Abundance of Tridacna (Family Tridacnidae) at Seribu Islands and Manado Waters, Indonesia

Candhika Yusuf, Ambariyanto, Retno Hartati

[1]Fisheries Officer, WWF–Indonesia. Email: divedeepbluesea@yahoo.com
[2]Department of Marine Science, Faculty of Fisheries and Marine Science, Diponegoro University. Tembalang Campus, Semarang, Indonesia
Tel. / Fax. +6224 7474698

Abstrak

Kima, yang merupakan salah satu hewan laut dilindungi, sejak lama banyak dieksploitasi di berbagai daerah di Indonesia. Apabila keadaan ini terus berlanjut maka akan terjadi penurunan populasi di alam yang berujung pada kepunahan dari berbagai spesies Kima tersebut di alam. Penelitian ini bertujuan untuk menganalisis kelimpahan Kima di beberapa pulau di Kepulauan Seribu dan perairan di sekitar Manado. Metode penelitian yang digunakan adalah deskriptif yang bersifat eksploratif. Sampling dilakukan dengan metode Line Intersept Transect (LIT) menggunakan garis transek sepanjang 100 meter sejajar dengan garis pantai pada kedalaman 5 meter. Pengamatan dilakukan pada tiap 2,5 meter di sebelah kanan dan kiri garis transek. Hasil penelitian, ditemukan total 167 individu Kima di Kepulauan seribu dan 61 individu di perairan Manado. Nilai kepadatan rata – rata pada lokasi Kep. Seribu adalah T. squamosa *0.026 indv/m^2,* T. maxima *0,016 indv/m^2, T. crocea 0.028 indv/m^2 sedangkan pada lokasi Manado adalah* T. squamosa *0.021 indv/m^2,* T. maxima *0.0005 indv/m^2,* T. crocea *0.0085 indv/m^2 dan* T. gigas *0.002 indv/m^2. Hasil ini menunjukkan bahwa kepadatan Kima di dua lokasi penelitian masih lebih rendah dari beberapa lokasi di Indonesia dan luar negeri. Berdasarkan ukuran cangkang di dua lokasi penelitian diduga hanya* T. crocea *saja yang telah mencapai fase hermafroditiknya, sedangkan* T. gigas *dan sebagian besar* T. squamosa *serta* T. maxima *baru mencapai fase kematangan gonad jantan saja. Kebanyakan Kima ditemukan di karang mati beralga (Dead Coral Algae / DCA) dan tututan karang hidup (coral covered) dibandingkan dengan jenis substrat yang lain.*

Kata kunci : *Kima, tridacna, kelimpahan, Kepulauan Seribu, Manado*

Abstract

Giant clam, as a protected marine species, has been exploited massively in many regions in Indonesia. This has lead to the rapid extinction of the giant clam natural population. The purpose of the research is to obtain the abundance status of giant clam species in several island in Kepulauan Seribu and surroundings waters of Manado. Surveys were done by using the modification of Line Intercept Transect (LIT) methods. A hundred meter length of transect line were drawn, in depth of 5 meter and paralleled to the coast line. The observations were made in 2.5 meter to the left and right of the transect line. The results showed, there were total number of clams found at Seribu Islands and Manado waters were 106 and 61 individual, respectively. The average density in Seribu Islands were T. squamosa*: 0.026 indv/m^2,* T. maxima*: 0.016 indv/m^2, and* T. crocea*: 0.028 indv/m^2, and in Manado were* T. squamosa*: 0.021 indv/m^2,* T. maxima*: 0.0005 indv/m^2,* T. crocea*: 0.0085 indv/m^2 and* T. gigas*: 0.002 indv/m^2. These results showed that the density of giant clams in both places were found to be lower than other places in Indonesia and abroad. Based from the shell measurements on both locations, only* T. crocea *were suspected have reached its hermaphrodite phase, while* T. gigas *and most of* T. squamosa *and* T. maxima *were about to reached male gonad maturity phase. The most dominant substrate for the giant clam were the Dead Coral Algae (DCA) and the coral covered.*

Key words: *Giant clam, tridacna, abundance, Seribu Islands, Manado*

*) Corresponding author

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Introduction

Giant clams (Bivalvia, Tridacnidae) is a marine organism that live in coral ecosystems in the Indo-Pacific. These animals have two genera (Tridacna and Hippopus) and nine species where seven of them can be found in Indonesian waters, i.e. *Tridacna gigas, T. derasa, T. squamosa, T. maxima, T. crocea, Hippopus hippopus,* and *H. porcellanus* (Lucas, 1988; Pasaribu, 1988; Ambariyanto, 2009). Geographically, Tridacna have a limited distribution in the tropical Indo-Pacific from the Red Sea to the Pacific Islands Toamatu. Each species of Tridacna has its own distribution area. *T. maxima* are spread most widely, whereas *T. tevoroa* have the most limitted distribution area (Rosewater, 1965; Lucas, 1994).

