Cryptic Species from Biodiversity Hotspot: Estimation of Decapoda on Dead Coral Head Pocillopora in Raja Ampat Papua

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Abstract

Cryptic organisms that live within the interstices of reef habitats contribute significantly to coral reef biodiversity. One example of this cryptic biodiversity is the high abundance of decapods in dead coral heads that associated with various biota. However, this diversity poorly studied especially species identification and species richness. This study aims to estimate the decapods diversity in Raja Ampat, Papua, using Pocillopora dead coral head method as semi-quantitative sampling approach. Raja Ampat in Papua is chosen because it situated in the center of Coral Triangle marine hotspot. Data were collected from 10 dead coral heads of genus Pocillopora from 10-meter depth near the islands of Kri and Misool. This study observed a total of 205 individuals Decapoda from Kri Island and 672 Individual from Misool Islands. Species richness observation (Chao1 and ACE) of the total samples reports only 11 families of decapoda detected in this study. Rarefaction curve reach an asymptote after all after all ten dead coral were analyzed; indicating that additional sample collection would not change estimates of diversity found in this study. The Shannon-Wiener index diversity on the Kri Island showed lower diversity value (2.09) compared to Misool Island (2.18). In the future, this research can be used as a basis for understanding the diversity of coral reefs as well as for management and conservation of coral reef ecosystems.

Keywords*: cryptic species, decapoda, diversity, dead coral head, Raja Ampat*

Introduction

Raja Ampat area is a part of the world's coral triangle (coral triangle) that is region distribution center of coral comprise in Indonesia, Philippines, Papua New Guinea, Malaysia, Timor Leste and Australia. Raja Ampat Islands, West Papua Province of Indonesia include 4 million acres of land and sea that includes four large islands (Waigeo, Salawati and Misool, Batanta islands off), hundreds of small islands and two large Strait (Dampier and Sagewin). The diversity of coastal and marine habitat supports diverse coral reefs, sea-grass meadow to mangrove ecosystems (Mangubhai *et al.,* 2012). Tropical marine biodiversity belonging to Raja Ampat islands of survey results on coral reef ecosystems conducted since the year 2001 successfully identify as many as 553 coral species and approximately 1320 types of reef fish (Veron *et al.,* 2011; Allen and Erdmann 2009). This number indicates that the diversity of species of coral in the area belongs to very high, because of the estimated total number of coral in the world only about 800 species.

The waters of Raja Ampat influenced the existence of “Indonesia-throughflow”, which is the exchange between the Pacific Ocean and India (Vranes and Gordon, 2005) and generates turbulence and vortices between the local Islands. It makes the Papua Islands are primarily Raja Ampat has a unique and rich diversity. Raja Ampat becomes one of the locations that received priority marine biodiversity conservation in Indonesia. Biodiversity includes variety and abundance of species in a given location including diversity within species, between species and of ecosystems

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(Maguran, 2009), is an important factor to represent the wealth of coral reefs. Coral and fish used as a substitute in the valuation of biodiversity due to the well-known taxonomy and easy to identify. However, both this group represents only a fraction of the diversity of coral and not all the scope of diversity of organisms. The complex structure of coral reefs is also a factor when it is to find and to estimate the hidden diversity of reef organisms (Plaisance *et al*., 2009), in particular the organisms that live in the coral reef cracks and fissures.

Decapoda is not backboned animals (invertebrates) in the phylum Arthropoda crustacean subphylum, class Malacostraca, and which has the characteristic that is there is the sum of 10 and consists of 5 pairs of legs. Currently, Decapoda is recorded in the world totaling 14,756 species (genera 2,725) (Grave *et al.,* 2009) while in Indonesia contained as many as 1,400 species (Rahayu *et al.,* 1992-2016). Based on previous research (Plaisance, 2009) shows that coral reefs are dead given recesses to biota living in it with the organism that dominates is the organism of the Decapoda.

The purpose of this research was to answer the question about the diversity of cryptic coral reef species in Raja Ampat, Papua. Research that was used to represent the Decapoda biota collected from dead Pocilopora to estimate biodiversity. As a pilot study, the islands of Misool and Kri made a sample location due to the difference in the characteristics of the potential location of the study as a tourist area and conservation, and also the high percentage of the total number of dead coral reefs were found in this location than in other locations. This data can be used as a basic knowledge in monitoring coral reefs for protection and conservation in the territory of Raja Ampat.

