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Short Communication

DIVERSITY, MORPHOMETRY, AND POPULATION ABUNDANCE OF SEA URCHIN (*Tripneustes gratilla*) IN NORTH LOMBOK

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ARTICLE HIGLIGHTS

- The highest absolute abundance of sea urchin *Tripneustes gratilla* was observed in August 2023
- In 2024, the low absolute abundance of *Tripneustes gratilla* and the decline of sea urchin species diversity in North Lombok prospectively indicated overharvesting.
- The number of gleaners and the gleaning activity conducted by local villagers prospectively harm seagrass meadows, especially on *Tripneustes gratilla* abundance

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ABSTRACT

Sea urchin *Tripneustes gratilla* is commonly found in tropical shallow water-seagrass beds and is consumed for its roe in Southeast Asia. This study recorded five sea urchin species in the study area: *Tripneustes gratilla*, *Pseudoboletia maculata, Salmacis bicolor, Salmacis sphaeroides,* and *Maretia planulata,* with *T. gratilla* being the most abundant. The highest absolute abundance of *T. gratilla* was observed in August 2023, at 0.30 ind./m^2, while from May to July 2024, it declined to 0.02 ind./m^2. The mean diameters of *T. gratilla* ranged from 37.59 mm to 44.16 mm between August and October 2023 and from 17.39 mm to 48.45 mm between May and July 2024, having wide range of the mean weight. In September 2023, sea urchin with a test diameter of 35.0 – 39.9 mm were the most frequent to be found. This study provided baseline data on *T. gratilla* harvested from the seagrass habitat by the local community in North Lombok and highlights the potential for overharvesting in the area.

Keywords: North Lombok, overharvesting, seagrass, sea urchin, *Tripneustes gratilla*

INTRODUCTION

Tripneustes gratilla is a ubiquitous sea urchin in tropical seagrass beds, which can occupy various shallow water habitats, from sand flats, coral reefs, and coral rubble areas to seagrass beds and macroalgal flats (Lawrence & Agatsuma 2007; Toha *et al.* 2017). *T. gratilla* is an opportunistic herbivore, consuming its favorite seagrass, macroalgae, and microalgae species, while avoiding calcareous algae due to its tough cell wall (Lawrence & Agatsuma 2007; Lison de Loma *et al.* 2002).

In Southeast Asia (the Philippines, Malaysia, Vietnam, and Indonesia), the locals harvest and consume *Tripneustes gratilla* roe as a local delicacy (Regalado *et al.* 2010; Rahim & Nurhasan 2016; Hoa *et al.* 2019; Satyawan 2014). The people in East Lombok have a tradition of harvesting biota from seagrass beds, including sea urchin *T. gratilla*, during low tide events (Satyawan 2014). Overharvesting, especially in seagrass beds close to local villagers' residences, resulted in reduced sea urchin density and small test-diameter size (Nane & Paramata 2020). This research aimed to record the diversity, morphometry, abundance, and habitat type of sea urchins in North Lombok coastal areas and record the gleaning activity conducted by local villagers in sea urchin habitats. This research also indicated overharvesting by local villagers of North Lombok. In addition, this study provided valuable baseline information for monitoring the sea urchin population in North Lombok.

