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Review of Coral Reefs Conditions for the Development of District Object in Wangi-Wangi Island, Wakatobi District, Central Sulawesi, Indonesia

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----------*ABSTRACT*----------
Coral reefs in Indonesia are very beautiful, unique and complex ecosystems and are a place to live diverse marine life. Wakatobi, is an acronym for the names of four large islands in the southeastern Sulawesi, namely Wangi-wangi, Kaledupa, Tomia, and Binongko, which become an attractive national park with a total area of 1.39 million ha. This study uses primary and secondary data. Primary data collection uses the Line Intercept Transect (LIT) method to determine coral reef cover, and the Underwater Fish Visual Cencus (UVC) method to find out the types of fish associated with coral reefs. Observation of the condition of coral reefs and reef fish was carried out in shallow waters of 3-6 m at ten observation station points. Fragrant Fragrant on. At station 1, station 2, station 3, station 8, and station 10 are included in the S2 category, which is quite suitable for marine tourism. . The Uniformity Index (E) at the base of the water station 1 to station 10 is in the range of 0.83 - 0.91 indicating good uniformity, good uniformity or in other sense the coral architecture here is quite good. The Domination Index (C) on the base of stations 1 to 10 is between 0.09 - 0.14% indicating that there is no colony that dominates the area, in this case there is no dominating coral at the bottom of this observation station. While for station 4, station 5, station 6, station 7, and station 9, are included in the category S1 which is very suitable for coastal tourism.

KEYWORDS: *Coral Reefs, Reef fish, Marine Tourism*

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I. BACKGROUND

Indonesian coral reefs have 70 to 80 genera which are relatively high, and are estimated to have 450 species. Bryant, et all (1998) in Saad (2011) added that the area of coral reefs, about 16% of the total area of coral reefs in the world and consists of 70 genera and more than 500 species of coral, as well as the center of world biodiversity. The condition of coral reefs in Indonesia is currently experiencing a very heavy pressure, due to the use of activities that are not friendly to the environment. This can be seen from the results of research conducted by P2O LIPI (2002) about the condition of coral reefs. Of the 416 locations in 43 regions spread across Indonesian waters, only 6.49% were in very good condition, 24.28% were in good condition, and 28.61% were in moderate condition, and 40.62% were in bad condition (Direktorat Konservasi dan Taman Nasional Laut, 2006).

One type of biota that lives in coral reef waters is coral fish. Diverse species of reef fish are used as consumption fish and ornamental fish. Coral fish is one of the high-value fisheries commodities. Thousands of Indonesian fishermen depend their lives on the wealth of fish that live on coral reefs so that coral fishing often occurs on a large scale using cyanide and bombs. Coral reefs are habitats that are sensitive to fishing operations (Damayanti, 2005).

Wakatobi Regency has a land area of ± 823 km² or only about 4.3 percent of the total Wakatobi Regency Area as a whole, the rest is the area of sea waters which covers ± 19,200 km². Wakatobi Regency consists of 8 Subdistricts namely Binongko, Togo Binongko, Tomia, East Tomia, Kaledupa, South Kaledupa, Wangi-wangi, and South Wangi-wangi.

According to Wakatobi Coral Reef Rehabilitation and Management Program II (COREMAP II) (2009), the Wakatobi Islands have four large islands, 35 small islands, 3 charred islands, and 5 atolls. Wakatobi Islands with TNW area is an area that has a very high diversity of coral reefs. This is because Wakatobi is at the center of the world's coral triangle, even this group of coral reefs is located in the Heart of the World Coral Triangle. Based on the results of Landsat Satellite Imagery in 2003, it is known that the area of coral reefs in the Wakatobi Islands is around 54,500 ha.

The types of coral reefs in TNW that have been recorded are 396 types of hard corals, 28 genera of soft corals and 31 species of mushroom corals, 590 species of fish (Balai TNW 2008). While the results of the

identification of types of coral reefs in Kapota Waters conducted by the Office of TNW in 2009, there were 25 types of coral reefs. Of these, as many as 23 species including hard corals (Acropora) and 2 types including soft corals (Non Acropora).

Marine tourism is an activity that requires security, certainty, friendly service, supporting culture and so on. So that in the end the development of tourism really provides added value and initiative of local community awareness of the importance of resource conservation (Suharsono, 2010).

II. METHODOLOGY

This research was conducted on September 1 - November 20, 2013, located in the waters of Wakatobi National Park, Wangi-Wangi Island, Wakatobi Regency, Southeast Sulawesi. Primary data were obtained by using a survey method that is first snorkeling in Wangi-Wangi Island in order to determine the observation station to be taken. There are 10 stations that have been determined as observation locations. Of the 10 predetermined stations, it is estimated to represent the condition of coral reefs in the waters of Wangi-Wangi Island, Matahora Island and Kamponaone Island. Observations were made at a depth of 6 meters. For secondary data obtained from data related institutions such as Wakatobi National Park, Wakatobi COREMAP II, Wakatobi Central Statistics Agency (BPS), and literature studies.

Observation station coordinates:

1. Station I (Waha) is located at 05º 15' 20.74" South Latitude and 123º 31' 12.99" East Longitude.
2. Station II (Waetuno) is located at 05º 14' 51.11" South Latitude and 123º 34' 46.79" East Longitude.
3. Station III (Patuno) is located at 05º 15' 54.39" South Latitude and 123º 37' 33.61" East Longitude.
4. Station IV (Matahora) is located at 05º 19' 20.74" South Latitude and 123º 38' 53.69" East Longitude.
5. Station V (Liya Mawi) is located at 05º 25' 54.31" South Latitude and 123º 35' 55.09" East Longitude.
6. Station VI (Liya Bahari Indah) is located at 05º 23' 22.07" South Latitude and 123º 32' 49.50" East Longitude.
7. Station VII (North Kapota) is located at 05º 20' 24.08" South Latitude and 123º 27' 25.61" East Longitude.
8. Station VIII (Kapota) is located at 05º 19' 53.00" South Latitude and 123º 29' 57.77" East Longitude.
9. Station IX (Wandoka) is located at 05º 18' 45.17" South Latitude and 123º 31' 26.15" East Longitude.
10. Station X (Wisata Kollo) is located at 05º 23' 13.74" South Latitude and 123º 32' 47.83" East Longitude.