Materials and Methods

This research was carried out on 13-16 December 2016 deed coral retrieval is done on the islands of Misool and Kri, Raja Ampat, Papua Islands (Figure 1).

The methods used for sampling the corals die using a method that invokes the Plainsance *et al.* (2009). In general the procedures of activities to be performed consists of preparation tools and materials, the taking of the sample of dead coral, a collection of biota, and sort data capture (photo biota), data processing (identification of biota), and data analysis.

Sampling of dead coral *Pocillopora* sp. using scuba gear, a chisel, a hammer, a bucket, and a plastic bag. The chisel and the hammer is used to release the coral from the substrate, then coral death wrapped in a plastic bag so that biota found in the sample is not coming out at the time were transferred to the bucket. Dead coral samples taken consists of 10 dead coral *Pocillopora* sp. from Kri and Misool Island. The next step is the measurement of the volume of dead coral. The volume of dead corals in size with use a bucket and a measuring cup, where coral dead volume equal to the volume of water that spilled when the coral is entered or called by water displacement. The average volume of dead corals *Pocilllopora* sp 3.11±0.05 liters.

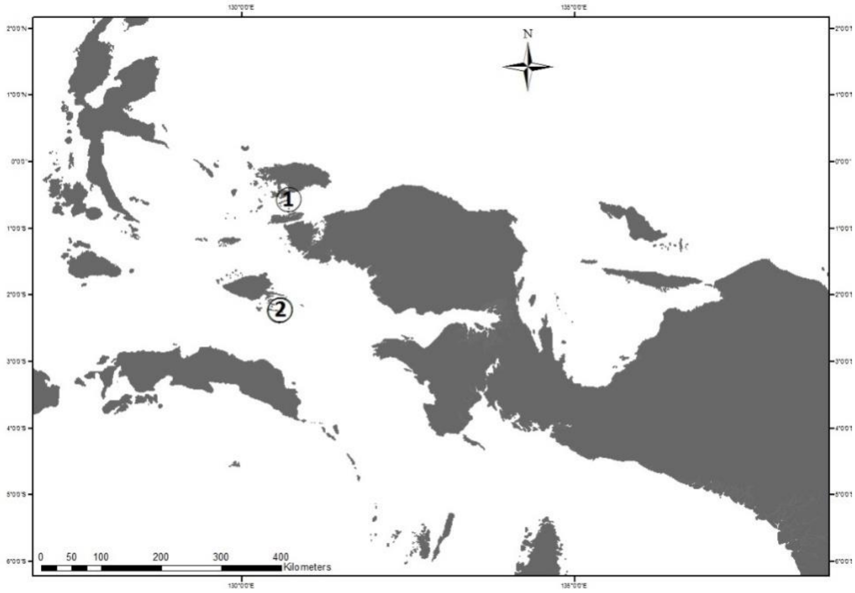


Figure 1. The location of the retrieval of the dead corals in Papua (1: Kri; 2: Islands of Misool)

The next step is the breakdown of the sample of dead coral retrieval of biota that are then sorted and given the label of each individual. Furthermore, the identification of the done up at family using the book identification Crustacean Guide Of The World (Debelius, 2001). The next stage is doing the taking of photos and collection of biota which at this stage of life that have passed the stage of documentation will be placed into a tube or bottle samples that contain ethanol 96%. Identification of biota to levels of family and the abundance of each individual decapoda noted. Abundance, diversity, the Shannon-Wiener Index, Chao1, ACE and Rarefaction curves are analyzed using 9.1.0 v. EstimateS (Colwell, 2013).