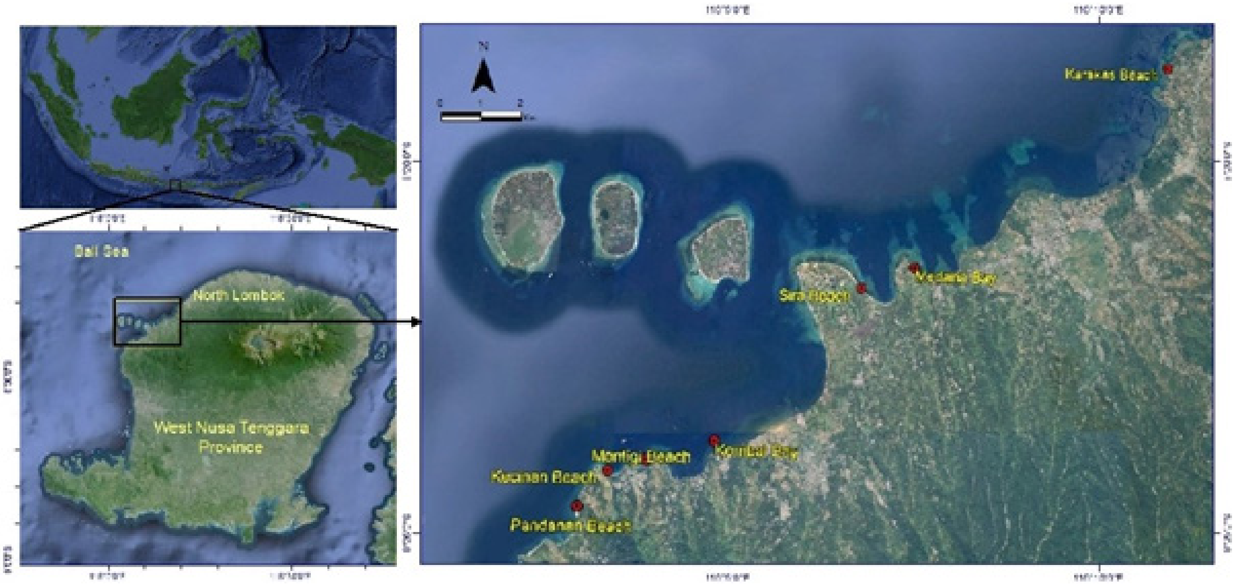

Figure 1 Location of sea urchin sampling sites in North Lombok Regency

MATERIALS AND METHODS

Study Locations

This study was conducted from August 2023 to July 2024 on seagrass beds in Kombal Bay (8°24’00.2” S; 116°04’52.6” E), Pemenang Subdistrict, North Lombok Regency, West Nusa Tenggara, Indonesia. Five additional sampling sites that represented three subdistricts were selected to obtain the general status of sea urchins in various types of habitats in the North Lombok Regency coastal area. The sampling sites were Pandanan Beach, Kecinan Beach, and Mentigi Beach in Pemenang Subdistrict, representing coral reefs and small seagrass meadows; Sira Beach and Medana Bay in Tanjung Subdistrict, representing vast seagrass meadows; and Karakas Beach in Gangga Subdistrict, representing coral reefs (Fig. 1).

Specimen Collection and Species Identification

Sampling was conducted during low tide when sea urchins and bottom substrate were exposed, allowing better observation (Fairoz *et al.* 2018). The sea urchin was transferred to Kurnaen Sumadiharga Science Park, Kombal Bay, and kept within a recirculation system supplied with sand-filtered seawater. The sea urchin was kept overnight, and morphometric measurement was taken the following day following the method by Chang-Po and Kun Hsiung (1981). Each sea urchin was removed from the water and placed on a towel to dry. Total weight was measured using an electronic balance (accuracy 0.01 g), while test diameter and test height were measured using a digital caliper (accuracy 0.1 mm). Species identification was conducted based on available literature (Barrett *et al.* 2019; Colin & Arneson 1995; Nomleni *et al.* 2020; Parvez *et al.* 2016; Walag *et al.* 2018).

After morphometric measurement and species identification, all samples of sea urchin were returned to the original seagrass habitats where they were collected. The type of animals and plants collected by local villagers for gleaning purposes was also recorded and identified based on Colin and Arneson (1995) and Titlyanov (2017). In addition, the mean test diameter of sea urchins collected by gleaners was measured in situ. The sea urchin sample was collected using two sampling methods, i.e., belt transect and wandering transect methods. Additionally, quadrat transect was used to determine seagrass percentage coverage.

