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STUDY OF PREVALENCE ON CORAL BLEACHING AND DISEASES

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ABSTRAK

Monitoring nilai prevalence karang yang mengalami pemutihan dan penyakit sangat perlu dilakukan secara intensiv di Indonesia yang juga masuk dalam kawasan CTI, informasi tentang hal ini boleh dikatakan relatif belum banyak dilakukan orang. Metode yang dipakai selama survey adalah time swim dimana dibagi pada 2 kedalaman (5 dan 10 meter) selama 30 menit, untuk analisis data digunakan rumus prevalence. Nilai Prevalence karang yang mengalami pemutihan dan penyakit di Raja Ampat pada kedalaman 5m=30,67%; 10m=23,50% di bulan November 2009. Taman Nasional Bunaken kedalaman 5m=55,47%; 10m=83,73% di bulan Agustus 2009 dan di Pulau Runduma-Taman Nasional kedalaman 5m=23,55%; 10m=50,94% di bulan Oktober 2009. Jenis karang yang dominan mengalami pemutihan dan penyakit adalah genus Porites dan Acropora, sedangkan tidak dominan adalah genus Pocillopora dan Montipora.

Kata kunci: pemutihan karang, time swim, prevalence.

INTRODUCTION

Coastal zone and Indonesian seas have a potential and high biodiversity (mega biodiversity) in the world also include in CTC (Coral Triangle Center) region. The highly biodiversity comprise in genetic, species and other ecosystem to develop Indonesia economics, environment, sustainability and carrying capacity also Law reinforcement (Anonimous, 2007).

Based on characterize coastal ecosystem is natural or man made. The natural ecosystem located on the coastal zone, ex: coral reefs, mangrove forest, seagrass beds, sandy beach, barringtonia formation, estuary, lagoon, delta and small island ecosystem. (Dahuri, 2003).

Coral diseases and syndromes generally occur in response to biotic stresses such as bacteria, fungi and viruses, and/or abiotic stresses such as increased sea water temperatures, ultraviolet radiation, sedimentation and pollutants. One type of stress may exacerbate the other (Santavy and Peters, 1997).

Major Reef-Building Coral Diseases

The frequency of coral diseases appears to have increased significantly over the last 10 years, causing widespread mortality among reef-building corals. Many scientists believe the increase is related to deteriorating water quality associated with anthropogenic pollutants and increased sea surface temperatures. This may, in turn, allow for the proliferation and colonization of disease-causing microbes. However, exact causes for most coral diseases remain elusive. The onset of most diseases likely is a response to multiple factors (Peters, 1997).

This section discusses, in alphabetical order, the most prevalent coral diseases and syndromes currently known and under study: black-band disease, coral bleaching, dark-spots disease, red-band disease, white-band disease, white-plague disease, white pox and yellow-blotch disease. Additional information on these diseases and others can be found on NOAA's Coral Disease Identification and Information Web site.

Coral Bleaching

Healthy tissue of most stony corals ranges from yellow to brownish in color, a function of the photosynthetic pigments of their symbiotic zooxanthellae. When corals are inordinately stressed, they often expel their zooxanthellae, or the concentration of photosynthetic pigments declines. This response is known as bleaching (Glynn, 1996).

During a bleaching event, a coral's coloration disappears or becomes pale, and the white of the coral skeleton shows through the translucent coral tissue. In some species, such as the massive starlet coral *Siderastrea sidereal,* the tissue can appear pinkish or bluish, due to pigments within the animal tissue. Localized bleaching has been observed since at least the beginning of the 20th century. However, beginning in the 1980s, regional and global bleaching affecting numerous species has occurred on reefs worldwide. Bleaching usually is not uniform over single coral colonies within coral communities or across reef zones, and some species are more susceptible to bleaching than others under the same conditions (Glynn, 1996). In some instances, only the upper surface or lower surface of the colony is affected. In others, bleached tissue appears as a circular patch or in the shape of a ring or wedge.

Localized bleaching has been attributed to exposure to high light levels, increased ultraviolet radiation, tem-

perature or salinity extremes, high turbidity and sedimentation resulting in reduced light levels, and other abiotic factors (Glynn, 1996). In addition, bleaching in some species has occurred in response to a bacterial infection (Kushmaro *et al.*, 1996). However, the seven major episodes of bleaching that have occurred since 1979 have been primarily attributed to increased sea water temperatures associated with global climate change and el Niño/la Niña events, with a possible synergistic effect of elevated ultraviolet and visible light (Hoegh-Guldberg, 1999).

