Global Scientific JOURNALS

GSJ: Volume 9, Issue 6, June 2021, Online: ISSN 2320-9186
www.globalscientificjournal.com

COMMUNITY STRUCTURE AND SPATIAL DISTRIBUTION PATTERNS OF KIMA (TRIDACNIDAE) IN CORAL REEFS IN SEPA THOUSAND ISLANDS

Puteri Emya Q[1], Indah Riyantini[2], Yudi N. Ihsan[2], Herman Hamdani[2]

[1]Student of Fisheries, Faculty of Fisheries and Marine Sciene, Universitas Padjadjaran, Indonesia
[2]Lecture of Fisheries, Faculty of Fisheries and Marine Sciene, Universitas Padjadjaran, Indonesia

ABSTRACT

This research aims to obtain the community structure and spatial distribution patterns of clams and to obtain the relationship between clams and the condition of coral reefs in the waters of Sepa Island, Seribu Islands. This research was conducted from October – March 2020 and field data collection in January 2020 at 4 stations based on different depths and located in the waters of the East, South, West, and North Sepa Island using a survey method. Coral reef data retrieval using the LIT method and chemical observations using a belt transect. The results showed that in the waters of Sepa Island, 24 individuals from 4 species of the bivalve class were found, namely Tridacna squamosa, Tridacna maxima, Tridacna crocea, Hippopus hippopus. The highest relative abundance of clams was found at the north station, which was 21% and the lowest relative abundance was at the south station, which was only 4%. The chemical diversity index at the four stations was obtained in the medium category, which ranged from 1,054 – 1,386 and the uniformity index at the four stations ranged from 0.635 – 1,000, which means high population uniformity. The spatial distribution pattern of chemistry at the four stations was uniform, ranging from 0.17 to 0.81. The relationship between clams and coral reefs is 0.784, which means that clams have a strong relationship with the condition of coral reefs.

Keywords: Community Structure, Distribution Pattern, Tridacnidae, Coral Reef

1. INTRODUCTION

Kima is a member of the class bivalves, phylum molluscs. This animal has two genera, namely Tridacna and Hippopus which consists of nine species in the world while seven species of which can be found in Indonesian waters, namely T. gigas, T. swifta, T. squamosa, T. maxima, T. crocea, Hippopus hippopus, and H. porcellanus (Lucas, 1988; Pasaribu, 1988; Ambariyanto, 2009).
Kima is known to have important economic value because apart from being a source of food, its shell can be used as decoration material. In addition, clams are sought after by many people for jewelry so that the population is decreasing (Nontji, 2002). This makes its existence threatened in nature. Therefore, clams are one of the protected marine animals throughout the world, including in Indonesia. Since 1983 CITES (Convention on International Trade In Endangered Species) classifies clams as protected marine biota and is followed up by the Decree of the Minister of Forestry No. 12 of 1987. This determination is based on the fact that the clam population in nature has greatly decreased, mainly due to human use (Ambariyanto, 2007).

Kima plays an important role in coral reef ecosystems in maintaining the balance of the ecosystem (Neo, et al. 2013). This is because the clam mantle becomes a good substrate for zooxanthellae to grow which can later supply oxygen for coral reef growth. The distribution of clams (Tridacnidae) in depth affects their shape and size, in deeper waters clams have a smaller size than those living in shallow waters (Niartiningsih, et al., 2008). The presence of clam groups with high abundance can be influenced by the condition or quality of coral reefs as their habitat (Marsuki, et al., 2012).

Coral reef ecosystems have an important role in the productivity and high diversity of biota species (Sukmara, et al., 2001). Coral reefs are an ecosystem that supports the life of various types of living things that exist around coral reefs. Coral reefs function as natural fortifications to protect the coast from the waves so that there is no beach abrasion, shelter, shelter, foraging and spawning fish and other marine biota.

The decline in the number of clams was getting higher in the waters of the Thousand Islands National Park, especially on Sepa Island. The Thousand Islands Marine National Park (TNLKpS) is a nature conservation area in Indonesia, located in the north of Jakarta. The reason this happens is because the habits of the people around the Thousand Islands National Park take and use it illegally. Kima is known as one of the most important export commodities from various countries (Tisdell et al., 1994). The Thousand Islands region, especially in the waters of Sepa Island, there is not much information about clams. For this reason, research is needed as an effort that can enrich information on the abundance and diversity of clams as well as spatial distribution patterns on coral reefs that act as their habitats.