Belt Transect

The belt transect method used two 50 x 1 m transects to measure sea urchin density per 100 m^2 (Fig. 2) (Regalado *et al.* 2010; Nane & Paramata 2020). Small-size quadrat transects (1 - 2 m) are the best sampling method to estimate sea urchin abundance (Micael *et al.* 2021). The transects were set perpendicular to the shoreline. The number of sea urchins inside the transect was recorded and captured.

Figure 2 Specimen collection method

Notes: A) Belt transect; B) Wandering transect; C) Quadrat Transect.

Wandering Transect

The wandering transect method was implemented to survey a larger area (Pinn *et al.* 2014; Fairoz *et al.* 2018). The wandering transect was performed by walking from the shore and crossing each habitat type perpendicular to the shoreline. After reaching the edge, the observer moved 2 m to the right and started another observation walk, headed to the shoreline (Fig. 2). This zig-zag wandering pattern was resumed until a certain time limit was reached. For vast and dense seagrass meadows, the wandering transect was terminated in 60 minutes, while for other habitat types, the wandering transect was completed in 30 minutes. The observation area was limited to 1 m to the left and the right of the observer. Sea urchin located inside the area was recorded and captured. A 60-minute wandering transect in dense seagrass meadows was estimated to cover 1,680 m^2 area, while a 30-minute wandering transect in other habitat type could cover 1,400 m^2. The total area of seagrass meadows, coral reefs, and wandering transect coverage area were recorded using Global Positioning System (GPS) and estimated by Google Earth Engine (GEE).

Quadrat Transect

Determination of seagrass percentage coverage was carried out in Kombal Bay, Sira Beach and Medana Bay, using quadrat transect method (Fig. 2) (McKenzie *et al.* 2003; Rahmawati *et al.* 2017). Two transect lines, each 100 m, were laid perpendicular to the seashore. The distance between each transect line was 50 m. Quadrat shape frame (50 x 50 cm) was placed at the right side of the transect. The interval between each quadrat placement was 10 m. Seagrass percentage coverage category was estimated according to Mackenzie (2003).

Statistical Analysis

Absolute abundance and relative abundance were calculated based on the following formulas:

$$\text{Absolute abundance} = \frac{\sum \text{individual number(ind.)}}{\text{survey area (m}^2\text{)}}$$

$$\text{Relative abundance} = \frac{\text{number of individuals of same species}}{\text{total number of individuals of all species}} \times 100$$

Morphometric parameters were subjected to statistical analysis to determine the difference in each sampling date. The nonparametric Kruskal-Wallis Test with post-hoc analysis was conducted on mean weight, mean test height, and mean test diameter datasets because normal distribution and equal variance were not obtained. Statistical analyses were performed using IBM Statistic SPSS 26. A significant difference between each morphometric parameter is recognized if $P > 0.05$.

RESULTS AND DISCUSSION

A total of 5 sea urchin species were recorded from seagrass beds of Kombal Bay, Pemenang Subdistrict (Table 1).

T. gratilla and *Pseudoboletia maculata* were included in family Toxopneustidae, while *Salmacis bicolor* and S. sphaeroides were included in the family Temnopleuridae, and *Maretia planulata* were included in the family Maretiidae (Fig. 3).

T. gratilla was the most abundant species in 2023, with an absolute abundance of 0.24 - 0.30 ind./m^2 and a relative abundance of 95.6 - 100%. The absolute abundance in this study is higher compared to the absolute abundance recorded in Eastern Lombok, Indonesia (0.01 - 0.04 ind./m^2) and Maluku, Indonesia (0.008 ind./m^2) (Satyawan 2014; Uneputty *et al.* 2017). However, the absolute abundance recorded in this study is lower compared to the absolute abundance recorded in South-Eastern Sulawesi, Indonesia (2.7 - 10.0 ind./m^2) (Nane & Paramata 2020). The relative abundance obtained in this study is higher than that recorded in Borneo, Malaysia (0.34 - 2.51%) (Rahim & Nurhasan 2016). In regard to abundance, *T. gratilla* dominated the sea urchin assemblage in the seagrass beds of Teluk Kombal. Seagrass beds provide microhabitats for *T. gratilla* to graze and hide from predators (Du *et al.* 2020).

