Notes on the Gracious Sea Urchin *Tripneustes gratilla* (Echinodermata: Echinoidea) in Pag-asa Island, Kalayaan, Palawan, Philippines

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ABSTRACT

The Gracious Sea Urchin *Tripneustes gratilla* is one of the most heavily exploited sea urchins in the Philippines. However, knowledge about its status in Palawan especially in Pag-asa Island, Kalayaan is wanting. The study was conducted to determine the size structure, population density and test diameter-weight relationship of *T. gratilla* in Pag-asa Island, Kalayaan. Transect surveys at the intertidal area of the island revealed an average density of 3,500 ind.ha^{-1}. The test diameter ranged between 2.6 and 8.8 cm, and body weight ranged between 8 and 248 g. Other than *T. gratilla*, four other echinoid species were recorded but in very less number. While it appears that *T. gratilla* is under exploited in Pag-asa Island, policies affecting its sustainable utilization are suggested.

Keywords: Pag-asa Island, sea urchins, size structure, *Tripneustes gratilla*

INTRODUCTION

Sea urchins are globular, spiny animals related to sand dollars under Phylum Echinodermata, Class Echinoidea. There are about 1,000 accepted sea urchin species worldwide, and 64 are described from the Philippines (Appeltans et al. 2012). They are distributed both in the tropical and temperate regions, and play key roles in nutrient recycling in the intertidal areas, seagrass and coral ecosystems in the tropical regions (Lawrence and Agatsuma 2007; Alcoverro and Marianni 2002). They are herbivorous and serve as biocontrol for invasive macroalgae inhabiting the seagrass and coral communities (Conklin and Smith 2005). In scallop culture, sea urchins are used to control fouling organisms (Zhanhui et al. 2013).

Sea urchins are one of the economically important echinoderms in the Indo-Pacific region. These are harvested for their roe (gonad) which is usually consumed locally as raw (Schoppe 2000). It is regarded as delicacies in many countries and high quality gonads are exported as “uni” in Japan and the USA which pitch high prices (Andrew et al. 2002).

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The sea urchin fishery, particularly of the Gracious sea urchin *Tripneustes gratilla,* generates multi-million exports annually (Talaeu-McManus and Kesner 1993). Such high market demand and aquaculture potentials attract researchers to study its biology and ecology. In the Philippines, some of the sea urchin studies include the species inventory (Schoppe 2000), gonadal development, growth and survivorship (Juinio-Meñez et al. 2008), population biology (Regalado et al. 2010), and genetic diversity, population structure, and exploitation (Casilagan et al. 2013) of *T. gratilla*.

Many studies have shown that overharvesting has caused the decline of sea urchin populations in many localities (Juinio-Meñez et al. 2008). Efforts to enhance sea urchin populations include grow-out studies in cages (Malay et al. 2000; Juinio-Meñez et al. 2008).

Studies with regard to the status of this echinoid species in Pag-asa Island are inadequate. Only Gonzales et al. (2008) mentioned sea urchins in the reefs of Pag-asa. Fishing activities by claimant countries in Kalayaan Island Group (KIG) or Spratlys Islands are unregulated and could have impacted the once ubiquitous marine resources. As such, this study aimed to determine the size structure, population density and test diameter-weight relationship *T. gratilla* in Pag-asa Island, Kalayaan, Palawan, Philippines.

METHODS

The intertidal areas of Pag-asa Island, Kalayaan Island Group (KIG), Palawan, Philippines were surveyed between 28 April and 10 May 2014. Four stations were established: the northern and eastern stations were dominated by coral rubble, while stations at the southern and western sides were dominated by seagrass. Two 5 x 50 m belt transects were laid at least 100 m apart in each station (Figure 1). The survey was conducted either by wading or snorkeling during low tide up to the depths of 1.5 m from 07:00 to 09:00 and 18:00 to 20:00 hours (Figure 2). Sea urchins encountered within transects were counted and recorded.

To record the size structure and test diameter - weight relationships, 158 *T. gratilla* individuals were collected, measured for test diameter (cm) using a caliper, and weighed (g).

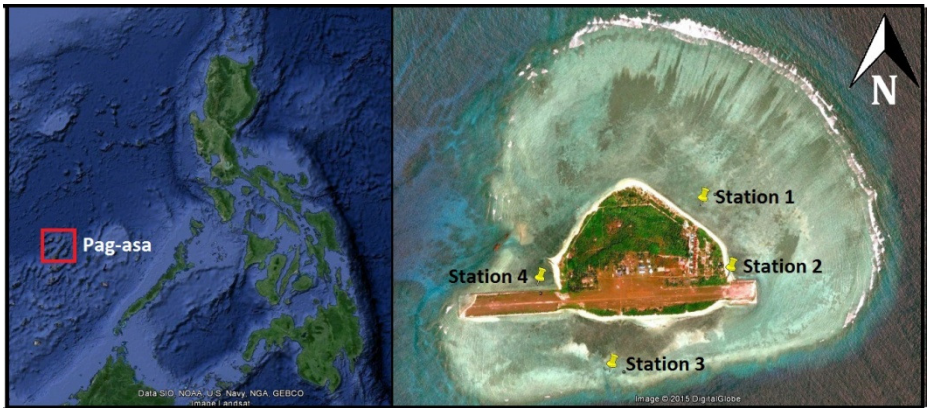

Figure 1. Map of Pag-asa Island, Kalayaan Island Group, Palawan, Philippines showing the sampling stations.