2. MATERIALS AND METHODS

This research is planned from October 2019 to March 2020. The research location is in the waters of Sepa Island, Thousand Islands Marine National Park, DKI Jakarta. Data collection was carried out in the waters of Sepa Island determined at 4 observation station locations.

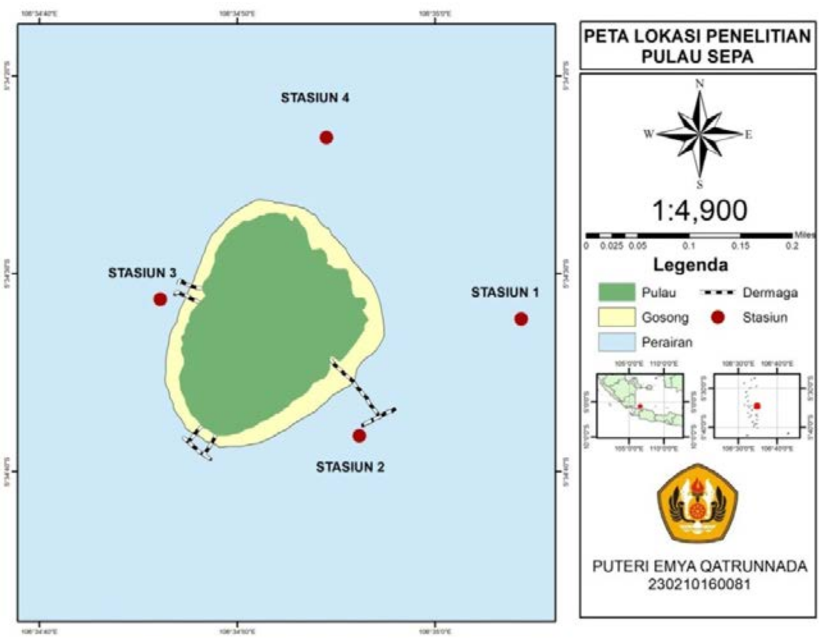

Figure 1. Research Area Map

The research method in the form of a survey method was carried out with a sampling technique using purposive random sampling (Sugiyono, 2012). The data obtained included clam data (Tridacnidae), coral reef data and water quality data, from 4 observation stations covering the percentage of coral reef cover, community structure and distribution pattern of clams, and the correlation of clams with coral reef conditions which were processed by analyzing data.

There are 5 stages in this study, namely the preparation stage, the stage of determining the research station, the stage of measuring the physico-chemical parameters of the waters, the stage of observing the structure of the clam community and the stage of observing coral reefs and then analyzing the data.

The preparatory phase includes a literature study by searching for literature from journals and theses, as well as collecting research data on coral reefs and clams. The preparatory stage is carried out to enrich knowledge and the latest developments regarding chemical research. The preparatory stage in research includes the preparation of a list of tools and materials needed for research, and a survey is carried out to determine the observation station.

The stage of determining the research station is determined by purposive sampling, this technique is one of the sampling techniques using certain considerations (Sugiyono, 2012). In this research, 4 stations were selected. Each station consists of 2 plots based on the difference in depth, namely 3 meters and 9 meters.

The measurement of the physico-chemical parameters of the waters is carried out by measuring in situ (directly on the spot) at each observation station. The physical-chemical parameter data includes water temperature data using a thermometer, brightness using a sechi disk, salinity using a refractometer, and water acidity (pH) using a pH meter.

The stage of observing the clam community structure was carried out using the Belt Transect method, this method used a 50 m long transect and 1 meter distance to the right and left. The Belt Transect method used can describe the condition of the population of a biota that has a relatively diverse size or has a certain maximum size such as coral reefs and clams.

The coral cover observation stage was carried out using the Line Intercept Transect (LIT) method. The Line Intercept Transect (LIT) method is carried out by pulling a Line Transect 50 m long, stretched parallel to the shoreline, at a depth of 3 m and 9 m. Coral reef components recorded in this method are based on coral lifeforms in centimeters. Observations and data collection were carried out by observing the percentage of live coral cover, dead coral, other biota, and other abiotic components.

