

## Percentage of Hard Coral Cover and Coral Recruitment on in Bangsring Beach, Banyuwangi Regency

Pratama Diffi Samuel<sup>1\*</sup>, Muhammad Fakhri<sup>2)</sup>, Citra Satria Utama Dewi<sup>3)</sup>, Jessica Ellona<sup>4)</sup>, M. Choirul Anam<sup>5</sup>

<sup>1</sup>Department of Aquatic Resource Management, Faculty of Fisheries and Marine Science, University of Brawijaya

<sup>2</sup>Department of Aquaculture, Faculty of Fisheries and Marine Science, University of Brawijaya

<sup>3</sup>Department of Marine Science, Faculty of Fisheries and Marine Science, University of Brawijaya

<sup>4</sup>Student in Department of Marine Science, Faculty of Fisheries and Marine Science, University of Brawijaya

<sup>5</sup>Student in Department of Fisheries Resources Utilization, Faculty of Fisheries and Marine Science, University of Brawijaya

Email address : [diffipik@ub.ac.id](mailto:diffipik@ub.ac.id)

### KEYWORDS

Coral;  
Recruitment;  
Bangsring.

**Abstract** One of the tourist attractions at Bangsring Beach is the condition of the coral reef ecosystem and unique marine biota that tourists can enjoy by snorkeling and diving. Based on research (Ekawati *et al.*, 2021) using remote sensing, the area of live coral reefs on Bangsring Beach is as follows; 2005; 3.38, 2008; 2.61, 2011; 3.7, 2017; 3.98, 2020; 6.1 Ha). It can be said that the area of coral reefs increases yearly, although, in 2008-2011, it decreased by 32%. The results of the economic valuation explain that the (Total Economic Value) of the coral reef ecosystem in Bangsring Beach is 38.2 billion Rupiah/year or 2.9 billion Rupiah hectares/year. The use-value that has the largest economic value comes from tourism utilization of 25 billion or 60% of the Total Economic Value. The coral community structure includes Coral Branching, Coral Encrusting, Coral Massive, Coral Submaasive, and Coral Mushroom. Mushroom Coral is found solitary and shaped like a mushroom. The research data shows the average value of Bangsring Fish House cover is 82.5%. Fish house cover here is seen and assessed based on the presence of hard corals, soft corals, and algae. The average percentage of hard corals growing at the Bangsring Fish House was 30%, soft corals 21.5%, and algae 17.5%. Found 21 types of coral such as; Acropora, Favia, Turbinaria, Symphyllia, Goniastrea.

### Introduction

Bangsring Beach is one of the leading tourist destinations in Banyuwangi Regency. Bangsring Beach is administratively included in Krajan, Wongsorejo Village, Wongsorejo District, Banyuwangi Regency. One of the tourist attractions at Bangsring Beach is the condition of the coral reef ecosystem and

unique marine biota that tourists can enjoy by snorkeling and diving. Based on research (Ekawati *et al.*, 2020) using remote sensing, the area of live coral reefs on Bangsring Beach is as follows; 2005; 3.38, 2008; 2.61, 2011; 3.7, 2017; 3.98, 2020; 6.1 Ha). It can be said that the area of coral reefs increases yearly, although in 2008-2011, it decreased by 32%.

The coral reef ecosystem has provided environmental services through diving and snorkeling activities. The results of the economic valuation explain that the (Total Economic Value) of the coral reef ecosystem in Bangsring Beach is 38.2 billion Rupiah/year or 2.9 billion Rupiah hectares/year. The use-value that has the largest economic value comes from tourism utilization of 25 billion or 60% of the Total Economic Value.

The potential of the coral reef ecosystem needs to be managed wisely so that its condition remains stable and even increases. One effort that needs to be done is to find out information related to coral recruitment. Information about coral recruitment is very important in coral reef management efforts. Hard coral recruitment is the entry of new coral individuals into the coral population, which can be caused by reproduction or migration (Karmila *et al.*, 2019). The recruitment process begins with the change of coral planula from the planktonic phase to benthic and is ready to attach to the substrate at the bottom of the waters (Rafilu *et al.*, 2020). The coral recruitment process in water is strongly influenced by the entry of coral larvae, which will attach to the right substrate so that they become young coral individuals (adolescents) (Abrar, 2015). According to Muhlis (2019), coral growth and distribution is limited by various factors such as: temperature, turbidity, light, salinity, current speed, and type of substrate. Facing these changes in aquatic environmental conditions, coral reefs will naturally survive, adapt or find themselves after being damaged until a resilient community is formed (Obura & Grimsditch, 2009).