In 2024, the absolute abundance of *T. gratilla* dropped to 0.01 ind./m^2 (Table 1). Only 1 or 2 sea urchins were recorded in a 100 m^2 area of seagrass beds between May 2024 and July 2024. The diversity of sea urchin species also decreased from 4 species in 2023 to only 2 species in 2024. In the absence of P. maculata, S. bicolor, and S. sphaeroides and the abrupt decrease of *T. gratilla* abundance, the abundance of sand dollar M. planulata increased rapidly. The inferior sand dollar now thrives on the scarcely populated seagrass meadow. In the absence of dominant sea urchin species, inferior species can occupy territories outside of their original niche (Steneck 2013).

Mean weight, mean test diameter, and mean test height were not significantly different ($P > 0.05$) when sampling was conducted with the belt transect method. In contrast, sampling with the wandering transect method showed a significant difference ($P < 0.05$) in all morphometric parameters (Table 2).

Table 1 Absolute and relative abundance of sea urchins in Kombal Bay measured by belt transect and wandering transect

Species	Belt transect					
	Absolute abundance (ind./m^2)					
	Aug. 2023	**Sep. 2023**	**Oct. 2023**	**May 2024**	**Jun. 2024**	**Jul. 2024**
T. gratilla	0.30	0.25	0.24	0.01	0.01	0.02
P. maculata	-	0.01	-	-	-	
M. planulata	-	-	-	-	0.02	0.05
Total sea urchin	**30**	**26**	**24**	**1**	**3**	**7**
			Wandering transect			
			Relative abundance (%)			
T. gratilla	95.6	97.9	100.0	100.0	100.0	100.0
P. maculata	2.2	2.1	-	-	-	-
S. bicolor	1.1	-	-	-	-	-
S. sphaeroides	1.1	-	-	-	-	-
Total sea urchin	**90**	**96**	**23**	**11**	**8**	**2**

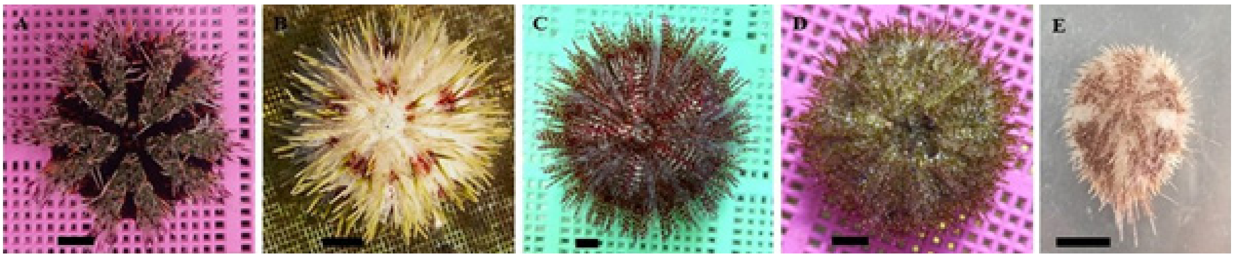

Figure 3 Sea urchin from seagrass beds in Kombal Bay, North Lombok
Notes: A) *T. gratilla*; B) *P. maculate*; C) *S. bicolor*; D) *S. sphaeroides*; E) *M. planulata*; scale bar = 10 mm.