Figure 2. Extensive seagrass in the western side (Station 4) of Pag-asa Island, Kalayaan, Palawan, Philippines.

RESULTS

Size Structure of *Tripneustes gratilla*

The sizes of *T. gratilla* were generally dominated (97.5%) by large individuals having test diameters of 5.8 to 8.8 cm. Very few individuals (2.5%) with test diameter 2.6 - 4.0 cm were recorded. The body weight

ranged from 50 to 250 g and most individuals (77.8%) fell within a body weight of 101-200 g (Table 1).

Table 1. Test-diameter and body weight distribution of *T. gratilla* in Pag-asa Island, Kalayaan, Palawan, Philippines.

Test diameter range (cm)	Mean test diameter (cm)	Frequency	%	Weight range (g)	Mean weight (g)	Frequency	%
1.0 – 2.5	-	-	-	0 – 50	16.0	4	2.5
2.6 – 4.0	3.2	4	2.5	51 – 100	92.8	14	8.9
4.1 – 5.5	0	0	0	101 – 150	122.9	68	43.0
5.6 – 7.0	6.5	61	38.6	151 – 200	173.4	55	34.8
7.1 – 9.0	7.7	93	58.9	201 – 250	226.8	17	10.8

Population Density of *T. gratilla*

The estimated average population density of *T. gratilla* in the island was 3,500 ind.ha^{-1}. The highest densities were noted in Station 1 (6,380 ind.ha^{-1}) and Station 2 (6,940 ind.ha^{-1}). Densities in the other two stations (Stations 3 and 4) were lesser than 400 ind.ha^{-1} (Figure 3).

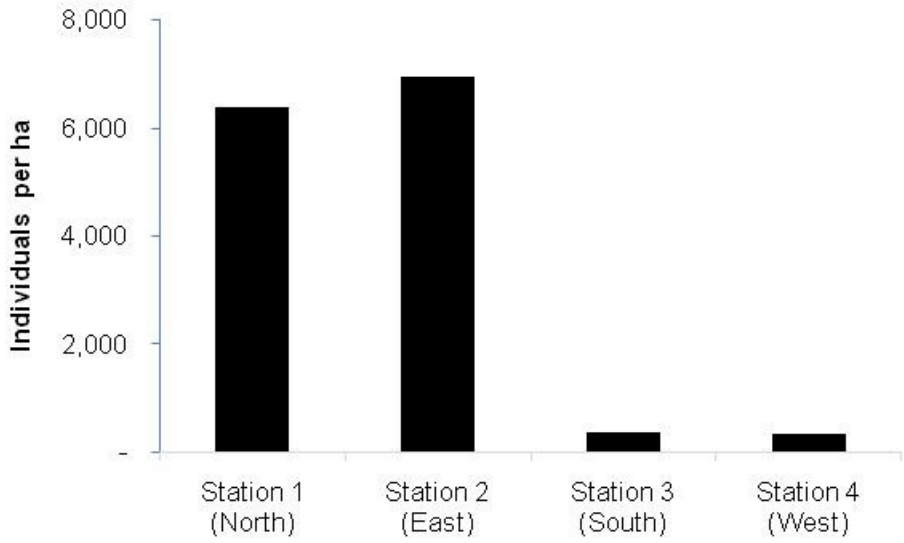

Figure 3. Population density of *T. gratilla* in different sampling stations in Pag-asa Island, Kalayaan, Palawan, Philippines.

Test Diameter-Weight Relationship of *Tripneustes gratilla*

Most (97.5%) of the samples had a test diameter larger than 6 cm, and weighed at least 125 g. The relationship between the test diameter and body weight is best explained by the equation $W = 0.7334*TD^{2.6725}$ (Figure 4), where "W" is the weight and "TD" stands for test diameter.