Figure 1. Position of Wangi-wangi Island Observation Station

Observation of the Condition of Coral Reefs

The method used to determine the condition of coral reefs is the Line Intercept Transect method. The trick is to spread 2 transect lines along 50 meters parallel to the coastline at a depth of 6 meters with the interval of each transect being 10 meters. For practical purposes the roller meter is stretched along 100 meters, then the 1st transect is determined from point 0 to point 20 meters, and given an interval of 10 meters, the second transect starts from the point 30 meters to the point 50 meters, and given an interval with the distance 10 meters and the 3rd transect starting from 60 meters to 80 meters (Direktorat Konservasi Kawasan dan Jenis Ikan, 2010).

All forms of coral growth and other biota below the transect line are recorded in centimeter (cm) accuracy. The results of the recording are then transferred to the life form table format. Retrieval of coral cover data is carried out in locations that are often visited by fishermen in conducting fishing activities.

Observation of Coral Fish

Observation of reef fish using the enumeration method underwater visual census. Quantitative observations and calculations of the number of reef fishes are carried out 5-15 minutes after the transect is placed. Observation of reef fish is carried out during the day when reef fish are generally active.

The observer is carried out by slowly swimming along the transect line and recording the fish found. The observation area of each transect is 20 x (2 x 2.5) or 100 square meters with an observation distance of 2.5 meters to the left and right. The types and abundance of individual reef fishes were observed in each transect. What needs to be considered in observing reef fish is that they should not look back to avoid repetition of the data taken. This reef fish data is recorded on slates in the form of fish species data and their numbers. Fishes observed by this method are fish that meet the following criteria: 1. Species of fish that are visually and numerically dominant, with disguised behavior, 2. Can be easily identified under water, 3. Has related properties with reef slope habitats.

Measurement of Aquatic Environmental Parameters

Temperature

Temperature measurements are carried out using a dive computer at an observation station depth of 6 meters. The dive computer will automatically show the temperature at that depth.

Salinity

Salinity measurements are carried out using a refractometer. The workings of the measurements are as follows: 1) The refractometer is calibrated with fresh water until the blue line that appears on the ocular lens is exactly 00/00. 2) Dripping water to be measured salinity on the prism then closing the prism closed again. 3) The refractometer is faced with the light, then the researcher observes from the lens, 4) The salinity value is indicated by a horizontal blue line that will point to a value in units of ‰. 5) After completion of use, the appliance must be washed with fresh water.

Brightness

Measurements were made using a Secchi disk with a 12 meter string length. The workings of the measurements are as follows: 1) The Secchi disk is submerged in the body of water to be investigated 2) The depth of the water at the beginning of the Secchi disk is lost from sight is recorded, 3) The Secchi disk is pulled up, then recorded on the size to how much the Secchi disk is starting looked. 4) The water brightness is the average result of the total depth when the Secchi disk starts to disappear and the Secchi disk starts to appear.

Water Flow Speed

Flow velocity measurements are carried out using a window shade drogue with a length of 5 meters. The speed of the water flow is the quotient of the length of the window shade drogue rope with the time required until the rope is tense. How to measure the current can be done as follows: 1) Insert the window shade drogue into the waters, 2) Turn on the stop watch once the tool is immersed in the water, 3) Turn off the stop watch when the window shade drogue stretches tight or stiffens along 5 meters.

Data Analysis

Percentage of Coral Cover

Percent of coral cover is based on the category and percentage of live corals and dead corals. The higher the percentage of live coral cover the better the condition of the coral reef ecosystem and the more important it is to protect. The percent data of live coral cover obtained based on the Linear Intercept Transect (LIT) method calculated based on the English et al. (1997) equation in Terangi (2009) is as follows:

$$\mathbf{Ni = Ii / L \times 100\%}$$
$$\mathbf{N = \sum Ni}$$

Where, Ni is the percent cover of the i-type life form coral, Ii is the length of interception of the i-type life form, L is the length of the transect line (50 m), N is the percent of live coral cover. The condition of coral reef ecosystems is determined based on the percentage of live rock cover with CRITIC-COREMAP LIPI (2010) criteria based on Gomez and Yap (1999) as follows: 1) **Damaged** if the percent of live coral cover is between **0-24.9%**, 2) **Medium** if percent of live coral cover between **25-49.9%**, 3) **Good** if percent of live coral cover is between **50-74.9%**, 4) **Very good** if percent of live coral cover is between **75-100%**. Indicators of coral reef health can consist of: physical ecological conditions of coral reefs (in the form of percent live coral cover) and biota associated with coral reefs, namely: 1) Biota populations associated with coral reefs (megabentos), 2) Coral reef fish populations consists of target fish, indicator fish and major fish.

Abundance of Coral Fish

Fish abundance is the number of fish found in a broad union of transects. According to Odum (1993) in Tia (2010), coral fish abundance is calculated using the formula:

$$Xi = xi / n$$

With Xi being the abundance of i-th species fish, xi is the number of i-th species fish, n is the area of observation transect area.

III. RESULTS AND DISCUSSION

Based on visual observations, coral reefs in Wakatobi are fringing reefs, scorched reefs, patch reefs and atolls. The average reef has a width that varies between 50 meters to 1.5 km for fringing reefs. Almost all of them are in reef condition with steep reef slope. The coral that lives in Wakatobi reaches a depth of more than 40 meters. Percentage of coral reefs will be presented as follows:

Percentage of Live Coral Cover and at the Bottom of Water at Each Station

The percentage of live coral cover at station 1 was 73.55%, station 2 was 61.93%, station 3 was 69.1%, station 4 was 67.85%, station 5 was 67.7 station 6 was 53.56 stations 7 at 69.42 station 8 at 55.6 station 9 67.08% station 10 at 59.63. These ten stations are classified in both categories based on criteria (Gomez and Yap, 1988 in Terangi, 2009).