Analysis Data from the field was then collected, after the data collected were analyzed by calculating the percentage of coral reef cover, calculating the clam community structure consisting of diversity and abundance index, uniformity index, determining the distribution pattern of clams and determining the results of descriptive physico-chemical parameter measurements.
Data analysis in this study was carried out using Bivariate Correlation Analysis with the help of Microsoft Excel program. Bivariate Correlation Analysis was conducted to measure the level of relationship between two variables.

3. RESULT

General Condition of Sepa Island Waters

Sepa Island has a fairly sloping beach, as well as white sand that is quite wide, besides that there are also several gazebos on the beach for tourists and Sepa Island also has 2 piers, namely in the west and in the south. Coral reef ecosystems surround the island which is 100 meters from the shoreline. Sepa Island is not an ordinary island like Tidung Island, Pari Island, Harapan Island and Pramuka Island because Sepa Island is an uninhabited island type and is a private island that is managed very well so that it can be said to have quite complete facilities. Because of its underwater beauty, this island is nicknamed "The Paradise for Diver in Jakarta".

Water Physical and Chemical Parameters

Based on the results of observations at 4 different observation stations in terms of water conditions, density and coral reef cover, data on water conditions were obtained at each observation station, the parameters observed were temperature, salinity, brightness, and pH.

Temperature is a very important factor in regulating life processes and the distribution of marine organisms. The water temperature of Sepa Island in (Table 1) measured at each station has an average of 28.6oC. The temperature range at the research site is still in the normal range and can be tolerated by aquatic biota. According to Rahman (2006), marine biota can tolerate temperatures ranging from 20-35oC. And according to Sastry, 1963 in Harahap 1987, the average temperature of clam organisms that can live is 28oC. The temperature at each station varies with the lowest value at the east station, which is 28.5oC, while the highest value is at the west station, which is 28.8oC. This temperature difference is due to the time difference at the time of measurement which is influenced by the intensity of the light that occurs, the higher the day and the higher the light intensity, the higher the water temperature will be.

Table 1. Physical and Chemical Parameters of Waters

Stasiun	Suhu (^{o}C)	Salinitas (ppt)	pH	Kecerahan (%)
Timur	28.5	30	8	100%
Selatan	28.7	30	8	100%
Barat	28.8	31	8	100%
Utara	28.7	30	8	100%

The results of salinity measurements at the research site showed that the salinity of the waters of Sepa Island ranged from 30-31 ppt. The salinity at these four stations was considered good for chemical growth. This is like the opinion of Jameson (1976) which states that a good salinity for clams is 25-40 ppt.

This salinity value also shows that this area has good conditions. At this salinity value, coral reef ecosystems can grow optimally. Seawater salinity has an important factor in the distribution of marine biota. This is supported by the opinion of Hutabarat and Evans (1985), who stated that the salinity of seawater affects the distribution of benthic animals such as bivalves, because marine organisms can only tolerate small and slow changes in salinity.
Based on (Table 1), the results of the measurement of brightness in the waters of Sepa Island, the brightness of the waters is 100%. Brightness is one of the important factors that greatly influences the survival of clams because it is related to the life of clam symbionts, namely zooxanthella which require sunlight for the photosynthesis process. Then, it was clarified by Romimohtarto et al., (1987) in Niartiningsih (2012) who said that zooxanthella need light for photosynthesis to take place, so clams need shallow and clear waters. Based on the Decree of the Minister of Environment for marine biota, the brightness of Sepa Island has met the requirements for a good life of biota.

The pH value of a waters cannot be separated from the various activities that occur in the waters. The results of measurements (Table 1) of the degree of acidity (pH) at the research site found that the pH at each station was 8. According to Hart and Fuller (1974) bivalves live in the pH range of 5.8 – 8.3. The pH values <5 and >9 create unfavorable conditions for most macrobenthos organisms.

Condition of Coral Reefs on Sepa Island

The condition of coral reefs in the waters of Sepa Island is represented by the percentage of live and dead coral cover. Based on (Figure 2), the highest live coral cover was at station 4, namely north at a depth of 3 meters with a value of 56.90% and the lowest live coral cover was at station 2, namely south at a depth of 9 meters with a value of 22.32%. The percentage of coral reef cover can be seen in Figure 2.