Debilitating effects of bleaching include reduced skeletal growth and reproductive activity, and a lowered capacity to shed sediments and resist invasion of competing species and diseases (Glynn, 1996). Prolonged bleaching can cause partial to total colony death. If the bleaching is not too severe, and the stressful conditions decrease after a short time, affected colonies can regain their symbiotic algae within several weeks to months (Glynn, 1996).

One predicted effect of climate change is increased coral bleaching (whitening), which is caused by the disruption of the symbiotic relationship between polyps and zooxanthellae resulting in the expulsion of zooxanthellae and loss of photosynthetic pigments. Stresses that can cause this include freshwater flooding, pollution, sedimentation, disease and, most importantly, changes in light and temperature. If stresses continue for long enough, corals and whole reefs can suffer reduced fecundity and growth rates, and eventually even mortality. Once sections of the coral reef die they become vulnerable to further structural degradation by algal overgrowth and bioerosion. Overall, though, the bleaching phenomenon is extremely patchy and can vary greatly according to location, environmental conditions, season or species composition. (Douglas, 2003).

Based on the background, the aims of this research are 1) To Investigate about prevalence on coral bleaching and diseased, and 2) To determine dominant of the genus/species experience of bleaching and diseased.

METHODS

Study Area

Research location was consisted in 3 sites: TN Bunaken (North Sulawesi) in August 2009, TN. Wakatobi (Southeast Sulawesi) in October 2009 and KKP Raja Ampat (Birdshead of Papua) in November 2009.

Time Swims

Diver swim with given time. In this survey used 30 minutes to collect data especially bleaching/diseases and dive in 2 depths (5 and 10 meters).

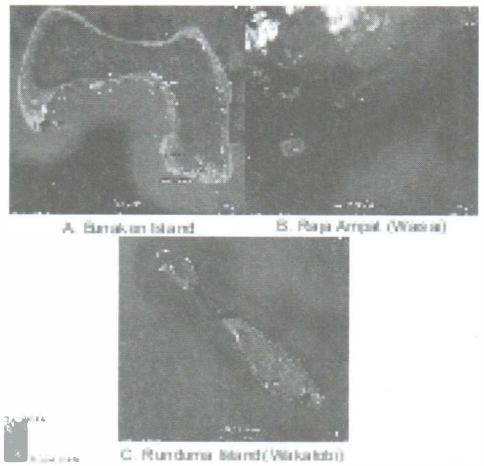

Figure 1. Survey location map from 3 site study to support data validation. **A.** Bunaken Island as the one part of Bunaken National Park-North Sulawesi., **B.** Marine Protected Area are so called Kawasan Konservasi Perairan (KKP) in Raja Ampat (Waisai) Bird's Head of Papua **C.** Runduma Island northeast from Wakatobi district as the one region of Wakatobi National Park–Southeast Sulawesi. (Google map 2010).

Diseased Prevalence

Diseased Prevalence is the proportion of diseased colonies to the total measured population of colonies. It can be calculated for individual populations, species or genera, or for the coral community as a whole, as well as for each particular disease/syndrome, similar group of diseases or for all diseases lumped together. What is calculated depends on the question asked.

– *Prevalence(P) = (# diseased colonies/total # colonies) x 100*

– *Total Prevalence (P) = (# diseased colonies/total # colonies) x 100 / Σ Location*

A prevalence value is estimated for each area-sample unit. An average prevalence value with standard deviation can then be calculated for habitats, zones or reefs (depending on the stratification and the question) using the sample unit prevalence value (Coral Diseases handbook, 2008).

Table 1. Prevalence category coral bleaching and diseases

No	*Prevalence (%)/location/Genus-Spesies*	Category
1	0 – 50	good
2	51 – 75	medium
3	76 – 100	poor
4	>100	Poorly/serious condition

RESULTS AND DISCUSSION

Bunaken Island

Total Prevalence at depth 5m 55,47%/Location/Genus-Sp. The dominant *bleaching & diseased* is Porites sp and Acropora in Ron's point. Prevalence = 113,33% and Muka Kampung = 80%. Less Prevalence in Celah-celah = 7% and Lekuan 2 = 6,6%.