We need to know that hard corals (Scleractinia) are a group of corals that dominate in compiling coral reef ecosystems and are symbiosis with zooxanthellae. Corals

naturally have both sexual and asexual methods of reproduction. Asexual reproduction is done by forming new shoots that will become new individuals on the parent. This shoot is done continuously, which is a mechanism to increase the colony's size but does not form new colonies. Sexual reproduction is done by producing one sperm or egg which will be released into free waters. The egg cell will be equipped with a coelenteron which will be fertilized by a sperm cell. This mating produces planula larvae that swim freely and settle on the bottom or hard substrate to form new colonies (Bengen, 2001; Morton, 1990; Nybakken, 1988). Reproduction of corals can be hermaphrodite or dioecious and gonochoric. Hermaphrodite corals are corals that produce male gametes and female gametes in a single colony or individual throughout their life. At the same time, gonococcal corals are corals in the form of colonies or individuals that produce male gametes and female gametes separately throughout their life (dioecious, sex separated) (Munasik, 2004). Hard coral recruitment is the main asset in the recovery of coral communities. Currently, there is no comprehensive information regarding the recruitment of hard corals at Bangsring Beach, therefore this study provides information regarding this matter.

### Materials and methods

This research was conducted in September 2021. The data collected from the research site included water quality, distribution and types of coral recruitment. Observations of coral recruitment in this activity were carried out using the Belt Transect method or a belt transect with a length of 30 x 2 meters. The material in collecting data on coral reef ecosystems is to identify the type of recruitment coral, count the number and determine the distribution

pattern of coral recruitment in the artificial substrate. This study uses two data sources, namely primary and secondary data. Primary data in the form of a percentage of coral cover, abundance of reef fish species, physical and chemical conditions of the waters, the abundance of juvenile coral species, analysis of substrate treatment, and different positions. Secondary data is data obtained from profiles of coastal areas, socio-economic data, coastal maps, reference books, reports, and studies that have been carried out. The research was conducted at 3 research stations consisting of Station 1 located on the south side of the floating house, Station 2 is the core zone, and Station 3 is in the fish apartment. According to Abrar (2015), juvenile coral identification was carried out by counting and recording all life forms and coral genera with a diameter of 10 cm in each square. Identification of coral recruitment genera was carried out based on coral identification, referring to Veron (2000a) and Suharsono (2008).

## Results and discussion

### *Percent Cover Of Coral*

Based on observations at the location. Coral community structure includes Coral Branching, Coral Encrusting, Coral Massive, Coral Submaasive, and Coral Mushroom. Mushroom Coral is found solitary shaped like a mushroom and comes from the species. Indications used that an area is experiencing damage to its coral reefs are the cover of rubble or rubble and the presence of algae. Rubble is a form of irregular coral fractures that natural disasters can cause, the use of explosives to find fish, coral mining for building materials, anchor dumping, and other destructive human activities. Algae is one of life for coral reefs, algae will be very difficult to live and grow on good coral reefs. Based on the calculation of the percentage of coral cover at

station 1; 11% - 30% (category 2) and Stations 231% - 50% (category 3).

The existence of soft corals is an indication of recovery in the coral reef ecosystem at Bangsring Beach, soft corals are a pioneer coral group that will grow in new areas or where there were reefs in the past. Elative fishing activities that do not exist in this area resulted in the number of fish found in greater quality and quantity than other research stations.

The general assessment of the success of rehabilitation and conservation efforts in Bangsring waters can be said to be successful. The condition of the fish house in this area is well maintained. This can be seen from the structural integrity of the Fish House and its current condition. Apart from being an attractor that can bring in fish, Bangsring Fish House has become a new habitat for many fish and other biota types. The Bangsring Fish House has also become a new bottom substrate for coral reefs to use. The research data shows the average value of the Bangsring Fish House cover is 82.5%. Fish house cover here is seen and assessed based on the presence of hard corals, soft corals and algae. The average percentage of hard corals growing at the Bangsring Fish House was 30%, soft corals 21.5% and algae 17.5%. The algae in the data also include coralline algae that form reef structures.