Percentage of Live Coral at Each Station

Station 1 (Waha)

The percentage of coral cover at the first station is 73.55% which can be classified in either category based on criteria (Gomez and Yap, 1988 in Terangi, 2009). The largest groups covering the substrate in a row were the living coral group at 61.53% which consisted of 1.5% branching Acropora, 7.54% encrusting acropora, 5.25% submasive Acropora, 3.62% Coral brenching, Coral heliopora 3.3% Coral massive 14.55%, coral mushroom 1.65%. Coral sub massive 5.23% and Soft Coral 30.45%. At station 1, the highest percentage of live corals was Coral massive 14.55%, and coral mass 14.55%. This is because station 1 has a brightness of 100% which according to Supriharyono (2000) that the amount of sunlight received by a coral reef is positively correlated with the growth of the coral reef. So it can be concluded that the more rays received by the coral reef, the better the growth rate of the coral reef. Dead coral group was 11.44% which consisted of Dead coral 0.42%, Dead coral with algae 11.02%. At station 1 the highest percentage of dead coral DCA (Dead coral with algae) was 11.02%. The algae group was 0.55%, consisting of Coralline algae 0.55%. The abiotic component group is 14.12% which consists of rubble (coral fragments) 10.07% and sand (sand) 2.22%.

Station 2 (Waetuno)

The percentage of coral cover at station two is 61.93% which can be classified in either category based on criteria (Gomez and Yap, 1988 in Terangi, 2009). The largest group that covered the substrate in a row were the living coral group at 61.93% which consisted of 2.5% branching Acropora, 9.72% encrusting acropora, 11.79% Acropora submasive, Acropora Digitate 0.9%, Coral brenching 0.95%, Coral heliopora 3.4% Coral massive 4.68%, coral mushroom 1.65%. Coral sub massive 4.42% and soft coral 19.13. At station 2 the highest percentage of live coral was Acropora submasive 11.79%, and Acropora encrusting 9.72%. This is in line with the statement of Rahman (2007) that the regions that have good water circulation and areas that experience high water pressure (hydrodynamic) tend to have growth forms in the form of massive colonies. The group of dead coral was 38.07% which consisted of Dead coral 0.72%, Dead coral with algae 17.82%. At station 2 the highest percentage of dead coral DCA (Dead coral with algae) was 11.02%. The other group was 3.25% which consisted of sponges by 0.35% and the other by 2.85%. The abiotic component group is 16.31% which consists of rubble (coral fragments) 16.31%.

Station 3 (Patuno)

The percentage of coral cover at station three is 69.1% which can be classified in either category based on criteria (Gomez and Yap, 1988 in Terangi, 2009). The largest group covering the substrate in a row was the live coral group of 69.1% consisting of Acropora branching 5.75%, Acropora encrusting 3.78%, Acropora submasive 13.43%, Acropora Digitate 1.39%, Coral brenching 5.58%, Coral heliopora 1.78% Coral massive 3.33%, coral mushroom 0.97%. Coral sub massive 5.1% and soft coral 21.82%. At station 3 the highest percentage of live coral was Acropora submasive 13.43%, and coral encrusting 6.17%. Dead coral group was 19.28% which consisted of Dead coral with algae 19.28%. At station 3 the highest percentage of dead corals was DCA (Dead coral with algae) 19.28%. The other group was 2.85%, consisting of sponge 0.95% and the

other group was 1.68%. The abiotic component group was 8.1% consisting of rubble (coral fragments) 7.85% and sand by 0.9%.

Station 4 (Matahora)

The percentage of coral cover at station four is 67.85% which can be classified in either category based on criteria (Gomez and Yap, 1988 in Terangi, 2009). The largest groups covering the substrate in a row were the living coral group at 67.85% consisting of Acropora branching 15.1%, Acropora encrusting 8.6%, Acropora submasive 11.58%, Acropora Digitate 1.58%, Coral brenching 2%, Coral heliopora 5.13% Coral massive 2.68%, coral mushroom 0.38%. Coral sub massive 3.12% and Soft coral 10.12%. At station 4 the highest percentage of live coral was Acropora branching 15.1% and Acropora submasive 6.17%. This is because at station one has 100% brightness which according to Supriharyono (2000) that the amount of sunlight received by a coral reef is positively correlated with the growth of the coral reef. So it can be concluded that the more rays received by the coral reef, the better the growth rate of the coral reef. Dead coral group was 26.71% which consisted of Dead coral with algae 26.15% and Dead Coral 0.59%. At station 4 the highest percentage of dead coral DCA (Dead coral with algae) was 26.71%. Other groups by 0.77% consisting of sponges by 0.77%. Abiotic component group by 4.5% consisting of rubble (coral fragments) 4.5%.

Station 5 (Liya Mawi)

The percentage of coral cover at station five is 67.7% which can be classified in either category based on criteria (Gomez and Yap, 1988 in Terangi, 2009). The largest groups covering the substrate in a row were the living coral group of 67.7% consisting of Acropora branching 2.17%, Acropora encrusting 5.02%, Acropora submasive 24.1%, Acropora Digitate 2.53%, Coral brenching 2.38%, Coral encrusting 8% Coral heliopora 0.92% Coral massive 2.07%, coral mushroom 0.17%. Coral sub massive 1.13% and soft coral 19.22%. At station 5 the highest percentage of live coral was Acropora submasive 24.1%, and coral encrusting 8%. This is in line with the statement of Rahman (2007) that the regions that have good water circulation and areas that experience high water pressure (hydrodynamic) tend to have growth forms in the form of massive colonies. Dead coral group was 23.25% which consisted of Dead coral with algae 21.88% and Dead Coral 1.25%. At station 5 the highest percentage of dead coral DCA (Dead coral with algae) was 21.88%. The other group was 3.2% which consisted of sponges by 0.99% and the other by 2.9%. Abiotic component group of 5.8% consisting of rubble (coral fragments) 4.92% and sand by 0.9%.