Total Prevalence on 10m = 83,73%/Lokasi/Genus-Sp. Dominant *bleaching & diseased* average from genus :Acropora, Pocillopora and Montipora. Which are dominant it was occurred in Lekuan 2 especially species *Symphyllia radians*. With Prevalence = 133,33% . Whereas less 50% in Celah-celah=39,44%, Lekuan 1=33,71% dan Fukui=16,66%.

Table. 2. Species Encountered in 5m depth

No	Location	Coordinates	Genus/Species
1	Celah-Celah	N 1' 35" 56.9 E 124' 46" 00.0	*Acropora brueggemani, Physogyra*
2	Lekuan 2	N 1' 36" 58.0 E 124' 45" 54.0	*Acropora palifera*
3	Muka Kampung	N 1' 35" 38.0 E 124' 46" 28.4	*Porites sp, Pocillopora sp, Goniopora sp*
4	Lekuan 1	N 1' 35" 41.6 E 124' 46" 16.3	*Porites mayeri*
5	Ron's Point	N 1' 36" 22.3 E 124' 44" 09.4	*Porites mayeri, Acropora brueggemanni,Goniastrea minuta, Goniastrea retiformis*
6	Fukui	N 1' 36" 44.1 E 124' 44" 22.9	*Oxypora lacera, Acropora prostate, Oxypora lucera*

Table. 3. Species Encountered in 5m depth

No	Location	Coordinates	Genus/Species
1	Celah-Celah	N 1' 35" 56.9 E 124' 46" 00.0	*Montipora foliosa, Montipora informis, Acropora nobilis, Acropora palifera*
2	Lekuan 2	N 1' 36" 58.0 E 124' 45" 54.0	*Acropora palifera, Tubastrea micrantha, Symphyllia radians*
3	Muka Kampung	N 1' 35" 38.0 E 124' 46" 28.4	*Acropora palifera, Goniastrea retiformis, Pocillopra verrucosa, Acropora Formosa, Acropora millepora, Goniastrea minuta, Pocillopora verrucosa, Porites stephensoni*
4	Lekuan 1	N 1' 35" 41.6 E 124' 46" 16.3	*Acropora millepora*
5	Ron's Point	N 1' 36" 22.3 E 124' 44" 09.4	*Acropora palifera, Porites stephensoni, Stylophora pistillata, Pocillopora, Isopora sp*
6	Fukui	N 1' 36" 44.1 E 124' 44" 22.9	*Acropora yongei, Pocillopora verucosa, Montipora sp, Porites lutea*

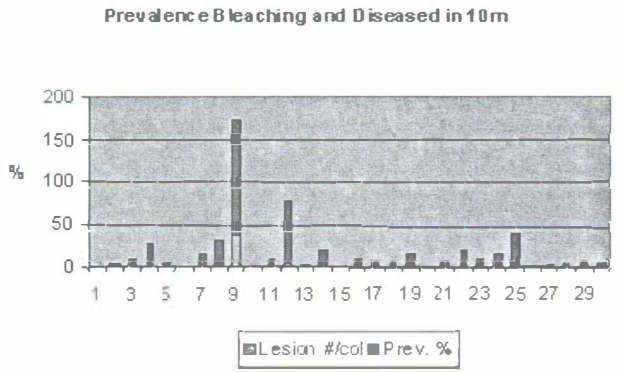

Figure 2. Prevalence in 10m

Total *Prevalence* at depth 10m 83,73%/Location/Genus-Sp. The dominant coral was *bleaching & diseased* average is :*Acropora, Pocillopora* and *Montipora*. It was occured at loacation Lekuan 2: *Symphyllia radians*, with *Prevalence* = 133,33% . Otherwise less Prevalence under 50% was occured at Celah-celah=39,44%, Lekuan 1=33,71% and Fukui=16,66%.