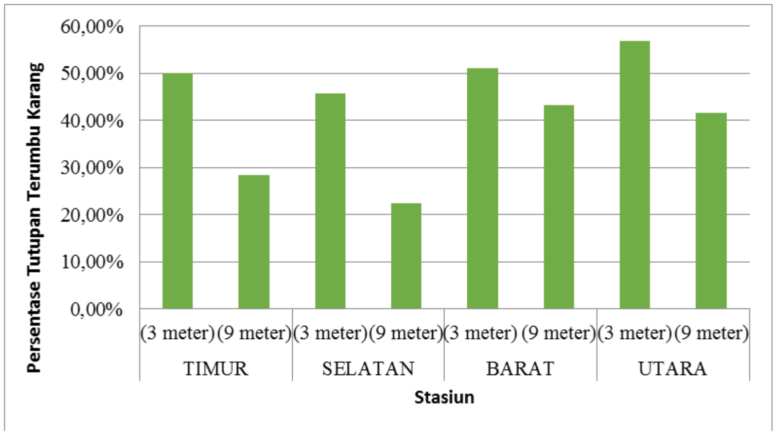

Figure 2. Percentage of coral reef cover

Referring to Decree of the Minister of Environment No. 51 of 2004 concerning sea water quality standards for marine biota, Sepa Island waters have water conditions that are suitable for living and developing coral reefs. The difference in the condition of coralreefs at each station is due to other factors such as boat berths, ecotourism sites and human activities.

The percentage value of live coral cover at station 1 which is east at a depth of 3 meters is 50.02% and is in good condition, while at a depth of 9 meters it is 28.44% and is in the medium category, for station 2 which is south at a depth of 3 meters the percentage value of coral cover is live coral is 45.66% and is in the medium category, while at a depth of 9 meters it is 22.32% and is included in the damaged category, for station 3, namely west at a depth of 3 meters, the percentage value of live coral cover is 51.14% and is in the good category, while at 9 meters is 43.22% and is in the medium category, as well as the percentage of live coral cover at station 4 at a depth of 3 meters is 56.90% and is in the good category, while at a depth of 9 meters it is 41.66% and is in the medium category.

The condition of coral reefs at station 4 in the northern part of Sepa Island at a depth of 3 meters is the best among all stations, presumably due to the infrequent tourism activities, both diving and snorkeling and the absence of human activities carried out there. Meanwhile, station 2 in the southern part of Sepa Island at a depth of 9 meters is the worst among all stations. The amount of coral damage that occurred was caused by several factors, one of which was human activities, either directly or indirectly. In the southern part of Sepa Island, it is an ecotourism place that has a lot of human activities and is the most popular diving spot in the waters of Sepa Island. Human factors apparently affect coral growth at the research site. This is also supported by the opinion of Suharsono (1996) that there are still many human activities on coral reefs which result in coral reefs being destroyed or broken.

Kima Community Structure

Kima Abundance

Referring to the Minister of Environment Decree No. 51 of 2004, it is known that the results of physical and chemical observations of sea water in the waters of Sepa Island have conditions suitable for the life and development of clams. The abundance of each type of clam in observations can be seen in Figure 3

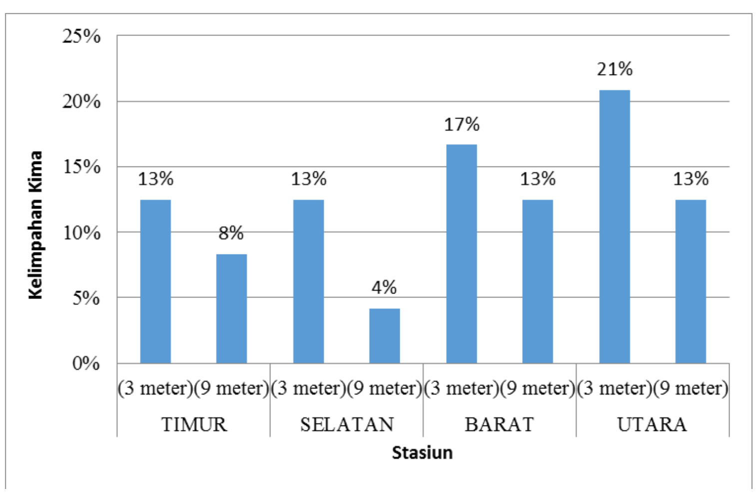

Figure 3. Relative abundance of chemical species

The figure above shows the relative abundance of clams found at the four stations based on differences in depth. The high-est total relative abundance is found at the north station at a depth of 3 meters, which is 21% and the lowest relative abundance is at the south station, which is only 4%.

