

## Food and Biological Development of Sea Urchin *Tripneustes gratilla* in Carmen-Danao Cove, Cebu Central Philippines

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### ABSTRACT

The sea urchin *Tripneustes gratilla* locally known as “swaki” has been harvested from the wild because of its gonad. The collection of the sea urchin gonads for food has been practiced for so long. However, the relationship of its biological features such as size, weight, gonadal development and sex ratio with reference to their food availability for sustainability of the species needs to be assessed. The sea urchin samples were gathered from two established sampling sites in Carmen waters, namely: Dawis Sur (Area 1) with sandy, algae and sea grass substrate and Puente (Area 2) with algae and rocky substrate. The gathered samples were analyzed in terms of its biological features. Data collected were statistically treated using correlation coefficient and t-test at 5% level of significance. There were 60 and 24 sea urchin samples collected from Area 1 and Area 2, respectively. Results show that the sea urchin from Area 1 had an average body weight of 429 g, body diameter of 4.38 cm, and gonad weight of 2.05 g, respectively. In Area 2, it has an average body weight of 139.49g, body diameter of 5.73 cm and gonad weight of 6.6, respectively. Gonadal weight and body diameter has been found to be moderately correlated in both areas ( $r=0.43$ ). In terms of sex ratio, male sea urchin dominates the female in Area 2. In Area 1, there was an equal distribution of sex ratio in both sexes. Results indicates that the area with sandy, algae and seagrass substrate resulted to have heavier average body weight of sea urchin in comparison with rocky and algae substrate. Thus, food greatly influence the biological feature of sea urchin particularly its average growth rate.

Keywords: food, size, weight, gonadal development and sex ratio.

### INTRODUCTION

The Sea Urchin, *Tripneustes gratilla*, is one of the edible sea urchins usually gathered because of its tasty gonad or roe. It is commonly known as “swaki” in the visayas region and is mostly found in the intertidal zone. Utilization of sea urchin roe is not only popular in the Philippines but in some other country as well like Japan, the major market of sea urchin roe, where it is known in that place as “Uni” (Junio-Menez *et al.*, 2001).

Gleaning of sea urchin is one of the alternative sources of income among the villagers in the coastal barangays of Carmen and to some, their only source of livelihood (Castro, 2011, Unpublished thesis). Among the sea urchin group, *T. gratilla* is commonly gleaned due to its high priced and good quality roe compared to the other species like *Diadema setusom*, *Echinometra*

*mathaei* and *Metalia* sp. At present, there were fifty identified sea urchin gleaners distributed in the five (5) coastal barangays in the Municipality of Carmen (Castro, 2011 ,Unpublished thesis). If the said activity continues, without proper regulation, the population of the sea urchin in the coastal areas of Carmen will soon becomes depleted in the long run.

The present status of sea urchin resources in the Municipality of Carmen serves as a wake-up call for the gleaners. They should have known the biological characteristics of the sea urchin so that they become aware as to when to collect and when not to collect sea urchin from the wild. Knowing the biological characteristics and importance of sea urchin would guide the gleaners as to what particular size does the sea urchin becomes mature and capable for reproduction and which size of the sea urchin produces roes or gonads. Although, anecdotal records tell us that gonadal development of the sea urchin depends on the phases of the moon but this claim is not supported with empirical and scientific study. A study is needed for such, in order to validate such claims. Thus, this study was conducted in order to characterize the sea urchin to determine the relationship of food and its biological development. Results of this study can be one of the basis of its regulation to allow the sea urchin to mature and reproduce for its sustainability.

## **MATERIALS AND METHOD**

### **Sampling Site Selection**

The Municipality of Carmen has five (5) coastal barangays of which two were chosen as study sites for this research activity, namely: Dawis Sur (Area 1) and Puente (Area 2). Sampling site was selected based on the feeding preference of the sea urchin, *Tripneustes gratilla*. Area 1 (Dawis Sur) was found to have sandy, algae and seagrass (dominant species) substrates, while Area 2 (Puente) has rocky and algae substrates. The dominant species of algae in Area 2 is *Sargassum* spp.

### **Sample Collection and Preservation**

Sample collection was done twice a month, during the full moon and three days after the last quarter to have low tide collection. It was collected early in the morning during the lowest tide approximately from 5:00 to 7:00. Samples were randomly picked up in the substrate in depths ranging from 2 to 4 feet and were placed in a plastic bag and were transported to the Post Harvest Laboratory of the CTU-Carmen Campus for the different analysis.