### *Coral Recruitment*

Recruitment in a population is defined as the addition of new individuals into the population from reproduction, either sexually or asexually (Caley et al., 1996; Soto & Weil, 2009). The recruitment process has a direct impact on changes in the structure and function of populations in the community and forms the basis for ecological studies, evolution, biogeography and conservation efforts in nature (Caley et al., 1996). One of the

important functions of coral recruitment in nature is to ensure the sustainability of its population and is an important process in the recovery and rebuilding of coral reef ecosystems after experiencing damage due to various stresses (Glassom et al., 2006). Changes in environmental conditions due to human activities and natural events have caused damage to coral reefs on a wide scale. Naturally, the response of coral reefs to environmental changes and pressures is to survive, adapt (adaptability) or recover (recovery) after being damaged to form a stable community (resilient) (Obura & Grimsditch, 2009). (Figure 2).

Based on observations at the location. Coral community structure includes Coral Branching, Coral Encrusting, Coral Massive, Coral Submaasive, and Coral Mushroom. Mushroom Coral is found solitary shaped like a mushroom and comes from the species. Indications used that an area is experiencing damage to its coral reefs are the cover of rubble or rubble and the presence of algae. Rubble is a form of irregular coral fractures that can be caused by natural disasters, the use of explosives to find fish, coral mining for building materials, anchor dumping, and other destructive human activities. Algae is one of life for coral reefs, algae will be very difficult to live and grow on good

coral reefs. Based on the calculation of the percentage of coral cover at station 1; 11% - 30% (category 2) and Stations 231% - 50% (category 3).

The existence of soft corals is an indication of recovery in the coral reef ecosystem at Bangsring Beach, soft corals are a pioneer coral group that will grow in new areas or where there were reefs in the past. Elative fishing activities that do not exist in this area resulted in the number of fish found in greater quality and quantity than other research stations.

The general assessment of the success of rehabilitation and conservation efforts in Bangsring waters can be said to be successful. The condition of the fish house in this area is well maintained. This can be seen from the structural integrity of the Fish House and its current condition. Apart from being an attractor that can bring in fish, Bangsring Fish House has become a new habitat for many fish and other biota types. The Bangsring Fish House has also become a new bottom substrate for coral reefs to use. The research data shows the average value of the Bangsring Fish House cover is 82.5%. Fish house cover here is seen and assessed based on the presence of hard corals, soft corals and algae. The average percentage of hard corals growing at the Bangsring Fish House was 30%, soft corals 21.5% and algae 17.5%. The algae in the data also include coralline algae that form reef structures. (See in Table 1 dan Figure 1)

**Table 1.** Percentage of Fish House Structure Coverage, Bangsring

| <b>Structure</b>  | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> | <b>7</b> | <b>8</b> | <b>9</b> | <b>10</b> | <b>%</b>    |
|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------------|
| <b>Hard Coral</b> | 35       | 30       | 30       | 25       | 25       | 30       | 20       | 35       | 40       | 30        | 30.0        |
| <b>Soft Coral</b> | 20       | 25       | 40       | 20       | 10       | 30       | 15       | 15       | 15       | 25        | 21.5        |
| <b>Algae</b>      | 25       | 20       | 15       | 25       | 20       | 20       | 20       | 10       | 10       | 10        | 17.5        |
| <b>Other</b>      | 5        | 5        | 10       | 5        | 30       | 15       | 15       | 15       | 10       | 25        | 13.5        |
|                   | 85       | 80       | 95       | 75       | 85       | 95       | 70       | 75       | 75       | 90        | <b>82.5</b> |