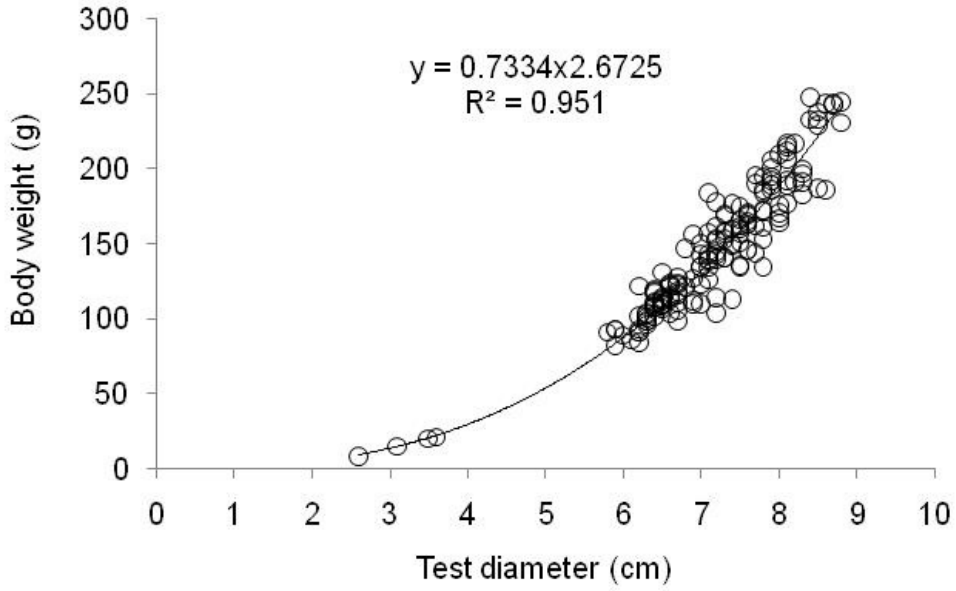

Figure 4. Test diameter-weight relationship of *T. gratilla* in Pag-asa Island, Kalayaan, Palawan, Philippines.

DISCUSSION

The dominance by large individuals (size range: 5.8-8.8 cm) in the sample could be sampling and exploitation related. Juvenile sea urchins are cryptic in nature and usually found hiding on algae and leaves of seagrasses. The prevalence of large individuals could be due also to the low fishing pressure for the species. Pag-asa Island is relatively inaccessible, inhabited by a few families and assigned military personnel, thus the degree of exploitation on the species is lesser compared with highly accessible areas such as in mainland Palawan.

The sizes of *T. gratilla* in Pag-asa Island is comparable in Curimao and Burgos in northwestern Luzon (Juinio-Meñez et al. 2008).The largest (8.8 cm) *T. gratilla* in Pag-asa Island is much smaller than the largest (16 cm)

world record (Lawrence and Agatsuma 2001). However, the largest size obtained in Pag-asa Island is larger than those in Balaoan, La Union (Prado et al. 2012), and southern Guimaras in Iloilo (Regalado et al. 2010) (Table 2). Commercially important species are often small in size and less abundant in overharvested than in protected areas (Ablan et al. 2004, Alcala et al. 2005; Russ and Alcala 2011).

Table 2. Size range of *T. gratilla* from other locations in the Philippines.

Location	Test diameter range (cm)	Source
Southern Guimaras	4.4 – 8.2	Regalado et al. 2010
Balaoan, La Union	4.0 – 5.0	Prado et al. 2012
Pag-asa Is., Kalayaan, Palawan	2.6 – 8.8	This study

The skewed distribution in favor of large individuals (Table 1) suggests low fishing pressure, but can be affected by the sampling methods with the tendency to catch the more visible large individuals. It may also suggest that the surveyed area may not be the preferred habitat of juveniles or they may burrow in the sand or inhabit crevices. For some species of snail like *Tectus niloticus*, juveniles are encountered at shallow areas while large individuals occupy a wider range of depths (Nash 1993, Dolorosa et al. 2015).

The variations in population density in the four sites could be habitat related and could have been influenced by the Northeast monsoon. *Tripneustes gratilla* are known to occur in seagrass beds (Alcoverro and Mariani 2002), but densities were much lower at the seagrass beds of the island during the survey. It is presumed that the northeast monsoon has favored the recruitment and growth of sea urchins at the northern and eastern stations, thus many urchins (large individuals) were noted in rubble dominated areas. A year round survey at the four stations could help verify the effects of monsoons on the abundance of sea urchins in Pag-asa Island. While the recorded densities in Pag-asa Island were higher compared with other locations in the country (Table 3), surveys in other islands of the KIG could provide a clearer picture of the status of the species.

There is a high positive relationship between the test diameter and weight of *T. gratilla.* The data also revealed that 95.1% of the increase in weight of the samples is accounted to the increase in its test diameter. In the study of Regalado et al. (2010), only 77% of the increase in weights are attributed to the increase in test diameter ($W = 0.0048*TD^{2.3952}$) of *T. gratilla*.

The variation in the influence of diameter on the increase in weight of a species is related to their diet, season, and number of samples (Hossain 2010). Understanding the reproductive biology and abundance of *Tripneustes gratilla* and many other understudied species in the KIG is recommended.

Table 3. Population density of *T. gratilla* in different sites in the Philippines.

Location	Population density (ind. ha^{-1})	Source
Northwestern Luzon	1,000	Juinio-Meñez and Bangi 2008
Southern Guimaras, Iloilo	2,600	Regalado et al. 2010
Balaoan, La Union	600	Prado et al.2012
Pag-asa Is., Kalayaan, Palawan	3,500	This study

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