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THE INFLUENCE OF DEPTH TO PRIMARY PRODUCTIVITY IN BAMA BEACH, BALURAN NATIONAL PARK

Widhi Raut Nugrahening, Paluphi Raut Wahyuning*

Department of Aquatic Resources Management, Faculty of Fisheries and Marine Sciences,
Khairun University, Ternate, Indonesia

*E-mail: raut.paluphi.rp@gmail.com

ABSTRACT

Bama Beach is one of the beaches used as a tourist destination in Baluran National Park. Coral reefs are coastal ecosystems that have high productivity. This research will study the difference primary productivity of coral reef ecosystems at depth 1 - 10 meter. This study was conducted in Bama Beach on January 2023, with descriptive method. The results of this research showed, the influence of depth to Net Primary Productivity (NPP) is 71,4 % and categorized as good. Net Primary Productivity (NPP) at a depth of 1 meter 62,50 - 90,27 mgC/m²/hour; the depth of 5 meter 17,36 - 52,08 mgC/m²/hour and the depth of 10 meter 8,68 - 34,72 mgC/m²/hour. Net Primary Productivity (NPP) highest at a depth 1 meter, so primary productivity decreases with increasing depth.

KEY WORDS

Coral, primary productivity, Bama beach.

Coral reef ecosystems are fertile and very productive ecosystems due to their ability to retain nutrients (Dahuri *et al.*, 2011). Coral reefs are one of the aquatic ecosystems that have high primary productivity. The high primary productivity of coral reefs in waters plays an important role in maintaining ecosystem balance. The coral reef ecosystem has an ecological function as a habitat for breeding, nurturing, foraging and shelter for other biota (Dahuri *et al.*, 2003). Apart from that, coral reefs also have the function of protecting beaches from crashing waves and sea currents.

Bama Beach is located in Baluran National Park which has a unique diversity of ecosystems, especially its aquatic ecosystem. The coral reefs on Bama Beach are very diverse; this is because Bama Beach is a conservation area. Baluran National Park has fringing coral reef types that vary in width with a depth range of 0,5 - 15 meters (Susilo, 2016).

The aim of this research is to determine differences in primary productivity of coral reef ecosystems at a depth of 1 - 10 meters on branching coral reefs.

MATERIALS AND METHODS OF RESEARCH

The research was carried out in April 2024. The research location was at Bama Beach, Baluran National Park. The materials used in this research are coral reefs, primary productivity and water quality variables such as temperature, pH, salinity and DO. The tools used in this research include a roller meter, a set of diving equipment, a thermometer, a hand refractometer, pliers, GPS, an underwater camera, stationery, a pH meter, a dropper pipette, a 300 ml sample bottle, a 250 ml dark BOD bottle, a 250 ml light BOD bottle. ml and zipper bag.

The research method used is the description method, where the description method is a research method which aims to find out the description of an object of observation and be able to explain developments that occur. Sampling was carried out once with three repetitions at Bama Beach in April 2024. Sampling points were carried out at three depths, 0 - 1 m, 3 - 5 m and 10 m. Primary productivity measurements are carried out by measuring oxygen levels using the Winkler method. Coral reefs were placed in a Winkler bottle, then



incubated for 5 hours. According to Fahmi (2015), the primary productivity value of waters is measured using the following formula:

$$GPP (mgC/L/hour) = 0,375 \frac{LB - DB}{N \times PQ}$$

$$NPP (mgC/L/hour) = 0,375 \frac{LB - DB}{N \times PQ}$$

Where: GPP - Gross Primary Productivity; NPP - Net Primary Productivity; LB - Bright Bottle (After Incubation); DB - Dark Bottle (After Incubation); PQ - Photosynthesis Quotient; N - Long incubation period.

RESULTS AND DISCUSSION

The average water temperature at Bama Beach is based on depth differences sequentially at a depth of 1 meter 24°C, a depth of 5 meters 23°C and a depth of 10 meters 23°C. Water temperatures at depths of 5 meters and 10 meters tend to be lower than at a depth of 1 meter. Then the average salinity value sequentially at a depth of 1 meter is 31 ‰, a depth of 5 meters is 30 ‰ and a depth of 10 meters is 31 ‰. The dissolved oxygen (DO) level based on the measurement results was found to be 4 - 8.1 mg/l and the degree of acidity (pH) was found to be 8, which is included in alkaline conditions.

Table 1 – Water Quality Measurement Results

Location	Depth	Water Quality Parameters			
		Temperature	pH	Salinity	DO
1	1	24	8	32	4.3
1	5	23	8	30	4.3
1	10	23	8	31	8.1
2	1	24	8	32	4.4
2	5	23	8	30	4.1
2	10	23	8	32	7.5
3	1	24	8	31	5.9
3	5	23	8	31	4.0
3	10	23	8	31	4.7

