesia. *Biodiversitas* 24(4): 2217–2224. <https://doi.org/10.13057/biodiv/d240434>
- Hong X, Zhang K, Li J, Xu Y, Sun M, Xu S, Cai Y, Qiu Y and Chen Z. (2024). Stock assessment of the commercial small pelagic fishes in the Beibu Gulf, the South China Sea, 2006–2020. *Biology* 13(4): 226. <https://doi.org/10.3390/biology13040226>
- Huynh G C, Cummings N J and Hoenig J M. (2019). Comparisons of mean length-based mortalit estimators and age-structured models for six southeastern US stocks. *ICES Journal of Marine Science* 77(1): 162–173. <https://doi.org/10.1093/icesjms/fsz191.fsz191>
- Ismaili A, Sabrina, Sachinandan and Dutta. (2023). Ecosystem characteristics and trophic model of the artificial reef ecosystem in the Sea of Oman, Sultanate of Oman. *Sustainability* 15(24): 16574. <https://doi.org/10.3390/su152416574>
- Kindong R, Zhu J, Dai Z and Tian S. (2018). Life history parameters and yield per recruit analysis for *Tachysurus nitidus* and *Plagiognathops microlepis* in Lake Dianshan and their management implications. *Turkish Journal of Fisheries and Aquatic Sciences* 19(12): 1025–1038. http://doi.org/10.4194/1303-2712-v19_12_05
- King M. (2007). *Fisheries biology, assessment and management*, 2nd ed.. Blackwell Publishing.
- Link J S and Watson R A. (2019). Global ecosystem overfishing: Clear delineation within real limits to production. *Science Advances* 5(6): eaav0474. <https://doi.org/10.1126/sciadv.aav0474>

- Lisamy S E A, Simanjuntak C P H, Ervinia A, Romdoni T A, Munandar A, Nurfaiah S and Guarte D M. (2023). Reproductive aspects of the Japanese threadfin bream, *Nemipterus japonicus* (Bloch, 1791) in the Southern Java waters (FMA-RI 573). *E3S Web of Conferences* 442: 01025. <https://doi.org/10.1051/e3sconf/202344201025>
- Mahmoud M A and Ibrahim M M. (2024). Osteogenic sarcomas in two fish species giant sea catfish (*Arius thalassinus*), and Delagoa threadfin bream (*Nemipterus bipunctatus*) caught from Saudi Arabia, the Arabian Gulf. *Tissue and Cell* 21: 102629. <https://doi.org/10.1016/j.tice.2024.102629>
- Melnychuk M C, Kurota H, Mace P M, Pons M, Minto C, Osio G C, Jensen O P, de Moor C L, Parma A M, Little L R, et al. (2021). Identifying management actions that promote sustainable fisheries. *Nature Sustainability* 4: 440–449. <https://doi.org/10.1038/s41893-020-00668-1>
- Murugesan S, Buamard N, Zhou A, Zhao Y, Zhang B and Benjakul S. (2025). Improvement of gelling properties of surimi from threadfin bream (*Nemipterus* spp.) using saponin. *Applied Food Research* 5: 101318. <https://doi.org/10.1016/j.afres.2025.101318>
- Ning P, Wu R and Liu J. (2011). First record of red filament threadfin bream, *Nemipterus marginatus* (Valenciennes, 1830) (*Perciformes, Nemipteridae*), from Chinese waters. *Chinese Journal of Oceanology and Limnology* 29: 1306–1308. <https://doi.org/10.1007/s00343-011-0312-3>
- Nugroho K C, Zulfainarni N, Asikin Z, Budijanto S and Marimin M. (2025). A sustainability analysis of the small demersal fish used in the surimi industry in Indonesia using the length-based spawning potential ratio. *Sustainability* 17(11): 4827. <https://doi.org/10.3390/su17114827>
- Osathanunkul M and Suwannapoom C. (2023). Sustainable fisheries management through reliable restocking and stock enhancement evaluation with environmental DNA. *Scientific Reports* 13(11297): 11297. <https://doi.org/10.1038/s41598-023-38218-2>
- Pauly D and Martosubroto P. (1980). The population dynamics of *Nemipterus marginatus* (Cuvier & Val.) off Western Kalimantan, South China Sea. *Journal of Fish Biology* 17(3): 263–273.