Station 6 (Liya Bahari Indah)

The percentage of coral cover at station six is 53.57% which can be classified in the medium category based on criteria (Gomez and Yap, 1988 in Terangi, 2009). The largest groups covering the substrate in a row were the living coral group of 53.57% consisting of Acropora branching 9.27%, Acropora encrusting 4.43%, Acropora submasive 8.15%, Acropora Digitate 0.56%, Coral brenching 2.3%, Coral encrusting 3.33% Coral heliopora 2% Coral massive 2.23%, coral mushroom 0.55%. Coral sub massive 5.53% and soft coral 15.2%. At station 6 the highest percentage of live coral was Acropora Branching 24.1%, and Acropora Submasive 8.15%. The highest live corals were Acropora branching 15.1% and Acropora submasive 6.17%. This is because at station one has 100% brightness which according to Supriharyono (2000) that the amount of sunlight received by a coral reef is positively correlated with the growth of the coral reef. So it can be concluded that the more rays received by the coral reef, the better the growth rate of the coral reef. The group of dead coral was 34.5% which consisted of Dead coral with algae 34.5%. At station 6 the highest percentage of dead coral DCA (Dead coral with algae) was 34.5%. The other group was 2.63% which consisted of the other 2.63%. The abiotic component group is 9.3% which consists of rubble (coral fragments) 9.3%.

Station 7 (North Kapota)

The percentage of coral cover at station seven is 69.42% which can be classified in the medium category based on criteria (Gomez and Yap, 1988 in Terangi, 2009). The largest groups covering the substrate in a row were the living coral group at 69.42% consisting of Acropora branching 5.17%, Acropora encrusting 3.95%, Acropora submasive 15.92%, Acropora Digitate 1.29%, Coral brenching 6.67%, Coral encrusting 7.63% Coral heliopora 2.07% Coral massive 3.67%. Coral sub massive 1.6% and soft coral 21.05%. At station 7 the highest percentage of live coral was Acropora Branching 1592%, and Corall Encrusting 7.63%. This is because at station one has 100% brightness which according to Supriharyono (2000) that the amount of sunlight received by a coral reef is positively correlated with the growth of the coral reef. So it can be concluded that the more rays received by the coral reef, the better the growth rate of the coral reef. The group of dead coral was 34.5% which consisted of Dead coral with algae 34.5%. At station 7 the highest percentage of dead coral DCA (Dead coral with algae) was 34.5%. The other group was 2.63% which consisted of the other 2.63%. The abiotic component group is 9.3% which consists of rubble (coral fragments) 9.3%.

Station 8 (Kapota)

The percentage of coral cover at station eight is 53.57% which can be classified in the medium category based on criteria (Gomez and Yap, 1988 in Terangi, 2009). The largest groups covering the substrate in a row were the living coral group of 53.57% consisting of Acropora branching 9.27%, Acropora encrusting 4.43%, Acropora submasive 8.15%, Acropora Digitate 0.56%, Coral brenching 2.3%, Coral encrusting 3.33% Coral heliopora 2% Coral massive 2.23%, coral mushroom 0.55%. Coral sub massive 5.53% and soft coral 15.2%. At station 8 the highest percentage of live coral was Acropora Branching 24.1%, and Acropora Submasive 8.15%. The highest live corals were Acropora branching 15.1% and Acropora submasive 6.17%. This is because at station one has 100% brightness which according to Supriharyono (2000) that the amount of sunlight received by a coral reef is positively correlated with the growth of the coral reef. So it can be concluded that the more rays received by the coral reef, the better the growth rate of the coral reef. The group of dead coral was 34.5% which consisted of Dead coral with algae 34.5%. At station 8 the highest percentage of dead coral was DCA (Dead coral with algae) 34.5%. The other group was 2.63% which consisted of the other 2.63%. The abiotic component group is 9.3% which consists of rubble (coral fragments) 9.3%.

Station 9 (Wandoka)

The percentage of coral cover at station nine is 67.08% which can be classified in the medium category based on criteria (Gomez and Yap, 1988 in Terangi, 2009). The largest groups covering the substrate in a row were the living coral group of 67.08% consisting of Acropora branching 9.27%, Acropora encrusting 4.43%, Acropora submasive 8.15%, Acropora Digitate 0.56%, Coral brenching 2.3%, Coral encrusting 3.33% Coral heliopora 2% Coral massive 2.23%, coral mushroom 0.55%. Coral sub massive 5.53% and soft coral 15.2%. At station 8 the highest percentage of live coral was Acropora Branching 24.1%, and Acropora Submasive 8.15%. The highest live corals were Acropora branching 15.1% and Acropora submasive 6.17%. This is because at station one has 100% brightness which according to Supriharyono (2000) that the amount of sunlight received by a coral reef is positively correlated with the growth of the coral reef. So it can be concluded that the more rays received by the coral reef, the better the growth rate of the coral reef. The group of dead coral was 34.5% which consisted of Dead coral with algae 34.5%. At station 9 the highest percentage of dead coral was DCA (Dead coral with algae) 34.5%. The other group was 2.63% which consisted of the other 2.63%. The abiotic component group is 9.3% which consists of rubble (coral fragments) 9.3%.

Station 10 (Wisata Kollo)

The percentage of coral cover at station six is 59.63% which can be classified in the medium category based on criteria (Gomez and Yap, 1988 in Terangi, 2009). The largest groups covering the substrate in a row were the living coral group of 59.63% which consisted of Acropora branching 9.27%, Acropora encrusting 4.43%, Acropora submasive 8.15%, Acropora Digitate 0.56%, Coral brenching 2.3%, Coral encrusting 3.33% Coral heliopora 2% Coral massive 2.23%, coral mushroom 0.55%. Coral sub massive 5.53% and soft coral 15.2%. At station 10 the highest percentage of live coral was Acropora Branching 24.1%, and Acropora Submasive 8.15%. The highest live corals were Acropora branching 15.1% and Acropora submasive 6.17%. This is because at station one has 100% brightness which according to Supriharyono (2000) that the amount of sunlight received by a coral reef is positively correlated with the growth of the coral reef. So it can be concluded that the more rays received by the coral reef, the better the growth rate of the coral reef. The group of dead coral was 34.5% which consisted of Dead coral with algae 34.5%. At station 10 the highest percentage of dead coral was DCA (Dead coral with algae) 34.5%. The other group was 2.63% which consisted of the other 2.63%. The abiotic component group is 9.3% which consists of rubble (coral fragments) 9.3%.