Table 2 Morphometric parameters of *T. gratilla* collected using belt transect and wandering transect methods

Sampling Method	Sampling Date	Mean Weight (g)	Mean Test Diameter (mm)	Mean Test Height (mm)	Total Sea Urchin
Belt transect	August 2023	37.59 ± 2.63^a	44.44 ± 1.21^a	26.53 ± 0.85^a	30
	September 2023	39.09 ± 3.94^a	44.09 ± 1.71^a	25.82 ± 1.06^a	25
	October 2023	44.16 ± 2.31^a	47.42 ± 0.83^a	26.97 ± 0.51^a	24
	May 2024	48.45	48.50	30.30	1
	June 2024	9.62	25.80	15.70	1
	July 2024	17.39 ± 7.05	33.5 ± 4.70	19.7 ± 2.00	2
Wandering transect	August 2023	34.14 ± 1.93^x	42.76 ± 1.01^y	24.57 ± 0.58^y	86
	September 2023	28.50 ± 1.46^x	39.99 ± 0.68^x	22.83 ± 0.39^x	94
	October 2023	49.60 ± 2.75^y	48.58 ± 0.94^z	27.52 ± 0.64^z	23
	May 2024	69.87 ± 9.66	53.28 ± 2.98	32.22 ± 1.89	11
	June 2024	72.07 ± 12.11	54.53 ± 4.38	32.88 ± 2.84	8
	July 2024	110.74 ± 9.58	64.35 ± 3.05	37.20 ± 1.00	2

Each survey method has its advantages and drawbacks. The belt transect method provided absolute abundance data but was time-consuming, requiring transects and collecting fewer samples. Wandering transects collected more samples, surveyed vast areas in less time, and required no transects but needed more absolute abundance data and may have overlooked smaller sea urchins.

From August to October 2023, the mean weight, mean test diameter, and mean test height increased significantly, from 34.14 to 49.60 g, from 42.76 to 48.58 mm, and from 24.57 to 27.52 mm, respectively. However, the total sea urchins collected in October 2023 was nearly three times smaller compared to the August 2023 data.

Surveys conducted in May, June, and July 2024 recorded sea urchins with bigger mean weight, mean test diameter, and mean test height compared to the surveys conducted in August, September, and October 2023. However, the total number of *T. gratilla* in each survey conducted in 2024 was extremely low compared to the previous year. The considerable weight and size differences can be attributed to seasonal variation (Juinio-Menez *et al.* 2008; Satyawan 2014) or intraspecific competition (Narvaez *et al.* 2020). The location of sea urchins in seagrass meadows is also a contributing factor. Compared to the more accessible and highly exploited area, invertebrates, including *T. gratilla*, were more prevalent in the inaccessible or remote seagrass meadows (Nordlund 2010). Based on personal observation, seagrass meadows fringes areas were often overlooked by local villagers, and the majority of sea urchin was found in the area.

Morphometric data are an essential tool in assessing sea urchin population health and sustainability. Food availability (Smith & Garcia 2020), grazing zones, and domestic pollution (Caill-Milly *et al.* 2020) affected sea urchin morphometrics. Likewise, sea urchin morphometric data and abundance may be indicative of overharvesting (Tamti *et al.* 2021) or underexploited (Guinda *et al.* 2016).

The shift of relative abundance in the test diameter class highlighted the decrease of weight and size. In August 2023, the 45.0 - 49.9 mm test diameter class had the highest relative abundance compared to other classes (Fig. 4), but in September 2023, the highest relative abundance shifted to the 35.0 - 39.9 mm test diameter class, two size classes smaller. Local villagers avoided small sea urchins because of the limited amount of roe. The mean test diameter size harvested by local people in September 2023 was 52.08 ± 1.48 mm, while the mean test diameter size ranged from 48.2 - 55.9 mm. There were reductions in the frequency of size classes 45.0-49.9, 50.0-54.9, and 55.0-59.9 by 40.7%, 56.2%, and 100%, respectively (Fig. 4).

The size classes were within the range of sea urchin size that local villagers catch (personal observation; Satyawan 2012). The bigger diameter class experienced a greater reduction in frequency. During two sampling days, at least 2 local people harvested *T. gratilla*. Each person collected 100 - 110 sea urchins, mostly *T. gratilla*. Two size classes that contained more subjects in September 2023 disappeared in 2024. Only two size classes, each containing only one subject, were recorded in July 2024. The disappearance could be due to death of age or ecological factors.