- Pauly D and Munro J L. (1984). Once more on the comparison of growth in fish and invertebrates. *Fishbyte* 2(1): 21–23.
- Paul M, Hajisamae S, Pradit S, Perngmark P and Islam R. (2018). Trophic ecology of eight sympatric nemipterid fishes (*Nemipteridae*) in the lower part of the South China Sea. *Turkish Journal of Fisheries and Aquatic Sciences* 18: 277–287. https://doi.org/10.4194/1303-2712-v18_2_07
- Peltonen H and Weigel B. (2022). Responses of coastal fishery resources to rapid environmental changes. *Journal of Fish Biology* 101(3): 686–698. <https://doi.org/10.1111/jfb.15138>
- Ren Q and Liu M. (2020). Assessing north-west pacific fishery stocks using two new methods: The monte carlo catch-MSY (CMSY) and the Bayesian Schaefer model (BSM). *Frontiers Marine Science* 7: 430. <https://doi.org/10.3389/fmars.2020.00430>
- Retnoningtyas H, Yulianto I, Soemodinoto A, Herdiana Y, Kartawijaya T, Natsir M and Haryanto J T. (2021). Stakeholder participation in management planning for grouper and snapper fisheries in West Nusa Tenggara Province, Indonesia. *Marine Policy* 128: 104452. <https://doi.org/10.1016/j.marpol.2021.104452>
- Ritonga I R, Bureekul S, Ubonyaem T, Chanrachkij I and Sompongchaiyakul P. (2022). Mercury content and consumption risk of 8 species threadfin bream (*Nemipterus* spp.) caught along the Gulf of Thailand. *Marine Pollution Bulletin* 175: 113363. <https://doi.org/10.1016/j.marpolbul.2022.113363>

- Riza A H A, Wijayanto D, Hapsari T D, Kurohman F and Setyawan H A. (2026). Stock assessment of yellowtail fusilier in the Karimunjawa Islands, Indonesia. *AACL Bioflux* 19(1): 140–149.
- Russell B C. (1990). FAO species catalogue. Vol. 12. *Nemipterid* fishes of the world (Threadfin breams, whiptail breams, monocle breams, dwarf monocle breams, and coral breams). *FAO Fisheries Synopsis* 125(12). Rome: FAO.
- Sarr O, Kindong R, Sow F N and Tian S. (2023). Estimation of Atlantic bonito (*Sarda sarda*) stock status in the Senegalese Exclusive Economic Zone (EEZ) from the catch-based model (CMSY) and length-based Bayesian estimation (LBB) method. *Regional Studies in Marine Science* 65: 103052. <https://doi.org/10.1016/j.rsma.2023.103052>
- Schwermer H, Barz F and Zablotzki Y. (2020). A literature review on stakeholder participation in coastal and marine fisheries. In S Jungblut, V Liebich and M Bode-Dalby. (eds.), *YOURMARES 9 – The Oceans, our future*. Springer. https://doi.org/10.1007/978-3-030-20389-4_2
- Shafeeque M, George G, Akash S, Smitha B R, Shah P, and Balchand A N. (2021). Internannual variability of chlorophyll-a and impact of extreme climatic events in the southeastern Arabian Sea. *Regional Studies in Marine Science* 48: 101986. <https://doi.org/10.1016/j.rsma.2021.101986>
- Sparre P and Venema S C. (1998). *Introduction to tropical fish stock assessment. Part 1: Manual* (FAO Fisheries Technical Paper No. 306/1, Rev. 2, pp. 107–153). Rome: FAO.
- Sreekanth G B, Chakraborty S K and Jaiswar A K. (2017). Stock structure analysis of Japanese threadfin bream, *Nemipterus japonicus* (Bloch, 1791) along the Indian coast based on trust network analysis. *Indian Journal of Geo Marine Sciences* 46(9).