Giant clams are known to have important economic value by direct use and orgnamental organism. Tridacna trade in Asia Pacific markets for all parts of the animal can be used, either aductornya muscle, mantle (fresh, dried or mounted), or shell (Calumpong, 1992). Traditionally, people in coastal areas have been using the shells of Tridacna as household equipments such as a place of soap, food bowls, ashtrays, and jewelry. In Indonesia, especially in Jepara and Seribu Islands people gathered Tridacna shells as raw materials for ceramic industry in Jakarta, Central Java, East Java and Bali (Romimohtarto *et al.,* 1987).

This high economic value are causing pressure on the existence of Tridacna continue to rise. As a result, some species of Tridacna in the Indo-Pacific region can not be found anymore due to various factors, among other human activities that take Tridacna the large-scale (overexploitation), destruction of habitats and environmental disturbances such as pollution (Pasaribu, 1988). If this situation continues it will be a decline in natural populations that lead to the extinction of Tridacna populations.

Seribu Islands and Manado waters are known for its rich diversity of marine life. Marine tourism activities grew rapidly in recent years and along with these conditions, the existence of marine ecosystems have been degraded. This was also coupled with the use of a variety of marine life including the exploitation of Tridacna for different economic commodities.

Management of natural populations of organisms need information on the distribution, composition and density of these organisms (Lewis *et al.,* 1988). Therefore, research on the distribution, composition and density of natural population of giant clams needs to be done. This study aims to determine the abundance of Tridacna at Seribu Islands, Jakarta and Manado waters, North Sulawesi.

Materials and Methods

Surveys were conducted only on the reef with a criterion percent coverage is greater than 75%. Before setting the research station, observation by snorkeling first performed to observe the coral reef at the location specified. Sampling was conducted at three points in Seribu Islands and 4 points Manado waters (Table 1). Differences in the number of sampling points was due to logistical difficulties, mobility and wide area.

Survey method used is a modification of Line Intercept Transect (LIT), namely Belt Transect (Home *et al.,* 1994) and has been used previously (Braley, 1987b). Each research station is pulled along the 100-meter transect line parallel to the coastline at a depth of 5 meters. Each station is only one transect line. Observations were made at every 2.5 meters to the right and the left of the transect line. Therefore, the total area observed at each station is 500 m^2.

All tridacnids found in the survey area were recorded their species, number and photographed.

Tabel 1. Giant clams survey location at Seribu Islands and Manado waters

No	Lokasi	Titik Koordinat
	Kep. Seribu	
1.	Pramuka	S 05° 44' 767" E 106° 35' 513"
2.	Semak Daun	*Tidak tercatat*
3.	Karang Congkak	S 05° 42' 527" E 106° 34' 336"
	Manado	
1.	Tanjung Pisok	N 01° 34' 429" E 124° 48' 170"
2.	Nudi Retreat (Lembeh)	N 01° 29' 001" E 125° 14' 408"
3.	Batu Gosok (Bangka)	N 01° 47' 944" E 125° 11' 175"
4.	Serena West (Lembeh)	N 01° 27' 389" E 125° 13' 475"

A known size of scissor was placed beside the sample as a length comparison. Tridacna shell length measurement was performed by using Image Tool software UTHSCA. Tridacna substrates were also recorded by using benthic code (Home *et al.,* 1994). Tridacna identification is based on the Copland and Lucas (1988) and Knopp (1996).

Calculation of Tridacna density (indv/m^2) found in each station is calculated based on Snedecor and Cochran (1980). Giant clams shell length are grouped into several classes of Tridacna shell size with 5 cm intervals in order to facilitate analysis and prediction of the age and maturity level of the gonads of each species Tridacna recorded in the study. (Hardy & Hardy, 1969; Brown & Muskanofola, 1985; Braley, 1987a).

Results and Discussion

The survey found a total of 106 individuals on Seribu Islands from three species of Tridacna, i.e. *T. squamosa* (40 indv.), *T. maxima* (25 indv.) and *T. crocea* (41 indv.). While Manado waters, the survey found a total of 61 individuals from four species i.e. *T. squamosa* (40 indv.), *T. maxima* (3 indv.), *T. crocea* (17 indv.) and *T. gigas* (1 indv.). Table 2 shows the density

Tabel 2. Average density of giant clams (indv/m^2) found in Seribu Islands and Manado waters

Lokasi	Spesies Kima			
	T. squamosa	*T. maxima*	*T. crocea*	*T. gigas*
Kep. Seribu	0.026	0.016	0.028	0
Manado	0.021	0.0005	0.0085	0.002

Tabel 3. Shell length range of giant clams (cm) found in Seribu Islands and Manado waters

Lokasi	Spesies Kima			
	T. squamosa	*T. maxima*	*T. crocea*	*T. gigas*
Kep. Seribu	5.24 - 31.71	6.19 - 19.22	2.45 - 14.06	0
Manado	9.5 - 31.28	9.78 - 13.91	4.57 - 8.40	39.61

Tabel 3. Substrate types where giant clams were found in Seribu Islands and Manado waters. DCA (Dead Coral Algae), FAV (Faviidae), POR (Poritidae), dan RB (Rubble).