In the wild, *T. gratilla* life expectancy was estimated to be between one and two years (Tanita *et al.* 2023). Overfishing resulted in the absence of larger size classes in Sulawesi (Nane & Paramata 2020). In East Lombok, T gratilla reached sexual maturation after 1.2 years or after reaching test diameter size of 58.2 mm (Satyawan 2012). There were only 2 sea urchins that reached the sexual maturation size in 2024.

Harvesting sea urchins from the wild population usually target subjects with larger test sizes due to higher roe yield. Harvesting activity resulted in the change of size-frequency distribution and the total number of subjects compared to the undisturbed population (Bertocci *et al.* 2014).

Additional surveys were conducted from May 2024 to July 2024 in Kombal Bay and other selected locations to compare the *T. gratilla* population status in North Lombok and to observe gleaning activities conducted by local villagers. In general, *T. gratilla* abundance in each location was extremely low compared to that in Maluku (Tuapattinaja *et al.* 2014) and in the Philippines (Juinio-Menez *et al.* 2008).

In North Lombok, the highest *T. gratilla* abundance was recorded in the dense seagrass meadow of Sira Beach, Tanjung, and in the coral reefs of Karakas Beach, Gangga, while the lowest abundance was recorded in Kecinan Beach, Mentigi Beach, and Medana Bay (Table 3).

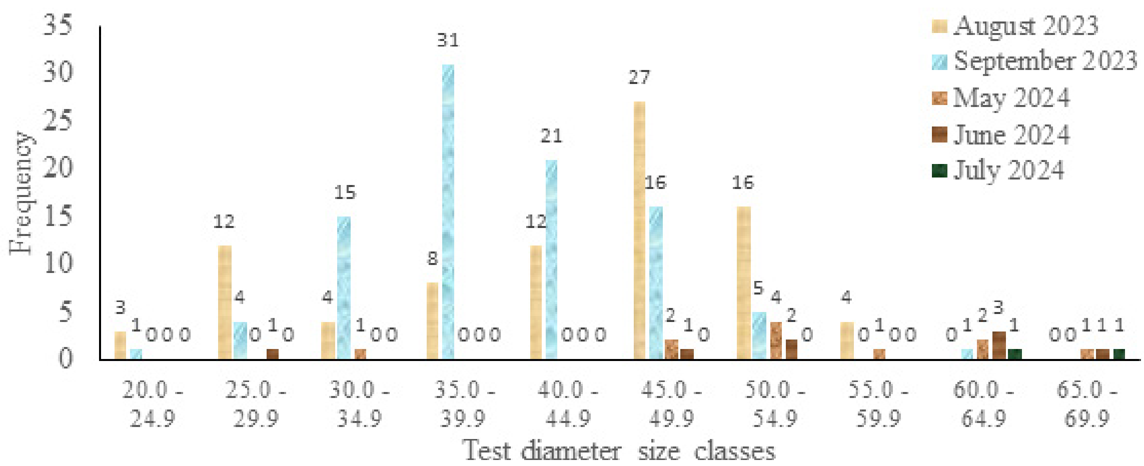

Figure 4 Frequency of each test diameter class collected by wandering transect

Table 3 Sea urchin (*T. gratilla*) abundance in North Lombok

Subdistrict	Site Name	Total Area (m^2)	Wandering Transect Area (m^2)	Total Subject Number	Substrate Type
Pemenang	Pandanan Beach	15,143	1,400	1	Coral, macroalgae, sandy
	Kecinan Beach	11,573	1,400	0	Coral rubble, sandy, seagrass, macroalgae
	Mentigi Beach	7,490	1,400	0	Coral rubble, sandy, seagrass, macroalgae,
	Kombal Bay	40,610	1,680	2	Seagrass, macroalgae, coral rubble, muddy
Tanjung	Sira Beach	50,380	1,680	7	Seagrass, macroalgae, coral rubble, muddy
	Medana Bay	56,806	1,680	0	Seagrass, macroalgae, coral rubble, muddy
Gangga	Karakas Beach	10,609	1,400	6	Coral, dead coral algae, macroalgae, sandy