Condition of Coral Fish Communities and Fish Diversity in Wangi-Wangi Island Waters

For all coral fish abundance stations ranging from 200-349 ind, most categories are found in major fish groups (small-sized fish that live around coral ecosystems and including ornamental fish species) with the number of species found ranging from 87 - 171 ind, while for the target fish group the number of species found ranges from 51 - 128 ind, and for the indicator fish group (typical fish that inhabit coral reefs and become indicators of the level of fertility of the waters around the coral reef ecosystem) found between 17 - 34 ind . The results of observations made at all stations, the abundance of reef fish found from all stations ranged from 0.80 to 1.24 ind/m^2.

From observations at all stations, 15 families and 73 species of reef fish were found that are included in 3 broad categories, major, target and indicator. The families found include *Chaetodontidae, Acanthuridae, Balistidae, Caesionidae, Cirrhitidae, Labridae, Pomacantidae, Pomacentridae, Tetraodontidae, Zanclidae, Acanthuridae, Caesionidae, Cirrhitidae, Labridae, Pomacantidae, Pomacentridae, Tetraodontidae, Zanclidae, Acanthuridae, Caesionidae, Carangidae, Labridae, Pomacantidae, Pomacentridae, Tetraodontidae, Zanclidae, Acanthuridae, Caesionidae, Carangidae, Labridae, Pomacantidae, Pomacentridae, Tetraodontidae, Zanclidae, Acanthuridae,*

Caesionidae, Carangidae, Labridae, Pomacantidae, Pomacentridae, Tetraodontidae, Zanclidae, Acanthuridae, Caesionidae, Carangidae, Labridae, Pomacantidae, Pomacentridae. Of the 16 families, the most commonly found are the Acanthuridae family with 7 species / species totaling 337 individuals belonging to the target fish category.

Abundance of Coral Fish at Each Station

Station 1 (Waha)

At station 1 the number of fish obtained at the time of observation was 242 individuals, consisting of 34 species (species), all fishes were divided into 3 groups namely; indicator fish, target fish and major fish). Indicators obtained were 29 individuals consisting of 10 species (species) with a presence of 12.0%, major fish obtained were 120 individuals consisting of 19 species (species) with a presence of 49.6%. The target fish obtained were 93 individuals consisting of 13 species (species) with 38.4% presence.

Fish abundance at station 1 is 865 ind / ha which consists of an abundance of indicator fish is 104 ind / ha. This indicator fish abundance is dominated by *heniochus pleuroteania* fish from the *Chaetodontidae* family of 25 ind / ha with the presence of 12.0%.

Chaetodontidae or known as Kepe-kepe generally live in pairs, there are some that are clustered in size less than 6 inches round and flat body, slow motion or graceful, how to eat on the reef like a butterfly. The color is generally bright from yellow, white with a black face and a striped pattern on the eyes. These fish eat coral polyps, algae, worms and other invertebrates and these fish are active during the day (Diurnal).

The major fish abundance is 120 ind / ha, the major fish abundance is dominated by *Cirrhilabrus cyanopleura* fish from the *Labridae* family of 54 ind / ha with the presence of 6.2% fish. Whereas the abundance of target fish was ind / ha which was dominated by *Ctenochaetus striatus* fish from the *Acanthuridae* family of 26 ind / ha with the presence of 10.7%. Below this is the percentage of coral fish attendance based on family.

Station 2 (Waetuno)

At station 2 the number of fish obtained at the time of observation was 232 individuals, fish consisting of 30 species (species), all of the fish were divided into 3 groups namely; indicator fish, target fish and major fish). Indicators obtained were 22 individuals consisting of 5 species (species) with 9.5% presence, Major fish obtained were 109 individuals consisting of 13 species (species) with a presence of 47.0%. The target fish obtained were 101 individuals consisting of 12 species (species) with the presence of 43.5%.

Fish abundance at station 2 is 829 ind / ha consisting of an indicator fish abundance of 79 ind / ha. This indicator fish abundance was dominated by *Heniochus pleurotaenia* from the *Chaetodontidae* family of 29 ind / ha with a presence of 2.6%.

Chaetodontidae or known as Kepe-kepe generally live in pairs, there are some that are clustered in size less than 6 inches round and flat body, slow motion or graceful, how to eat on the reef like a butterfly. The color is generally bright from yellow, white with a black face and a striped pattern on the eyes. These fish eat coral polyps, algae, worms and other invertebrates and these fish are active during the day (Diurnal).

The major fish abundance is 389 ind / ha, the major fish abundance is dominated by *Pomacentrus moluccensis* fish from the family *Pomacentridae* of 82 ind / ha with the presence of fish of 7.4%. While the abundance of target fish is 361 ind / ha which is dominated by *Acanthurus grammoptilus* fish from the *Acanthuridae* family of 75 ind / ha with a presence of 6.8%. Below this is the percentage of coral fish per family.

Station 3 (Patuno)

At station 3 the number of fish obtained at the time of observation was 334 individuals, fish consisting of 41 species (species), all of the fish were divided into 3 groups namely; indicator fish, target fish and major fish). Indicators obtained were 33 individuals consisting of 10 species (species) with a 9.9% presence, Major fish obtained were 166 individuals consisting of 17 species (species) with a presence of 49.7%. The target fish obtained were 135 individuals consisting of 14 species (species) with the presence of 40.1%.

Fish abundance at station 3 is 1193 ind / ha consisting of an abundance of indicator fish is 118 ind / ha. This indicator fish abundance is dominated by *Caethodon klenii* fish, *Heniochus singularius*, *Heniochus pleurotaenia* from the *Chaetodontidae family* of 14 ind / ha with the presence of 1.4%.