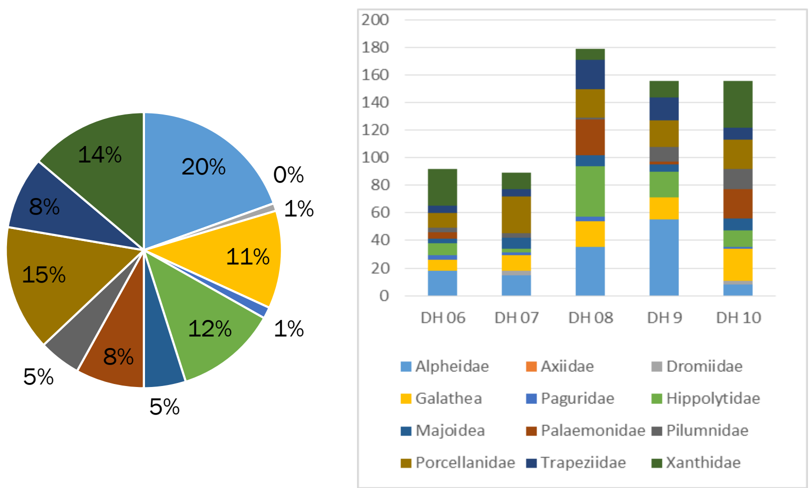
Results and Discussion

Dead Coral Head is a semi quantitative sampling methods that had previously been done by Plaisance *et al.* (2009). This method is used for the estimate decapoda organisms found on coral reefs to die from the genus Pocillopora despite challenges in finding coral reefs with a standard size for each coral reefs is difficult. The study did estimate the diversity of decapoda in Kri and Misool Island, Raja Ampat. Coral reefs dying are taken as many as five of the Kri Island and five dead reefs of Misool. Each individual decapoda found identified up to the level of the family. Total individuals derived from the island of Kri is 672 205 individuals and individuals from Misool with 11 families at each site. Eleven families found on the island of Kri is 78% 22% crab and shrimp. Four shrimp family Alpheidae is found, Axiidae, Palaemonidae, and seven families Hippolytidae while crabs found are Galathea, Paguridae, Majoidea, Pilumnidae, PorcellanidaeTrapeziidae, and Xanthidae. Whereas in 61% of the sample found in Misool is crab with seven families Dromiidae, Galathea, Paguridae, Majoidea, Pilumnidae, PorcellanidaeTrapeziidae, and Xanthidae and 39% of shrimp of the family Alpheidae, namely with the three, Palaemonidae, and Hippolytidae. These data indicate that in the island of Kri and Misool have a diversity of decapoda faunas with the same family number but when compared to the data of family crab Ng *et al.* (2008) there are 93 family indicate the family still found a little.

Data abundance decapoda at both locations (Figure 1.) showed that both of these locations have different abundances. Family Xanthidae shows an abundance of decapoda of all coral reefs are dead on the island of Kri 30% from the abundance of the other family (Figure 2a.). Compared to the abundance and diversity of data (Figure 2b.) shows that the maximum number of families that are found in a single dead coral reefs are 10 families and the minimum amount to 3. Whereas in Misool Alpheidae family has the highest abundance of 20% from the other family (Figure 2a.) and the abundance and diversity of every dead coral reefs are found at most 11 families and at least 10 families of decapoda.

Based on the results of singleton and doubleton (Figure 3 and 4) showed that species richness of dead coral reefs which indicates multiplicity variation decapoda in one coral reefs to die, but when coupled with the dead coral. Another variation of the species in the reefs die because there is no large number of the same species.

The value of the Chao 1 and ACE on the curve shows the curve still has not yet reached the point of equilibrium. Getting curves that reached a point of equilibrium can be done by adding one to three coral reefs to be see if the curve already are on the horizontal lines (plateu) in the sampling location.



(a) (b)

Figure 2. (a) the abundance of Decapoda (b) abundance and diversity of deed coral reefs in Misool Island