The total area, habitat type, and substrate type of Kombal Bay, Sira Beach, and Medana Bay were roughly similar. Kombal Bay had the lowest seagrass cover (47.0%) compared to that in Medana Bay (75.0%) and Sira Beach (80.9%) based on quadrat transect. The low abundance of sea urchins in Sira Beach, Kombal Bay, and Medana Bay was concerning. In Pacitan Beach, East Java, *T. gratilla* was ubiquitous in seagrass meadows with an absolute abundance of 0.07 ind/m^2, despite moderate seagrass percentage coverage of 31.44% (Muzaki 2019).

Gleaning is a common activity conducted by local villagers during the low tide period, especially in the villages close to seagrass meadows and shallow coral reefs. The duration of gleaning activity was affected by several factors. Gleaning activity usually lasted 1 - 2 hours and finished after the exposed seagrass meadows were inundated or before sunset (personal observation).

In this study, we observed that Medana Bay was the most favorite gleaning location, followed by Kombal Bay and Sira Beach. Most of the gleaner was adult female, except in Kombal Bay and Kecinan Beach. The majority of gleaners collected gastropods, while adult females also collected *Gracilaria* sp. as a secondary catch (Table 4). The main purpose for gleaning was collecting food material for home consumption.

Table 4 Gleaner composition and type of animals or plants collected by gleaners

Subdistrict	Site Name	Number of Adult Female as Gleaner	Number of Adult Male as Gleaner	Number of Young Child as Gleaner	Total	Taxa
Pemenang	Pandanan Beach	9	5	4	18	Gastropods, Bivalves, Florideophyceae, Echinoidea*
	Kecinan Beach	0	0	3	3	Gastropods
	Mentigi Beach	0	0	0	0	
	Kombal Bay	10	7	14	31	Gastropods, Florideophyceae
Tanjung	Sira Beach	7	3	1	11	Gastropods, Echinoidea**
	Medana Bay	38	19	20	77	Gastropods, Florideophyceae, Echinoidea***
Gangga	Karakas Beach	7	4	1	12	Gastropods

Notes: * = 5 gleaners collected *T. gratilla* as a secondary catch;
** = 2 gleaners collected *T. gratilla* as primary catch with a total catch of 91;
*** = 4 gleaners collected *T. gratilla* as primary catch with a total catch of 116.

Figure 5 Collection of sea urchin roe by gleaners

Notes: A) Collected *T. gratilla* inside a plastic bag; B) Plastic bottle containing sea urchin roe; C) Remains of tested sea urchin scattered in seagrass meadow.

Economic issues could be one of the reasons that local villagers conducted gleaning. As much as 27% of North Lombok people were categorized as poor and earned a monthly income of IDR 478,906 (CITANL 2022). Gleaning can have negative impacts on seagrass meadows. Seagrass meadows are preferred by gleaners due to higher catch rates compared to the coral reefs, mangrove, and tidal flats. (Aldea 2023). However, a high number of gleaners and an increased human population can cause overharvesting or a decrease in the abundance of targeted invertebrates (Nordlund *et al.* 2010; Stiepani *et al.* 2023).

From 7 locations, we found 11 gleaners that collected sea urchins as either a primary or secondary catch. In Pandanan Beach, 5 adult females collected *T. gratilla* as a secondary catch with each person collected an average of 5 sea urchins. From interviews (n = 2), the gleaners collected *T. gratilla* to make vegetable side dishes (Fig. 5).