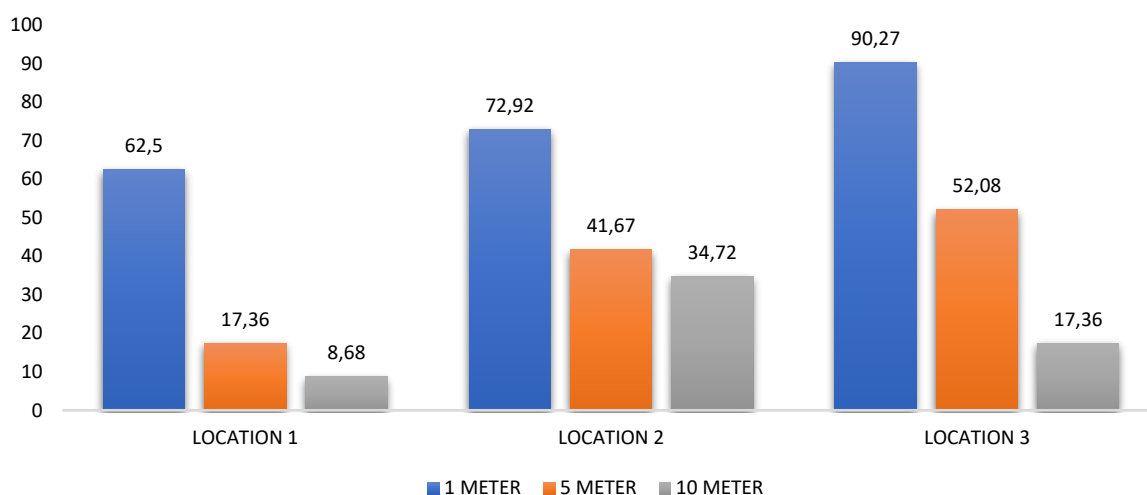


Figure 1 – Analysis of Primary Productivity at a Depth of 1 meter, 5 meters and 10 meters (mgC/m²/Hour)

The Net Primary Productivity (NPP) value at a depth of 1 meter is higher than at a depth of 5 and 10 meters. At a depth of 1 meter at location 1 the NPP value was 62,50 mgC/m²/hour, at location 2 it was 72,92 mgC/m²/hour and at location 3 the NPP was 90,27



mgC/m²/hour. Then at a depth of 5 meters at location 1 the NPP value was 17,36, location 2 was 41,67 mgC/m²/hour and location 3 had an NPP of 52,08 mgC/m²/hour. At a depth of 10 meters at location 1 the NPP value was 8,68, location 2 was 34,72 mgC/m²/hour and location 3 obtained an NPP value of 17,36 mgC/m²/hour.

Table 2 – Regression test analysis of the effect of depth on primary productivity

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,845 ^a	,714	,673	15,84394

a. Predictors: (Constant), DEPTH

Based on the regression analysis above, the R value is 0,845. This value can be interpreted to mean that the relationship between depth and NPP is in the strong category. The R Square value obtained is 71,4%, which means that depth has an influence on NPP.

Table 3 – Analysis of significance between depth and NPP

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	4385,762	1	4385,762	17,471	,004 ^b
1 Residual	1757,212	7	251.030		
Total	6142,974	8			

a. Dependent Variable: NPP

b. Predictors: (Constant), DEPTH

Based on the table above, the Sig value is obtained 0,004 which means the dacil is smaller than 0,05, thus the regression equation model between NPP and depth is significant.

The results of temperature measurements at Bama Beach, Baluran National Park, show a range of 23 - 24 °C, this temperature is included in the low category due to heavy sampling in the morning. The temperature range is classified as low but can still be categorized as normal for coral growth (Lakastri, 2018). The pH measurement results at Bama beach were 8, this value is still considered normal. According to KEPMEN LH No. 51 of 2004 shows the pH value range in the sea is around 6,5 - 8,5. The results of salinity measurements at the research location ranged from 30 - 32 ‰. This value is classified as low because according to KEPMEN LH No. 51 of 2004, good salinity for coral reefs is 33-34‰. Dissolved oxygen levels obtained at the research location ranged from 4 - 8,1 mg/L. KEPMEN LH No. 51 of 2004 states that good dissolved oxygen levels in the sea are more than 5 mg/L.

Based on the results of NPP measurements in branching corals at 3 depths, it has an influence on primary productivity. The high and low levels of primary productivity on coral reefs are influenced by various other sources such as seagrass, microalgae and phytoplankton (Supriharyono, 2017). According to Hocheberg (2008) states that measuring primary productivity depends on the conditions of the physical environment.

Primary productivity on coral reefs is higher than on sandy areas and coral reef fragments. The primary productivity value for each type of coral reef will vary, depending on the efficiency of light use on different coral reefs, causing different primary productivity values. Primary productivity can be influenced by light, temperature and depth. The factor that most influences primary productivity is light intensity, where light plays an important role in the photosynthesis process. According to Hardiyanto (2012), if the value of primary productivity increases due to the intensity of bright light, the photo synthesis process can run well.

The highest productivity on branching corals is at a depth of 1 meter, so the deeper the water, the primary productivity will decrease. Merina (2016) stated that there are differences in primary productivity in the aquatic environment; this can be influenced by physicochemical parameters. This is confirmed by Merlin (2015) who states that the high value of primary productivity shows the natural ability of the marine environment to absorb the effects of nutrient enrichment from land.



CONCLUSION

The conclusion that can be drawn from this research is that the NPP value on branching corals at depths of 1, 5 and 10 meters is significantly different with the NPP value being higher at a depth of 1 meter with a value of 62,50 - 90,27 mgC/m²/hour, while at a depth of 5 meters it is 17,36 - 52,08 mgC/m²/hour and the lowest value is at a depth of 10 meters, namely 8,68 - 34,72 mgC/m²/hour.

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