Chaetodontidae or known as Kepe-kepe generally live in pairs, there are some that are clustered in size less than 6 inches round and flat body, slow motion or graceful, how to eat on the reef like a butterfly. The color is generally bright from yellow, white with a black face and a striped pattern on the eyes. These fish eat coral polyps, algae, worms and other invertebrates and these fish are active during the day (Diurnal).

The major fish abundance is 593 ind / ha, the major fish abundance is dominated by *Pseudanthias dispar* fish from the *Anthiinae* family of 104 ind / ha with the presence of fish 9.9%. Whereas the abundance of

target fish was 482 ind / ha which was dominated by *Pterocaesio randalli* fish from the *Caesionidae* family as much as 168 ind / ha with the presence of 16.0%. Below this is the percentage of coral fish per family.

Station 4 (Matahora)

At station 4 the number of fish obtained at the time of the final practice was 315 individuals, fish consisting of 38 species (species), all of the fish were divided into 3 groups namely; indicator fish, target fish and major fish). Indicator fish obtained were 34 individuals consisting of 9 species (species) with a presence of 10.8%, major fish obtained were 173 individuals consisting of 17 species (species) with 54.9% presence. The target fish obtained were 108 individuals consisting of 12 species (species) with a presence of 34.3%.

Fish abundance at station 4 is 889 ind / ha consisting of an indicator fish abundance of 121 ind / ha. This indicator fish abundance was dominated by *Caethodon citrinellus* fish from the *Chaetodontidae* family of 21 ind / ha with the presence of 2.2%.

Chaetodontidae or known as Kepe-kepe generally live in pairs, there are some that are clustered in size less than 6 inches round and flat body, slow motion or graceful, how to eat on the reef like a butterfly. The color is generally bright from yellow, white with a black face and a striped pattern on the eyes. These fish eat coral polyps, algae, worms and other invertebrates and these fish are active during the day (Diurnal).

The major fish abundance is 618 ind / ha, the major fish abundance is dominated by *Pseudanthias dispar* fish from the *Anthiinae* family of 207 ind / ha with the presence of 20.9% fish. While the abundance of target fish is 386 ind / ha which is dominated by *Pterocaesio tile* fish from the *Caesionidae* family as much as 171 ind / ha with the presence of 17.3%. Below this is the percentage of coral fish per family.

Station 5 (Liya Mawi)

At station 5 the number of fish obtained at the time of the final practice was 263 individuals, fish consisting of 42 species (species), all of the fish were divided into 3 groups namely; indicator fish, target fish and major fish). Indicators obtained were 34 individuals consisting of 7 species (species) with a presence of 12.9%, major fish obtained were 133 individuals consisting of 19 species (species) with a presence of 50.6%. The target fish obtained were 96 individuals consisting of 16 species (species) with the presence of 36.5%.

The abundance of fish at station 5 is 939 ind / ha consisting of an abundance of indicator fish is 121 ind / ha. This indicator fish abundance is dominated by *Heniochus pleurotaenia* from the *Chaetodontidae* family of 43 ind / ha with the presence of 4.0%.

Chaetodontidae or known as Kepe-kepe generally live in pairs, there are some that are clustered in size less than 6 inches round and flat body, slow motion or graceful, how to eat on the reef like a butterfly. The color is generally bright from yellow, white with a black face and a striped pattern on the eyes. These fish eat coral polyps, algae, worms and other invertebrates and these fish are active during the day (Diurnal).

The major fish abundance is 343 ind / ha, the major fish abundance is dominated by *Pseudanthias dispar* fish from the *Anthiinae* family of 121 ind / ha with the presence of 11.3% fish. Whereas the abundance of target fish is 404 ind / ha which is dominated by *Pterocaesio tile* fish from the *Acanthuridae* family of 164 ind / ha with the presence of 15.2%. Below this is the percentage of coral fish per family.

Station 6 (Liya Bahari Indah)

At station 6 the number of fish obtained at the time of the final practice was 332 individuals, fish consisting of 30 species (species), all of the fish were divided into 3 groups namely; indicator fish, target fish and major fish). Indicator fish obtained were 7 individuals consisting of 5 species (species) with a presence of 10.5%, Major fish obtained were 94 individuals consisting of 13 species (species) with a presence of 52.4%. The target fish obtained were 123 individuals consisting of 12 species (species) with a presence of 37.0%.

Fish abundance at station 6 is 1183 ind / ha which consists of an abundance of indicator fish is 125 ind / ha. This indicator fish abundance is dominated by *Heniochus ephippium* fish from the *Chaetodontidae* family of 21 ind / ha with the presence of 3.0%.

Chaetodontidae or known as Kepe-kepe generally live in pairs, there are some that are clustered in size less than 6 inches round and flat body, slow motion or graceful, how to eat on the reef like a butterfly. The color is generally bright from yellow, white with a black face and a striped pattern on the eyes. These fish eat coral polyps, algae, worms and other invertebrates and these fish are active during the day (Diurnal).

The major fish abundance is 621 ind / ha, the major fish abundance is dominated by *Pomacentrus moluccensis* fish from the *Pomacentridae* family of 79 ind / ha with the presence of 11.0% fish. While the abundance of target fish is 439 ind / ha which is dominated by *Ctenochaetus striatus* fish from the *Acanthuridae* family of 75 ind / ha with the presence of 10.5%. Below this is the percentage of coral fish per family.

Station 7 (North Kapota)

At station 7 the number of fish obtained at the time of observation was 349 individuals, fish consisting of 40 species (species), all of the fish were divided into 3 groups namely; indicator fish, target fish and major fish). Indicators obtained were 42 individuals consisting of 8 species (species) with a presence of 12.6%, major fish obtained were 175 individuals consisting of 16 species (species) with a presence of 50.1%. The target fish obtained were 132 individuals consisting of 16 species (species) with the presence of 37.8%.

The abundance of fish at Station 7 is 1246 ind / ha consisting of an abundance of indicator fish is 150 ind / ha. This indicator fish abundance was dominated by *Heniochus pleurotaenia* fish from the family *Chaetodontidae* of 21 ind / ha with the presence of 2.9%.