In Sira beach, a married couple collected 91 sea urchins, while in Medana Bay, a team of two married couples collected 116 sea urchins during one gleaning activity. The husbands used snorkeling equipment to search and collect sea urchins from the reef crest and fore reef zone. The wives received the catch, cracked open sea urchins in half, and retrieved the roe. Sea urchin roe was placed in plastic bottle, and depending on the catch, can either be used for home consumption or be sold in local market (Fig. 5).

A 500-mL-plastic bottle filled with sea urchin roe was offered between IDR 20,000 to IDR 30,000. In Sira Beach, the catch consisted solely of *T. gratilla*, while in Medana Bay, it mainly consisted of *T. gratilla* with several *Toxopneustes pileolus* and *Pseudoboletia maculata*.

In 2023, we recorded 2 gleaners in Kombal Bay who collected *T. gratilla* as their primary catch. However, in 2024, in the same location, we hardly encountered gleaners that collected sea urchins. Interviews with gleaners revealed that the number of sea urchins was too small to be collected and used for consumption.

In Gangga Subdistrict, local villagers only collected gastropods and avoided sea urchins. Based on interviews with local villagers of Karakas Beach, they have no tradition of using sea urchins as food materials. Local villagers also revealed that only outsiders from the Pemenang Subdistrict and Tanjung Subdistrict collected sea urchins during low tide.

The majority of gleaners conducted gleaning activity every day, approximately 2 to 3 days, during spring low tide or when seagrass meadows were completely exposed (personal observation). Apparently, harvesting sea urchins was affected by local tradition and local wisdom.

Gleaning, especially carried out by adult females or housewives, can support families by providing protein and food security. Most of the time, gleaning requires little to no equipment (Pike *et al.* 2024) and can be done by young child (Furkon *et al.* 2020). However, gleaning, for trading, without supervision and regulation resulted in the decline of target species (Nordlund *et al.* 2010; Satyawan 2014), and habitat destruction by trample (Furkon *et al.* 2020). The continued increase in the number of gleaners further exacerbated the problem (Nordlund *et al.* 2010). Interviews with gleaners, especially older villagers, revealed the decline of catch and disappearance of certain target species (Nordlund *et al.* 2010). Interviews with gleaners in Kombal Bay (n = 5) also revealed similar conditions.

Several management methods, such as mariculture and restocking (Juinio-Menez *et al.* 2008), have proven to be successful in resolving the problem that arises with sea urchin *T. gratilla* gleaning and overharvesting. Furthermore, identification of spawning sites, establishing minimum catch size, and catch prohibition at certain sites had resulted in higher population density. Mariculture in sea cages, rather than larval release restocking, was cost-effective and feasible for stock enhancement in developing countries (Juinio-Menez *et al.* 2008). Regulation of minimum harvest size, marine sanctuary enforcement, and grow-out of hatchery produced juvenile or wild population in sea cages has proven to be successful in restoring and maintaining sea urchin population in the Philippines (Juinio-Menez *et al.* 2008). Temporal harvest prohibition during the spawning period could also be established to guarantee natural spawning and breeding (Guinda *et al.* 2016).

Overharvesting, excluding grazers, such as sea urchins, can increase macroalgal cover and alteration of the macroalgal community (Kriegisch *et al.* 2020) or habitat damage due to trampling of marine biota living in seagrass meadows (Nordlund *et al.* 2010). Due to its ecological role, the decrease or increase of sea urchin biomass can affect the balance of trophic levels in the seagrass ecosystem (Clores 2023), change community structure (Steneck 2013), and cause overgrazing of seagrass beds (Moreira-Saporiti *et al.* 2023).

CONCLUSION

The low absolute abundance of *T. gratilla* and the decline of sea urchin species diversity in North Lombok prospectively indicated overharvesting. The number of gleaners and the gleaning activity conducted by local villagers prospectively harm seagrass meadows, especially on *T. gratilla* abundance. A study on diversity, abundance, and morphometry can provide a base for characterizing sea urchin population and provide a strong baseline to design and implement management policy. Moreover, regular monitoring can be used to obtain the current status of the sea urchin population and check the progress of its management policies.

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