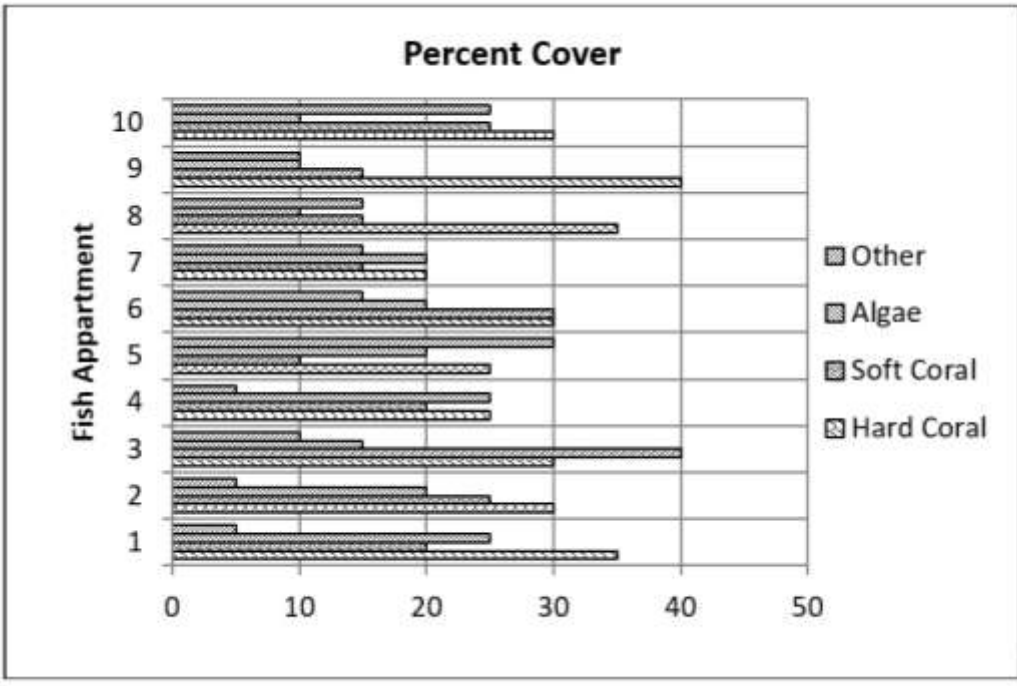


Figure 1. Graph of Bangsring Fish House Cover Percentage



**Figure 2.** Research results on recruitment corals

**Table 2. Type of Coral, Bangsring**

| No | Genus       | 5 - 10 cm | 10 - 15 cm | 15 - 20 cm | Total |
|----|-------------|-----------|------------|------------|-------|
| 1  | Acropora    | 4         | 3          | 6          | 13    |
| 2  | Montipora   | 3         | 2          | 2          | 7     |
| 3  | Lobophyllia | 0         | 1          | 0          | 1     |
| 4  | Pocillopora | 3         | 3          | 4          | 10    |
| 5  | Leptoseris  | 0         | 1          | 2          | 3     |
| 6  | Favia       | 5         | 2          | 5          | 12    |
| 7  | Turbinaria  | 2         | 3          | 2          | 7     |
| 8  | Symphyllia  | 2         | 1          | 0          | 3     |
| 9  | Goniastrea  | 2         | 0          | 1          | 3     |
| 10 | Heliofungia | 0         | 2          | 0          | 2     |
| 11 | Porites     | 2         | 4          | 3          | 9     |
| 12 | Montastrea  | 3         | 3          | 2          | 8     |
| 13 | Coeloseris  | 0         | 1          | 1          | 2     |
| 14 | Pavona      | 2         | 0          | 0          | 2     |
| 15 | Tubastrea   | 3         | 1          | 4          | 8     |
| 16 | Diploastrea | 0         | 2          | 5          | 7     |
| 17 | Favites     | 6         | 4          | 4          | 14    |
| 18 | Leptastrea  | 0         | 2          | 1          | 3     |
| 19 | Hydnophora  | 3         | 4          | 2          | 9     |
| 20 | Merulina    | 1         | 0          | 2          | 3     |
| 21 | Symphyllia  | 0         | 2          | 0          | 2     |
|    |             |           |            |            | 128   |

**Conclusions and Suggestion**

The coral community structure includes Coral Branching, Coral Encrusting, Coral Massive, Coral Submaasive, and Coral Mushroom. Mushroom Coral is found solitary shaped like a mushroom. The research data shows the average value of Bangsring Fish House cover is 82.5%. Fish house cover here is seen and assessed based on the presence of hard corals, soft corals and algae. The average percentage of hard corals growing at the Bangsring Fish House was 30%, soft corals 21.5% and algae 17.5%. Found 21 types of

coral such as; Acropora, Favia, Turbinaria, Symphyllia, Goniastrea. (see in Table 2)

**References**

Abrar, M. (2015). Recruitment Of Hard Coral (Scleractinia) in Natuna Waters, Riau Islands Province. *Oseanologi Dan Limnologi Di Indonesia*, 41(2), 133-147. [https://www.researchgate.net/publication/285541927\\_KARANG\\_KERAS\\_REKRUITMEN\\_SCLERACTINIA\\_DI\\_PERAIRAN\\_NATUNA\\_PROVINSI\\_KEPULAUAN\\_RIAU\\_R](https://www.researchgate.net/publication/285541927_KARANG_KERAS_REKRUITMEN_SCLERACTINIA_DI_PERAIRAN_NATUNA_PROVINSI_KEPULAUAN_RIAU_R)