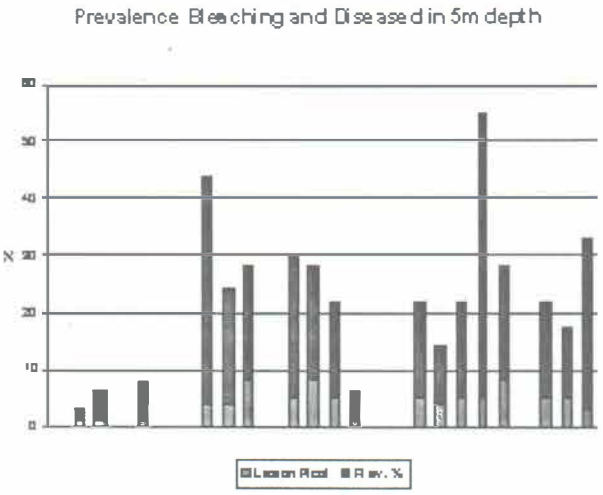

Figure 2. Prevalence in 5m

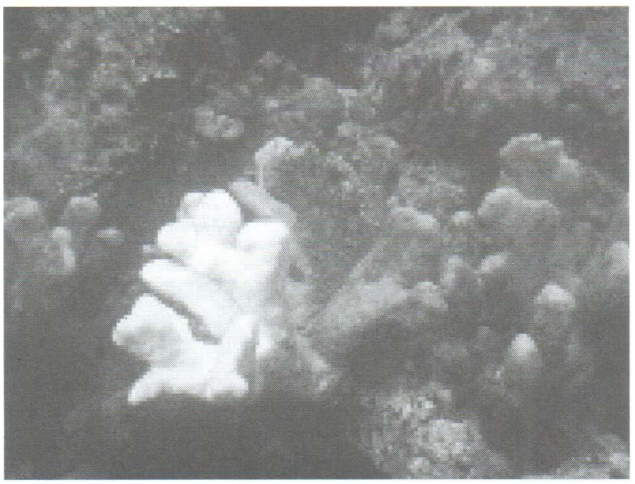

Figure 3. *Acropora palifera* at Celah-celah dive site at depth 10m with *"unusual bleaching patterns"*

Raja Ampat

Table. 4. Species Encountered in 5m depth

No	Location	Coordinates	Genus/Species
1	Saonek Monde (SN)	unrecord	*Porites, Acropora (3x), Porites*
2	Tanjung Saleo (TS)	00° 26.475' 130° 46.222'	*Acropora (2x), Porites*
3	Waisai 1 (WTC1)	00° 26.019' 130° 49.293'	*Acropora sp (3x), Porites (3x), Acropora cylindrica,*
4	Waisai 2 (WTC2)	00° 25.431' 130° 50.868'	*Porites (4x), Acropora (5x)*
5	Saonek (SNK)	00° 28.201' 130° 47.281'	*Acropora, Platygyra, Porites*

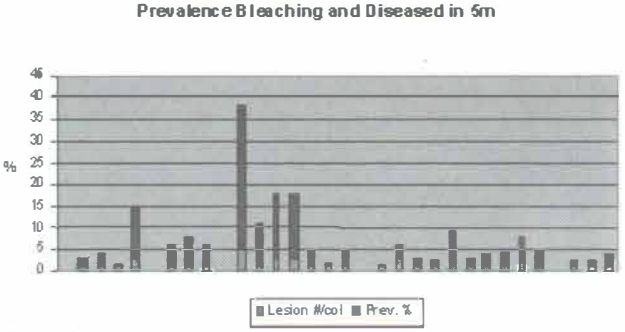

Figure 4. Prevalence in 5m

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Total Prevalence at depth 5m 30,67%/Location/ Genus-Sp. The dominant coral was *bleaching & diseased* average is *Porites sp* and *Acropora*. High category of prevalence was occurred in Waisai 1=**82,13%**. Otherwise in Saonek prevalence=**5,26%**. Is indicate that 5m depth include very good ecosystem ex: water quality, etc.

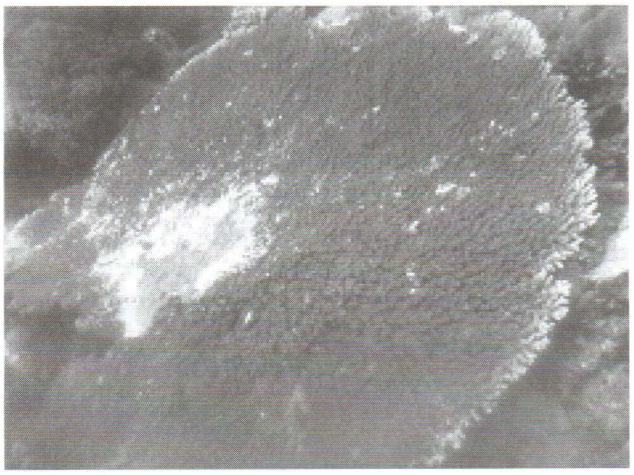

Figure 5. *Acropora* at 5m depth in Saonek Monde with *white band diseased*.