### **Sample Preparation and Measurement**

Collected samples from the two sampling sites were individually arranged for the different analysis. The diameter of the sea urchin was measured using a Vernier Caliper expressed in terms of centimeter while size was measured in terms of its weight (grams) using a Top Loading Electronic Balance.

Using a kitchen knife, the sea urchin shells were cut and the gut was removed. The roes or gonads were gently removed and washed using tap water taking care that these cannot be removed from washing. The roes or gonads were carefully removed by scrapping it gently using spatula and was placed in a pre-labeled and pre-weighed container. After which it was weighed individually using a Top Loading Electronic Balance.

### Statistical Treatment

Data gathered were treated statistically using correlation coefficient and T-test at 5% level of significance. Body diameter and gonad weight were correlated using correlation coefficient. The gonads collected from the two sampling sites during full moon and three days after the last quarter were statistically treated using T-test.

## RESULTS AND DISCUSSION

### Common Size and Weight of the Sea Urchin Bearing Gonads

Table 1 shows the average body weight, size and gonad weight of sea urchin in two sampling sites. As shown, Area 1 (seagrass and algae sandy substrate) has the highest number of collected samples but with lowest diameter and gonad weight. However, highest weight of gonads and bigger diameter were noticed in Area 2 (sargassum substrates) but less number of samples were collected. Results indicate that the size of sea urchin has a direct relationship with the amount of gonads produced, which means the bigger the sea urchin, the greater is the amount of gonads.

As reflected in Table 1, greater number of sea urchin were collected in Area 1 compare to Area 2. However, in terms of body size and gonad weight, greater amount has been observed in Area 2, this is mainly because in Area 2 large volume of sargassum was observed compared in Area 1 wherein there were only patches of seagrass available as food for sea urchin. According to Konar (2000) areas with less food (barren) had urchins with consistently smaller gonad indices. These indices varied independently in water depth and seasonal variation in algal drift and algal cover. This could be the possible reason why Area 2 yielded better gonad weight compared to Area 1 despite lesser number of collected samples.

Table 1. Average size and gonad weight of sea urchin from the two sampling sites.

Parameters	Area 1 (Dawis Sur)	Area 2 ( Puente)
Size ( cm)	3.82	5.73
Gonad weight (g)	1.82	6.66

### Influence of Habitat on Gonadal Development

Based on the habitat characterization of the sampling sites, Area 1 was found dominated

by seagrasses while Area 2 was dominated by *Sargassum* spp. The said areas were believed to be suitable habitat of sea urchin. Sea urchin has been found and observed to feed mostly on a wide variety of seagrasses in which they grazed directly (Mukai, *et al*, 1987; Stimson *et al*, 2007).

Table 2. The sea urchin (*T. gratilla*) in the two sampling areas in Carmen coastal water

Sampling Sites	Total Samples Collected	Ave. Body Weight (g)	Ave. Body Diameter (cm)	Average Gonad Weight (g)
Area 1	69	429	3.82	1.82
Area 2	24	139.49	5.73	6.66

It was observed that the sea urchin in the sargassum bed were found bigger and have better gonads than the sea urchin found in seagrass bed. This result is similar with the findings of Junio-Menez *et al* (2001) wherein the laboratory reared sea urchin fed with sargassum resulted in highest growth and better gonads. Table 2 shows that in terms of gonad weight and body diameter, Area 2 was found much better than Area 1, although the latter was found higher in terms of number. Gonadal development of sea urchin from was found to have significant difference considering their habitat, based on T-test at 5% level of significance ( $t_c=5.289$ ;  $t_a=1.714$ ). This clearly indicates that the sea urchin found in the area where *Saragassum* spp. is abundant, have better growth and higher weight of gonads compared to the one that inhabited an area where seagrasses are abundant. The stability and availability of the food and the suitability of the environment aids in the ability of the sea urchin to regulate body size (Levitan, 1988a). As reflected in the results, it was found out that the habitat greatly influence the gonadal development of the sea urchin.

### Relationship of Moon Phases and Gonadal Development

Sea urchin being a nocturnal organism has been presumed that its activity will be greatly influenced and affected by lunar phases. In terms of average body weight and diameter and average gonad weight results show that the sea urchin collected in Area 2 has a highest average gonad weight compared to Area 1 as shown in Figure 1. The summary of the characteristics of sea urchin collected from the two sites in Carmen, Cebu is reflected in Figure 1. As statistically determined using t-test, Area 1 ( $t_c=0.5087$ ;  $t_a=1.703$ ) and Area 2 ( $t_c=0.222$ ;  $t_a=6.314$ ), was found to have no significant difference when gonad weight was compared between the two lunar phases when sea urchin were gathered. This implies that the different lunar phases of the moon when sea urchin was gathered does not have an effect on the gonadal development of sea urchin. Although, the study of Kennedy and Pearse (1978) suggested that the reproductive rhythm of sea urchin closely synchronized with lunar phases and not with tidal cycles, but that synchronization does not have a statistical difference (Iliffe and Pearse, 1982). The same findings was noted by Junio-Menez *et al* (2001) in a grow-out culture experiment of sea urchin, in which lunar phases and gonad index does not show any significant relationship. Result indicates that the gonadal development of the sea urchin does not depend on the different lunar phases but to the kind of

habitat they are mostly found.