In general, the clams found in the waters of Sepa Island live on massive coral substrates, both living and dead, as well as rock substrates. And the clams found at the four stations based on the difference in depth were more found at a depth of 3 meters compared to a depth of 9 meters. This happens because at a depth of 3 meters the sunlight is still very sufficient to reach the bottom of the waters, while at a depth of 9 meters the sunlight is decreasing. This is supported by the statement of Rosewater (1965) which states that sunlight is very important for the photosynthesis of zooxanthellae which is very useful for clams.

At the four observation stations based on differences in depth, it can be seen that T. crocea and T. maxima are the most abundant species compared to other species. The high abundance of T. crocea and T. maxima was due to the fact that both types of clams lived by immersing themselves in coral reefs, making it difficult for people to take both types of clams for use. T. crocea and T. maxima were found attached to rock substrates with all their shells immersed in the hard substrate, namely massive corals and rocks. This is also supported by Yusuf et al., (2009) and Hermawan (2011) who stated that T. maxima mostly lives on rock substrates, however this type of clam can also be found on massive coral substrates and dead corals. Panggabean (1991) also said that T. crocea is a small clam that requires a hard substrate to sink its shell.

T. squamosa is a type of clam with the lowest relative abundance level, which is only 4%. This is supported by the statement by Nugroho and Ambriyanto (2001) that in general research results report that clam populations in nature are dominated by small species such as T. crocea and T. maxima, while large species such as T. swifta, T. squamosa, H. hippopus and H. porcellanus are very rare.

Chemical Diversity and Uniformity

Based on data analysis, it is known that the diversity index in the waters of Sepa Island is obtained in the medium category (1<H'<3) and the uniformity index is obtained in the high category (E> 0.6).

Based on the research results, the index of chemical diversity and uniformity at the four stations obtained varied results. The diversity and uniformity of chemistry in the waters of Sepa Island can be seen in Figure 4.

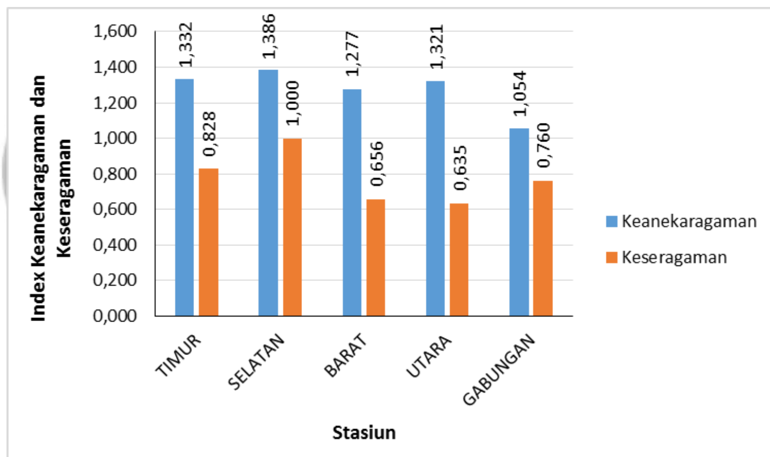

Figure 4. Chemical diversity and uniformity in the waters of Sepa Island

The diversity index at the four observation stations ranges from 1,054 – 1,386, which means the diversity index is in the medium category. This condition indicates that the productivity is quite high, the ecosystem condition is balanced, and the ecological pressure is moderate. Diversity index can be interpreted as a systematic depiction that describes the structure of the community and can facilitate the process of analyzing information about the types and numbers of organisms. The more species found, the greater the diversity, although this value is highly dependent on the number of individuals of each species (Wilhm and Doris 1986). This opinion is also supported by Krebs (1985), who stated that the more the number of individuals and evenly distributed, the higher the diversity index.