- Sululu J S, Ndaro S G and Kangwe S J. (2017). The food and feeding habits of the Delagoa threadfin bream, *Nemipterus bipunctatus* (Valenciennes, 1830), from the coastal waters around Dar es Salaam, Tanzania. *Western Indian Ocean Journal of Marine Science* 16(1): 13–23. <https://doi.org/10.4314/wiojms.v16i1>
- Taurusman A A, Syah Y M and Fauzi A. (2025). Impacts of cantrang (boat Danish seine) on fish resources in the Java Sea. *Fisheries and Aquatic Sciences* e30: 1–13. <https://doi.org/10.47853/FAS.2025.e30>
- Thao H N, Thu T T, Ha L T, Ly N T and Hong D T. (2022). Distribution of *Nemipterus marginatus* (Valenciennes, 1830) (*Nemipteridae*, *Perciformes*) in the estuary and coastal areas of North Central, Vietnam. *Check List* 18(5): 1127–1130. <https://doi.org/10.15560/18.5.1127>
- Tirtadanu, Prihatiningsih, Yusuf H N, Zamroni A, Amri K and Chodrijah U. (2023). Assessing the stock status of areolate grouper (*Epinephelus areolatus*) in Java Sea, Indonesia. *Regional Studies in Marine Science* 66: 103116. <https://doi.org/10.1016/j.rsma.2023.103116>
- Tonnie N, Abu Hena M K, Idris M H, Rajaei A H, Amin S M N and Nesarul M H. (2018). Food and feeding habits of *Nemipterus japonicus* and *Nemipterus peronii* from coastal water on Bintulu Sarawak, South China Sea. *Journal of Environmental Biology* 39: 857–864. [http://doi.org/10.22438/jeb/39/5\(SI\)/10](http://doi.org/10.22438/jeb/39/5(SI)/10)
- Vaisakh G, Chakraborty S K, Jaiswar A K, Sibina Mol S, Renjith R K, Sreekanth G B and Stock. (2019). Structure analysis of *Nemipterus bipunctatus* (Valenciennes, 1830) from three locations along the Indian coastal. *Indian Journal of Geology and Marine Science* 48(12): 1888–1895.

- Wang K, Zhang C, Xu B, Xue Y and Ren Y. (2020). Selecting optimal bin size to account for growth variability in Electronic Length Frequency Analysis (ELEFAN). *Fisheries Research* 225: 105474. <https://doi.org/10.1016/j.fishres.2019.105474>
- Wibisono E, Mous P, Firmana E and Humphries A. (2022). A crew-operated data recording system for length-based stock assessment of Indonesia's deep demersal fisheries. *PLoS One* 17(2): e0263646. <https://doi.org/10.1371/journal.pone.0263646>
- Wijayanto D, Kurohman F, Wibowo B A, Dewi D A N N, Aprijanto, Irfani M and Santosa M A. (2025). The exploitation status of white-streaked grouper (*Epinephelus ongus*) in Karimunjawa waters. *AACL Bioflux* 18(2): 744–752.
- Williams A J, Loeun K, Nicol S J, Chavance P, Ducrocq M, Harley S J, Pilling G M, Allain V, Mellin C and Bradshaw C J A. (2013). Population biology and vulnerability to fishing of deep-water Eteline snapper. *Journal of Applied Ichthyology* 29(2): 395–403. <https://doi.org/10.1111/jai.12123>
- Zhang K, Li M, Li J, Sun M, Xu Y, Cai Y, Chen Z and Qiu Y. (2022a). Climate-induced small pelagic fish blooms in an overexploited marine ecosystem of the South China Sea. *Ecological Indicators* 145: 109598. <https://doi.org/10.1016/j.ecolind.2022.109598>
- Zhang K, Geng P, Li J, Xu Y, Kalhor M A, Sun M, Shi D and Chen Z. (2022b). Influences of fisheries management measures on biological characteristics of threadfin bream (*Nemipterus virgatus*) in the Beibu Gulf, South China Sea. *Acta Oceanologica Sinica* 41: 24–33. <https://doi.org/10.1007/s13131-021-1925-9>