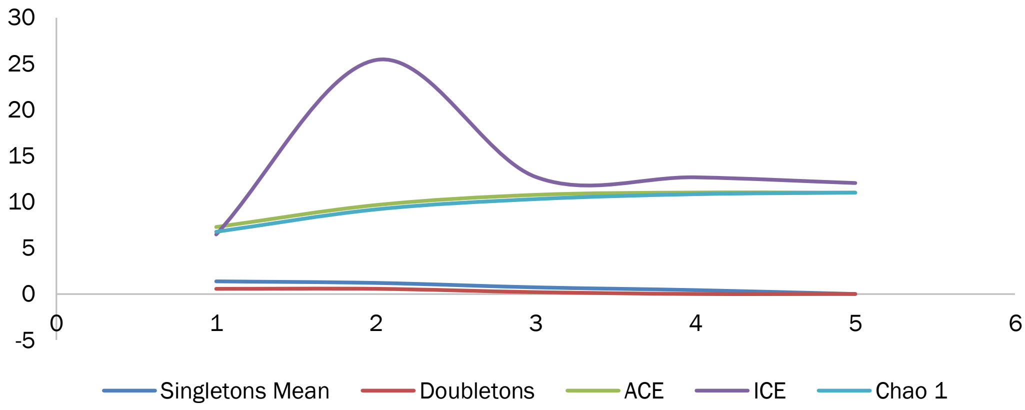


Figure 3. Rarefaction curves using analysis of Estimation on the island of Kri

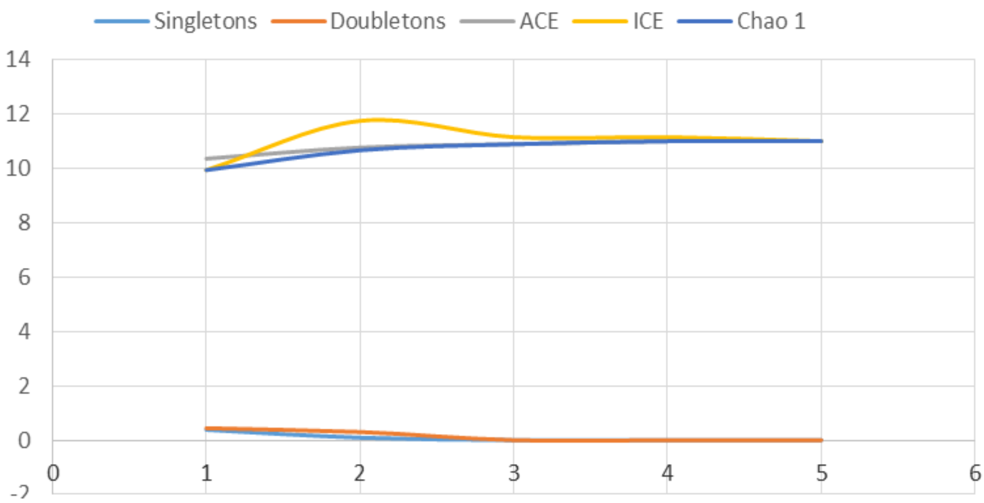


Figure 4. Rarefaction curve analysis using Estimation in Misool Island

This value shows how the number of dead coral reefs to be added will not add to the diversity of the decapods. Chao1 (Chao, 1984) and Ace (Chao and Lee, 1992) estimating diversity by providing estimates of diversity when many species in the sampling (Coddington and Collwell, 1994). This result is also supported by estimates such as the analysis of the Singleton and doubleton indicating a low amount (Figure 3. and 4.). Shannon-Wiener index of Kri Island has a lower value i.e. 2.09 compered with in Misool *i.e.* .18 indicating that the high diversity and abundance of the decapoda. It can be said that the diversity of decapoda on deed coral reefs in Kri Island is inferior that Misool Island.

The difference diversity at both of these locations can be caused by the difference of the topography of the region and a threat that occurs in coastal areas like the island of Kri, including areas that have the most diverse resource users compared to other regions, the influx of non-natural materials into the environment and changes to the natural habitat can also affect the ecosystem functions. The region of Misool have a condition with a current that brings nutrient intake is sufficient for the growth of coral reefs so recorded 339 species of coral (Donnelly *et al.,* 2002) makes this region contains a high diversity. In addition the percentage cover of the living coral reefs, and topographic complexity created by the skeleton of the coral and other marine organisms diversity also affects diversity (Stella *et al.,* 2010).

This data can be used as initial data from a diversity of cryptic species in Raja Ampat Island location with the representative Kri and Misool and can be equipped with further studies on other islands, particularly the island of different function zones like in the zone the main zone and zone conservation and utilization. Identification and molecular techniques in morphospecies can help in identifying the same species (Knowlton *et al.*, 2010) and to further research needs to be done by comparing the diversity between taxa of the lowest level as the level of species to see cryptic species.

Conclusions

Estimation of the composition and diversity of decapoda on coral dead on the island of Kri and Misool have indicated that in the region of Misool decapoda faunas have more than a total of 10 samples of dead coral reefs that have been taken from both locations. The abundance and diversity of data shows 11 decapoda families recovered from each sampling location. This research can be the foundation of an overall understanding of the diversity of coral reefs and help in the management area of the coral reef ecosystem.

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