Chaetodontidae or known as Kepe-kepe generally live in pairs, there are some that are clustered in size less than 6 inches round and flat body, slow motion or graceful, how to eat on the reef like a butterfly. The color is generally bright from yellow, white with a black face and a striped pattern on the eyes. These fish eat coral polyps, algae, worms and other invertebrates and these fish are active during the day (Diurnal).

The major fish abundance is 625 ind / ha, the major fish abundance is dominated by *Cirrhilabrus cyanopleura* and *Chrysiptera talboti* fish from the *Labridae* and *Pomacentridae* families by 50 ind / ha with the presence of 6.7% fish. While the abundance of target fish is 471 ind / ha which is dominated by *Ctenochaetus striatus* fish from the *Acanthuridae* family as much as 89 ind / ha with the presence of 12.0%. Below this is the percentage of coral fish per family.

Station 8 (Kapota)

At station 8 the number of fish obtained at the time of observation was 302 individuals, fish consisting of 42 species (species), all of the fish were divided into 3 groups namely; indicator fish, target fish and major fish). Indicators obtained were 38 individuals consisting of 7 species (species) with a presence of 12.5%, Major fish obtained were 163 individuals consisting of 19 species (species) with a presence of 53.8%. The target fish obtained were 102 individuals consisting of 16 species (species) with 33.7% presence.

The abundance of fish at station 8 is 1082 ind / ha consisting of abundance of indicator fish is 136 ind / ha. This indicator fish abundance is dominated by *Forcipiger longirostris* fish from the *Chaetodontidae* family of 43 ind / ha with the presence of 5.4%.

Chaetodontidae or known as Kepe-kepe generally live in pairs, there are some that are clustered in size less than 6 inches round and flat body, slow motion or graceful, how to eat on the reef like a butterfly. The color is generally bright from yellow, white with a black face and a striped pattern on the eyes. These fish eat coral polyps, algae, worms and other invertebrates and these fish are active during the day (Diurnal).

The major fish abundance is 582 ind / ha, the major fish abundance is dominated by *Pomacentrus moluccensis* fish from the family *Pomacentridae* of 75 ind / ha with the presence of fish of 9.4%. While the abundance of target fish is 364 ind / ha which is dominated by *Acanthurus grammoptilus* fish from the *Acanthuridae* family as much as 50 ind / ha with the presence of 6.3%. Below this is the percentage of coral fish per family.

Station 9 (Wandoka)

At station 9 the number of fish obtained at the time of the final practice was 332 individuals, fish consisting of 30 species (species), all of the fish were divided into 3 groups namely; indicator fish, target fish and major fish). Indicator fish obtained were 7 individuals consisting of 5 species (species) with a presence of 10.5%, Major fish obtained were 94 individuals consisting of 13 species (species) with a presence of 52.4%. The target fish obtained were 123 individuals consisting of 12 species (species) with a presence of 37.0%.

The abundance of fish at station 9 is 1183 ind / ha consisting of an abundance of indicator fish is 125 ind / ha. This indicator fish abundance is dominated by *Heniochus ephippium* fish from the *Chaetodontidae* family of 21 ind / ha with the presence of 3.0%.

Chaetodontidae or known as Kepe-kepe generally live in pairs, there are some that are clustered in size less than 6 inches round and flat body, slow motion or graceful, how to eat on the reef like a butterfly. The color is generally bright from yellow, white with a black face and a striped pattern on the eyes. These fish eat coral polyps, algae, worms and other invertebrates and these fish are active during the day (Diurnal).

The major fish abundance is 621 ind / ha, the major fish abundance is dominated by *Pomacentrus moluccensis* fish from the *Pomacentridae* family of 79 ind / ha with the presence of 11.0% fish. While the abundance of target fish is 439 ind / ha which is dominated by *Ctenochaetus striatus* fish from the *Acanthuridae* family of 75 ind / ha with the presence of 10.5%. Below this is the percentage of coral fish per family.

Station 10 (Wisata Kollo)

At station 10 the number of fish obtained at the time of observation was 302 individuals, fish consisting of 42 species (species), all of the fish were divided into 3 groups namely; indicator fish, target fish and major

fish). Indicators obtained were 38 individuals consisting of 7 species (species) with a presence of 12.5%, Major fish obtained were 163 individuals consisting of 19 species (species) with a presence of 53.8%. The target fish obtained were 102 individuals consisting of 16 species (species) with 33.7% presence.

Fish abundance at station 10 is 1082 ind / ha consisting of abundance of indicator fish is 136 ind / ha. This indicator fish abundance is dominated by *Forcipiger longirostris* fish from the *Chaetodontidae* family of 43 ind / ha with the presence of 5.4%.

Chaetodontidae or known as Kepe-kepe generally live in pairs, there are some that are clustered in size less than 6 inches round and flat body, slow motion or graceful, how to eat on the reef like a butterfly. The color is generally bright from yellow, white with a black face and a striped pattern on the eyes. These fish eat coral polyps, algae, worms and other invertebrates and these fish are active during the day (Diurnal).

The major fish abundance is 582 ind / ha, the major fish abundance is dominated by *Pomacentrus moluccensis* fish from the family *Pomacentridae* of 75 ind / ha with the presence of fish of 9.4%. While the abundance of target fish is 364 ind / ha which is dominated by *Acanthurus grammoptilus* fish from the *Acanthuridae* family as much as 50 ind / ha with the presence of 6.3%. Below this is the percentage of coral fish per family.

Conditions of Aquatic Environmental Parameters

Temperature

The temperature at all research locations was 28°C conducted in the morning, afternoon, and evening at 10 observation station points, this value is still in a good range for coral life, this is caused because the data collection season is still in the transitional season from the west season to the east season, so the temperature around the observation station is still stable or in a good category. This is the same as the opinion of Nybakken (1992) showing that the most optimal development of reefs occurs in waters where the average annual temperature is 23-25°C and the coral reefs can tolerate temperatures up to about 36-40°C.