Meanwhile, the uniformity index at the four observation stations ranged from 0.635 to 1,000, which means the population uniformity is high. According to Lind (1979) in Amin (2008) the uniformity index is close to one, the community is in a stable state and the number of individuals between species is the same. In addition, the diversity and uniformity of biota in a waters is highly dependent on the number of species in the community.

The results of research conducted in the waters of Sepa Island found 4 types of clams, namely T. squamosa, T. crocea, T. maxima, and H. Hippopus. T. squamosa found in the waters of Sepa Island has a blackish brown coat with a mixture of white spots. These clams were found only at the south station and numbered one individual. T. maxima found in the waters of Sepa Island has a colorful coat. T. maxima was found as many as 9 individuals and lived on rock substrates. These clams are found at the east, west and north stations. T. crocea is found in striking and beautiful coat colors. T. crocea were found as many as 12 individuals and live on massive coral substrates and rock substrates. This clam has the most abundant population. This is evidenced by the discovery of this type of

Kima at the four observation stations namely east, south, west and north. H. hipoppus found in the waters of Sepa Island has a brown and faded gray shell. The clams of this species were found as many as 2 individuals and live on massive corals and rock substrates. These clams are found at the south and north stations. Distribution Pattern of Kima (Tridacnidae) To determine the spatial distribution pattern of clams in the observation location of the waters of Sepa Island, the morisita index was calculated. Based on the results of calculations using the Morisita Index, the distribution pattern of clams on Sepa Island is uniform. The chemical distribution pattern data can be seen in Table 4.

Table 4. Chemical distribution pattern

Stasiun	Indeks Morisita	Pola Distribusi
Timur	0.28	Seragam
Selatan	0.17	Seragam
Barat	0.60	Seragam
Utara	0.81	Seragam

Based on the results above (Table 4), the highest Morisita Index value is at the North station with a value of 0.81 and the lowest value is at the South station with a value of 0.17. The results of the calculation of the morbidity index at each station show a uniform distribution pattern. At the four stations the results of the calculation of the morisita index were less than one which indicated that the distribution pattern of the chemical at that location was uniform. This happens due to the availability of space for preferred habitat conditions so as to encourage each species to seek their own habitat or food. This is supported by Odum (1971) which states that a uniform distribution pattern will occur if the level of competition between individuals is the same or there is a positive antagonistic relationship that supports spatial distribution.

The uniformity of the clams at the four stations is most likely influenced by the substrate they live in and the supply of sunlight. Suin (2002) states that the physical and chemical factors that are almost evenly distributed in a habitat and the availability of food for the animals that live in it will determine the animal to live in groups, randomly or uniformly.

According to Krebs (2003), the pattern of distribution is determined by the natural nature of the individual itself, namely genetic characteristics and preferences in choosing habitats as well as the interaction of several other factors, namely the distribution of food in space and time, as well as competition in the utilization of habitat resources. due to the adverse effects of environmental conditions.

The Relationship of Kima (Tridacnidae) with Coral Reefs

The results of the correlation analysis of clam abundance with the percentage of coral reef cover in the waters of Sepa Island obtained from all transects of 0.784, which means that clams have a strong relationship with coral reef conditions (Table 5) and show a positive relationship. And the magnitude of the influence of the presence of clams on live coral cover can be seen from the value of the coefficient of determination obtained from the calculation by the value (R square) of 0.6148 or 61.48%, which means that the presence of clams is influenced by coral reef cover, 38.52% the influence of other factors. Correlation percentage of coral reef cover and clam abundance can be seen in Figure 6.