[ACTINIA IN NATUNA WATERS RIAU I  
SLANDS PROVINCE](#)

<https://doi.org/10.1146/annurev.ecolsys.27.1.477>

- Bengen, D.G. 2001. Resources of Marine and Coastal Ecosystem and an integrated and sustainable management. Proceeding of Integrated coastal management. Bogor, October 29<sup>th</sup> – November 3<sup>rd</sup> 2001. [https://www.crc.uri.edu/download/Proceeding\\_ToT\\_ICM.pdf](https://www.crc.uri.edu/download/Proceeding_ToT_ICM.pdf)
- Caley, M. J., Carr, M. H., Hixon, M. A., Hughes, T. P., Jones, G. P., & Menge, B. A. (1996). Recruitment and the local dynamics of open marine populations. *Annual Review of Ecology and Systematics*, 27.
- Irizarry-Soto, E., & Weil, E. (2009). Spatial and temporal variability in juvenile coral densities, survivorship and recruitment in La Parguera, southwestern Puerto Rico. *Caribbean Journal of Science*, 45(2–3). <https://doi.org/10.18475/cjos.v45i2.a14>
- Karmila, B. Sabarun, & Rahmadan. (2019). Type and Density of Coral Recruitment Based on Scleractinian Coral Life Form in Lalanu Waters Konawe Regency Southeast Sulawesi. *Sapa Laut*, 4(3), 106–112. <http://ojs.uho.ac.id/index.php/JSL/article/view/8774/6337>
- Morton, J. 1990. The Shore Ecology of The Tropical Pasific. Unesco Regional Office for Science and Technology for South East Asia. Jakarta. 282p. [https://pustaka.kebudayaan.kemdikbud.go.id/index.php?p=show\\_detail&id=11446&keywords=](https://pustaka.kebudayaan.kemdikbud.go.id/index.php?p=show_detail&id=11446&keywords=)
- Ekawati, K. N., Handayani, T., Susiloningtyas, D., & Manessa, M. D. M. (2021). Conservation Monitoring of Coral Reefs in Bangsring Village, Banyuwangi as a Location on Ecotourism using Remote Sensing Imagery. *Geomatics Engineering Seminars*, 787-794 <https://doi.org/10.24895/sng.2020.0-0.1194>
- Glassom, D., Celliers, L., & Schleyer, M. H. (2006). Coral recruitment patterns at Sodwana Bay, South Africa. *Coral Reefs*, 25(3). <https://doi.org/10.1007/s00338-006-0117-6>
- Muhlis, M. (2019). The Growth of Acropora (Acropora nobilis and Acropora nosuta) in Senggigi. *Jurnal Biologi Tropis*, 19(1). <https://doi.org/10.29303/jbt.v19i1.940>
- Munasik, M., & Widjatmoko, W. (2004). coral Acropora aspera reproduction at Panjang Island, Central Java: I. Gametogenesis. *Marine Science*, 9(4), 211-216. <https://doi.org/10.14710/ik.ijms.9.4.211-216>
- Nybakken, J. W. 1988. Marine Biology. Translator : H. M. Eidman, Koesoebiono, D. G. Bengen, M. Hutomo and S. Sukardjo. PT. Gramedia. Jakarta. 459p. [http://library.unisri.ac.id/opac/index.php?p=show\\_detail&id=7155](http://library.unisri.ac.id/opac/index.php?p=show_detail&id=7155)
- Obura, D.O. and Grimsdith, G. (2009). Resilience Assessment of coral reefs – Assessment protocol for coral reefs, focusing on coral bleaching and thermal stress. IUCN working group on Climate Change and Coral Reefs. IUCN, Gland,



- Switzerland. 70 p. 5(1): 9-14.  
[https://www.iucn.org/sites/default/files/import/downloads/resilience\\_assessment\\_final.pdf](https://www.iucn.org/sites/default/files/import/downloads/resilience_assessment_final.pdf)  
<https://doi.org/10.33772/jsl.v5i1.1094>
- Rafilu, A.H., B. Sadarun, & R.D. Palupi. (2020). Coral Recruitment in Hari Island South Konawe Southeast Sulawesi. Sapa Laut, Townsville: Australian Institute of Marine Science. Volumes 1-3. 1410p.  
[http://www.coralsoftheworld.org/synonymy\\_lookup/?taxonLink=Astrea\\_devantieri\\_Vero](http://www.coralsoftheworld.org/synonymy_lookup/?taxonLink=Astrea_devantieri_Vero)