Figure 6. *Acropora* at 5m depth with prey gastropoda (*Drupella cornus*).

Figure 7. *Porites* in Saonek Monde at 5m depth with *Pigmentation Response*. (Photo F. Ampou)

Table. 5. Species Encountered in 10m depth

No	Location	Coordinates	Genus/Species
1	Saonek Monde (SN)	unrecord	*Acropora (2x), Hydnopora*
2	Tanjung Saleo (TS)	00° 26.475' 130° 46.222'	*Porites (2x), Montipora*
3	Waisai 1 (WTC1)	00° 26.019' 130° 49.293'	*Sand*
4	Waisai 2 (WTC2)	00° 25.431' 130° 50.868'	*Sand*
5	Saonek (SNK)	00° 28.201' 130° 47.281'	*Acropora (2x), Porites (2x)*

Response.

Total Prevalence at 10m depth 23,50%/Location/ Genus-Sp. The dominant coral was *bleaching & diseased* average is *Acropora* and *Porites*. The area with high prevalence was occured at Tanjung Saleo=61%. Otherwise in Saonek Monde=11,83% (less prevalence). At 10m depth the level of biodiversity especially coral reef very rare or may even unexist in site: Waisai 1 and 2

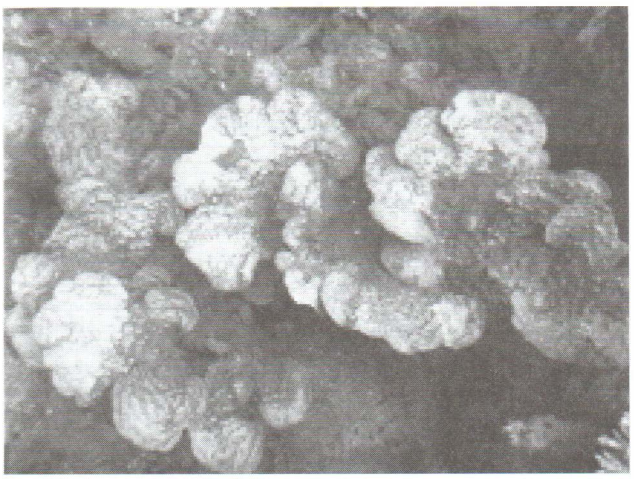

Figure 9. Montipora in Tanjung Saleo at 10m depth with *"white syndrome"*.

Runduma Island (Wakatobi)

Table. 5. Species Encountered in 5m depth

No	Location	Coordinates	Genus/Species
1	Runduma 1	05° 21. 115' 124° 21. 583'	*Porites sp, Pocyllopora*
2	Runduma 2	05° 20. 843' 124° 20.073'	*Pocylopora, Porites sp, Acropora*
3	Runduma Anano 1	05° 17. 396' 124° 17. 186'	*Porites sp (6x)*
4	Runduma Anano 2	05° 17. 789' 124° 17. 312'	*Pocylopora sp*
5	Runduma Anano 3	05° 18. 238' 124° 17. 930'	*Porites sp, Lobophyillia, Acropora*

Total Prevalence at 5m depth 23,55%/Location/ Genus-Sp. The dominant coral was *bleaching & diseased* average is *Porites sp* in Runduma Anano 1 with Prevalence = 74,59%

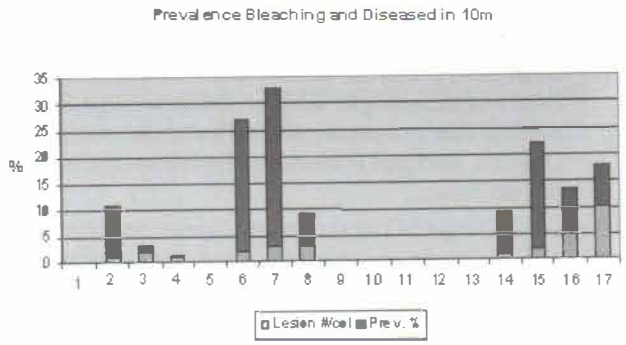

Figure 8. Prevalence in 10m

Figure 11. Stoney coral genus *Porites* at 5m depth with *pigmentation response*.