Water Flow Speed

Current velocity at all observation stations is in the range of 0.13 - 0.14 m / s, conducted in the morning, afternoon and evening for 28 days or 4 weeks. Current velocity is very influential on coral growth in addition to being a food carrier in the form of plankton and can also clean corals from sediments - sediments that attach to and cover coral polyps, which function as mouths. That is why corals that live in undulating or strong currents develop more than calm and protected areas. As a statement by Nontji (2003), currents are needed to bring food in the form of plankton.

Salinity

Based on the measurement results during the study, salinity took place during observations on average 34 ‰. This stable salinity value indicates that the condition of the waters at the observation site is good to support the level of coral growth. According to Supriharyono (2000), Salinity is also known as a limiting factor for the life of coral animals, the average salinity of sea water in the tropics is around 35 ‰. Salinity has a role in regulating osmotic and electrolyte pressure in the organism's body and the surrounding environment, so salinity is one of the environmental factors that greatly influences coral growth.

Brightness

Based on direct observations in the field, shows that the level of brightness in the waters of Wangi Wangi Island can penetrate to the bottom of the waters, or the value of brightness on the fragrant Wangi Island (up to the bottom of the water). This shows that the need for sunlight in this area can be met so that it is very supportive of the life processes in the waters, including the life of coral reefs. This brightness is related to the life of corals, given the life of coral animals in symbiosis with *zooxanthelae* which carry out the process of photosynthesis, the influence of light is very important. According to Kinsman, (1964) in Supriharyono, (2000). In general, with clear waters, coral reefs can live at depths reaching 20 m. The condition of clouds in a place affects the lighting during the daytime, this condition can affect coral growth (Goreau and Goreau, 1959 in Supriharyono, 2007).

The Correlation Percentage of Coral Reef and Abundance of Coral Fish

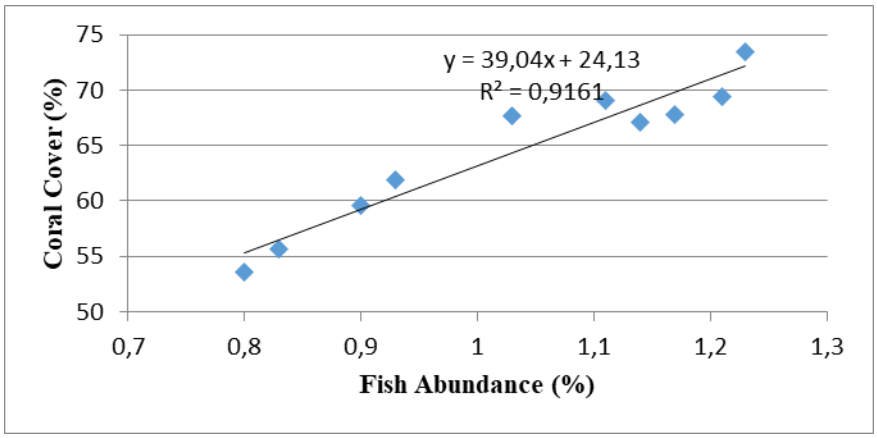

Figure 2. The Correlation Percentage of Coral Reef and Abundance of Coral Fish

From the graph above, we can get a linear equation about the relationship between coral fish and coral cover that is y = 39.04 x + 24.13 with r = 0.916 or correlation determination = 91% of the linear equation can be interpreted that each addition of coral reef cover x meter, then produces reef fish as much as 39.04 ind / m^2.

IV. CONCLUSION

1. The types of coral reefs in Wangi-Wangi Island are classified as fringing reefs. In general, the condition of coral reefs is classified as moderate to good. The average percentage of live coral cover on the bottom of Station 1 to Station 10 is 64.61%.
2. The index value of coral cover in the bottom waters of stations 1 to station 10 is; diversity index ranges between (H') 3.2% - 3.62%, this indicates high diversity, this indicates that the depth of coral species is quite diverse. The Uniformity Index (E) at the bottom of station waters 1 to station 10 is in the range of 0.83 - 0.91, which indicates good uniformity, good uniformity or in other sense the coral architecture here is quite good. The Domination Index (C) at the bottom of Station 1 to Station 10 is in the range of 0.09 - 0.14%, indicating that there are no colonies dominating the area, in this case it means that at the bottom of the water the observation station has no coral dominating.
3. The diversity index of reef fish at station 1 to station 10 ranged from 2.96% - 3.97%. This value is included in the category of high diversity (H' > 3) because there is a good ecosystem balance in the waters of Wangi-Wangi Island, the index value of uniformity (E) of reef fish at station 1 to station 10 obtained ranged from 0.51 to 0.72 . This value is categorized in the high or stable category, uniformity of reef fish species in the bottom waters of Wangi-Wangi Island as a whole is considered to be stable species of fish species. The dominance index (C) value of reef fish at station 1 to station 10 ranges between 0.04-0.08. From the dominance index value it can be interpreted in the structure of the biota community that was observed there were no species of domineering in these waters.
4. When viewed from the average range of water environmental parameters at all observation stations, the conditions are still good enough for coral reef growth such as the average temperature measurement is 28 to 31°C, salinity is 32 to 34 ‰, brightness to the bottom of the waters at each observation station, and the speed of the current ranges from 0.13 - 0.14 m / s, which is carried out periodically observations for 4 weeks in the morning, afternoon and evening at all observation stations.
5. The waters of Pulau Wangi-wangi in Station 1, station 2, station 3, station 8 and station 10 are included in the S2 category which is quite suitable for marine tourism. Quite appropriate categories are in diving tourism and snorkeling. Whereas station 4, station 5, station 6, station 7 and station 9 are included in the S1 category, which is very suitable for beach tourism. This category is very suitable for beach tourism not for marine tourism such as for diving and snorkeling.
6. Efforts made by the fishing communities of Wangi-Wangi Island are to look after each other, remind each other, and supervise each other in the waters of the Wangi-Wangi Island, so that fishermen who use tools that are not environmentally friendly can be prevented, POKMASWAS (Community Watch Group) Wangi-Wangi Island act to protect coral reefs from various types of damage, maintain the cleanliness of the island and preserve nature, especially from destructive fishing activities (destructive fishing).

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