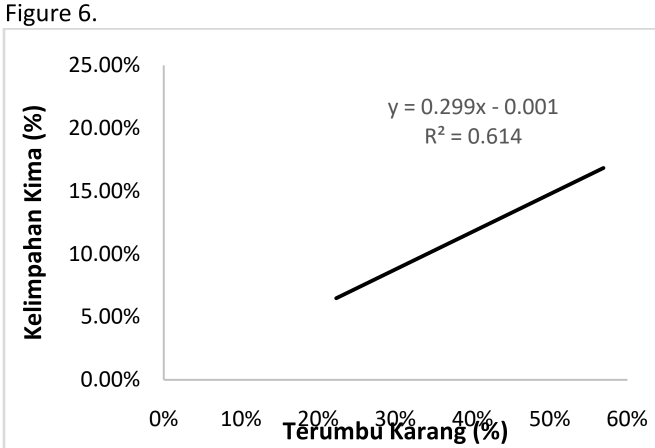

Figure 6. Correlation of coral reef cover and chemical abundance

According to Astuti (2017), the value of the correlation coefficient (r) is positive, meaning that there is a relationship between X and Y variables that is directly proportional. The increase in variable X, the value of variable Y will also increase (Figure 18). The results of the correlation analysis obtained are that they have a very strong relationship (Appendix 6), this is supported by the statement of Neo (2013) which states that clams play an important role in coral reef ecosystems in maintaining ecosystem balance and clams are one of the keystone species for coral reefs. coral reef communities, therefore clams have a directly proportional relationship with coral reefs.

The decline in clam populations can be caused by habitat damage caused by clam hunting techniques that damage coral reefs. Several types of clams live attached to the coral substrate and stuck among living corals, there are even clam species that immerse themselves in the coral. For the removal of clams that live attached to corals, it is usually done by damaging the corals by using a crowbar or iron picker so that the corals will break and be damaged. If this continues, the coral damage will become more severe and the clam population will automatically decrease.

REFERENCES

Ambariyanto. 2007. Pengelolaan Kima di Indonesia: Menuju Budidaya Berbasis Konservasi. Seminar Nasional Moluska: dalam Penelitian, Konservasi dan Ekonomi Jurusan Ilmu Kelautan, FIKP UNDIP, Semarang, 17 Juli 2007.

Campbell, N. A. & J. B. Reece. (2010). 3. Biologi, Edisi Kedelapan Jilid 3 Terjemahan: Damaring Tyas Wulandari. Jakarta: Erlangga.

Hernawan, U.E. 2011. Taxonomy of Indonesian Giant Clams (Cardiidae, Tridacninae). Bonorowo Wetlands.

Neo, M. L., P. A. Todd, S. L.-M. Teo and L. M. Chou. (2009). Can artificial substrates enriched with crustose coralline algae enhance larval settlement and recruitmentin the fluted giant clam *(Tridacna squamosa)*. *Hydrobiologia*. 625:83–90

Neo, M.L. And P.A. Todd. 2013. Conservation Status Reassessment of Giant Clams *(Mollusca: Bivalvia: Tridacninae)* In Singapore Nature In Singapore. National Universiy of Singaore. 6 : 125-13

Niartiningsih, A. 2012. Kima, Biota Laut Langka: Budidaya dan Konservasinya, Identitas Universitas Hasanuddin, Makassar.

Nontji, A. 2002. Laut Nusantara. Djambatan. Jakarta.

Marsuki, I.D., Baru, S., Ratna, D.P. 2012. Kondisi Terumbu Karang dan Kelimpahan Kima di Perairan Pulau Indo. Universitas Haluoleo. Jurnal Mina Laut Indonesia. Kendari.

Niartiningsih, A., Maghdalena, L., Emma, S., Idris, P. 2008. Pemeliharaan Juvenil Kima Sisik *(Tridacna squamosa)* dan lola *(Trochus niloticus)* Secara Monokultur dan Polikultur Pada Kedalaman Berbeda Di Perairan Pulau Badi Kabupaten Pangkep. Program Rehabilitasi dan Pengelolaan Terumbu Karang COREMAP II. Jakarta Selatan.

Romimohtarto, K., Pardomuan, S., M.G. Lily Panggabean, Sutomo. 1987. KIMA Bilogi, Sumberdaya dan Kelestariannya. Pusat Penelitian Dan Pengembangan Oseanologi-LIPI. Jakarta.

Sugiyono. (2013). Metode Penelitian Kuantitatif, Kualitatif dan R&D. Bandung: Alfabeta.CV

Suharsono,1996. Jenis-Jenis Karang yang Umum Dijumpai Di Perairan Indonesia. P3O-LIPI. Jakarta, 116 hlm.

Tisdell, C., Shang, Y.C., Leung, P. (1994). Economics of Commercial Giant Clam Mariculture. ACIAR Monograph 25. 306 p.

Usher, G.F. 1984. Coral reef invertebrates in Indonesia their exploitation and conservation needs. Rep. IUCN/WWF Project 1688. Bogor IV.: 100.