Table. 6. Species Encountered in 10m depth

No	Location	Coordinates	Genus/Species
1	Runduma 1	05^0 21. 115' 124^0 21. 583'	*Porites sp (5x)*
2	Runduma 2	05^0 20. 843' 124^0 20.073'	*Porites sp, Pocylopra*
3	Runduma Anano 1	05^0 17. 396' 124^0 17. 186'	*Porites sp (4x), Lobophyllia*
4	Runduma Anano 2	05^0 17. 789' 124^0 17. 312'	*Pocylopora sp (2x), Acropora sp, Montipora*
5	Runduma Anano 3	05^0 18. 238' 124^0 17. 930'	*Porites sp (2x), Acropora sp (2x)*

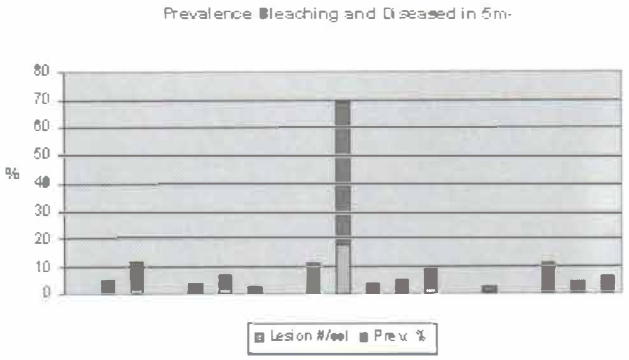

Figure 10. Prevalence in 5m

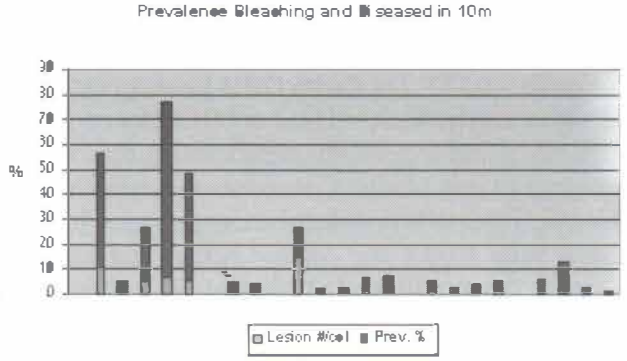

Figure 12. Prevalence in 10m

Total *Prevalence* at 10m depth 50,94%/Location/ Genus-Sp. The dominant coral was *bleaching & diseased* average is *Porites sp*. In Runduma 1 with *Prevalence* = 185,42%.

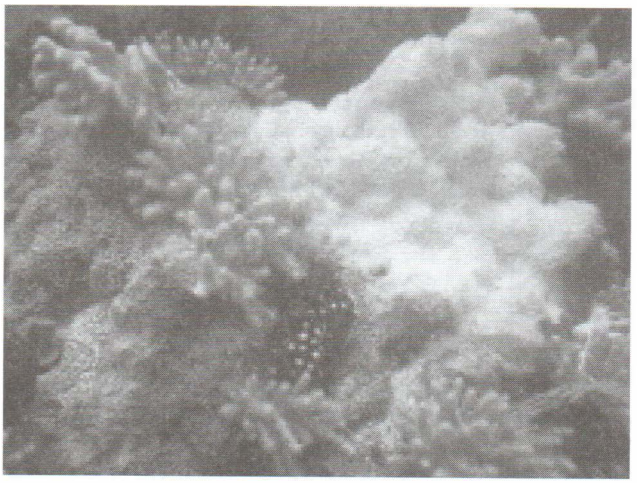

Figure 13. Porites with *bleaching pattern*. (Foto: E. Ampou)

CONCLUSION

1. The high prevalence was occurred at Bunaken National Park especially at 10m depth : 83,73 (poor), low prevalence in Raja Ampat at 10m depth : 23,50 (good).
2. The coral dominant bleaching and diseased is *Porites* and *Acropora*, otherwise Pocillopora and *Montipora* undominant.

SUGGESTION

1. The ideal approach to studying coral diseases/ bleaching and their impacts, given sufficient funding and qualified personnel, is a well designed, integrated, multi component survey.
2. The result of this research need to be continued in the future such as long term monitoring at the same location to gathering more significant data.

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