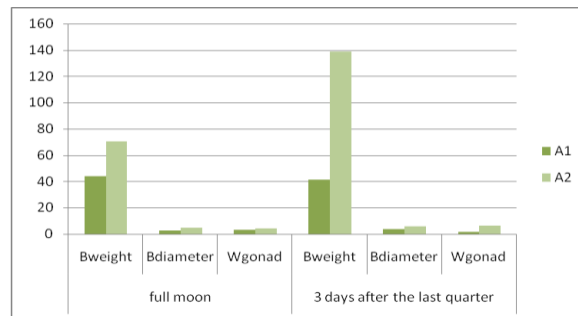


Figure 1. Average body weight, body diameter and gonad weight measured when collected in two different lunar phases

### Relationship of Size and Gonadal Development

Figure 2 shows the relationship of the body and gonad weight of the sea urchin obtained from the two sampling sites. As shown it was found out that the sea urchin obtained in Area 2 have higher body diameter and gonad weight compared with the sea urchin obtained from Area 1. This is possibly due to the abundant food found in Area 2 (sargassum bed) which influences greatly in the development of the gonad. Sea urchins have been known to be an herbivorous organism and are highly mobile and easily locate patches of high quality food (Sloan and Campbell, 1982). According to Lawrence and Sammarco (1982) sea urchin that encounter energy-rich food resources has accelerated rates of gonadal production and growth. This is the reason why the average gonad weight of Area 2 is higher than in Area 1 because of habitat differences. Area 2 has been dominated by *Sargassum* spp. which is considered as the favorite food of the sea urchin. According to Calzada (2007, unpublished) high growth increment has been noted to sea urchin feed with *Sargassum* than those feed with seagrasses. Similarly, Junio-Menez *et al*, (2001) also observed that better gonad was noticed to sea urchin fed with the same kind of algae. In terms of gonad weight and body size, it was found out that there is a moderate correlation in Area 1 ( $r=0.43$ ;  $P < 0.01$ ) and Area 2 ( $r=0.57$ ;  $P < 0.01$ ). This simply means that not all the time that the gonad weight depends on the size of the sea urchin. Smaller size of sea urchin does not guarantee that it also has a small size of gonads and the same is true with the bigger size.



Figure 2. Relationship Between Size and Gonad of the Sea Urchin, *T. gratilla*

## Sex and Sex Ratio

Figure 3 shows the sex ratio of male and female sea urchin in the two sampling sites. As shown it was found out that in the two areas, male ratio was higher compared to female. This result is similar to the findings of Fuji (1968) that male sea urchin preponderate the female in terms of abundance.

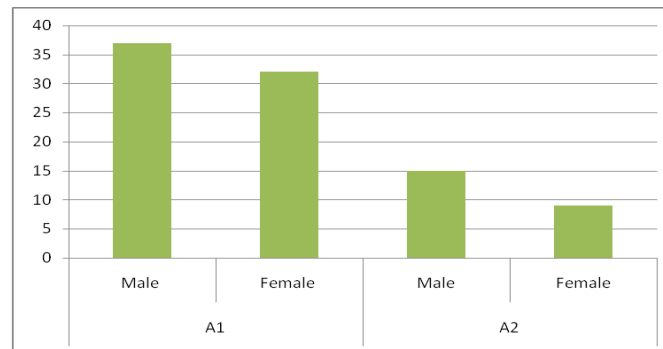


Figure 3. Sex Ratio of *T. gratilla* obtained from the two sampling sites

## CONCLUSIONS

Based from the results, it is concluded that gonadal development of the sea urchin *T. gratilla* is greatly influenced by the food found in the habitat. Further, the different lunar phases of the moon did not affect the development of the gonad of the sea urchin *T. gratilla*.

## RECOMMENDATION

It is strongly recommended to have a follow up study extending the duration of the study to at least one year and to include the gonado-somatic index to determine the sexual maturity of the sea urchin *T. gratilla*.

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