Lokasi	Substrat	Spesies				Jumlah	%
		T. squamosa	*T. maxima*	*T. crocea*	*T. gigas*		
Kepulauan Seribu	Coral Covered	9	0	0	0	9	8.49
	DCA	15	15	40	0	70	66.04
	FAV	0	1	0	0	1	0.94
	POR	0	8	1	0	9	8.49
	RB	16	1	0	0	17	16.04
Manado	Coral Covered	25	1	0	0	26	42.62
	DCA	5	0	16	0	21	34.42
	FAV	0	2	0	0	2	3.27
	POR	0	0	1	0	1	1.63
	RB	8	0	0	1	9	14.75
	Sand	2	0	0	0	2	3.27

of four species of Tridacna found during the study. While the shell size range of the clams can be seen in Table 3.

The results showed that the number of clams found in Seribu Islands is higher than those in Manado waters. Similarly, the density and shell length range of this animal were also higher at Seribu Islands. See Tables 2 and 3. Seribu Islands area are inhabited, however, it is suspected that giant clams harvest is very limited. The number of warning and appeal boards on the importance of protecting marine ecosystems can be found easily in strategic places seem to have an influence on the people.

However, compare with other places, Tridacna density in Seribu Islands and Manado is still lower than the survey results in several other places in Indonesia or abroad. Survey reported in Cenderawasih Bay found giant clams natural populations densities were from 0.6 to 0.7 indv/m^2, (Pranowo, 1998), and in Karimunjawa islands were ranged from 0.03 to 0.04 indv/m^2 (Hadi, 2000). While the survey conducted at Michaelmas Reef, Great Barrier Reef area approximately 2.7 ha found a total of 1166 individuals of *T. gigas* and 44 individuals of *T. derasa* (Pearson & Munro, 1991). While Ambariyanto (2001) survey reported in 1993 at One Three Island, Great Barrier Reef that the density of *T. maxima* were between 0,16-0.17 indv./m^2.

The types of substrate where the clams were found at Seribu Islands were mostly Dead Coral Algae (DCA) which was 66.04% (70 indv.) and the smallest percentage were found on corals Faviidae (Fav) which was 0.94% (1 indv.). While in the waters of Manado, the highest percentage were found on coral covered i.e. 42.62% (26 indv.), and the smallest percentage was found on coral Porites i.e. 1.63% (1 indv.). See Table 4

These results is in accordance with Romimohtarto *et al.* (1987) and Calumpong (1992) who stated that giant clams such as *T. maxima* will be found embedded firmly in the hard substrate reef boulders. While *T. crocea* are mostly found in the rock face massive coral boulders or rip (Hammer & Jones, 1976). These clams were less susceptible from human harvesting since not only these animals have smaller size, but also relatively difficult to be taken (Gilkes & Duke, 1987). In Manado waters, the majority *T. squamosa* were found living covered by coral growth around it. Gomez & Alcala (1988) stated that there are many Tridacna species protected by Acroporidae branching coral growth, so relatively secure. While *T.gigas* found in the waters of Manado was in live coral rubbles. According to Braley (1987a) and Calumpong (1992), *T. gigas* usually live among branching corals and can be found also in the sandy substrate or coral rubbles.

Both in the Seribu Islands and Manado waters only *T. crocea* who were suspected have reached hermaphrode phase based on theie shell length, whereas *T. gigas* and most *T. squamosa* and

T. maxima have only reached male gonad maturation phase.

According to Fitt (1991) *T. crocea* will reach male phase in the smallest size approximantely 2 cm shell length, and the hermaphrodite phase at 4 cm shell length. While the smallest size for male gonad maturation phase for *T. squamosa* approximately 9 cm shell length and the smallest size for hermaphrodite phase is 16 cm in shell length While in *T. maxima* the smallest size for male and hermaphrodite phase were 11-13 cm in Guam and 15-20 cm in Fiji, respectively (Romimohtarto *et al*., 1987).

Conclusion

Both the number of giant clams, the range of shell length and the density of giant clams in Seribu Islands were higher than those from Manado waters. While the number of species of giant clams found in Manado waters were higher than Seribu Islands, i.e 4 and 3 species. This survey also found that giant clams prefer to attach on substrate of Dead Coral Algae (DCA) and the coral covered than other substrates.

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