

The status of coral reefs in Aceh Besar district, Aceh Province, Indonesia

¹Nur Fadli, ²Zainal A. Muchlisin, ³Muzailin Affan, ¹Sayyid A. El Rahimi

¹ Department of Marine Science, Faculty of Marine and Fisheries, Syiah Kuala University, Indonesia; ² Department of Aquaculture, Faculty of Marine and Fisheries, Syiah Kuala University, Indonesia; ³ Department of Informatics, Faculty of Mathematic and Natural Science, Syiah Kuala University, Indonesia. Corresponding author: N. Fadli, ivad29@yahoo.com

Abstract. Coral reefs in Aceh Besar are one of the degraded ecosystems due to human activities. A number of interventions are made by the Government of Aceh Besar district to protect its coral reefs. One of the interventions is the establishment of a number of marine protected areas in Aceh Besar. However, the data of coral conditions in this area is deficient. The objective of the present study was to establish a baseline data of coral reefs in Aceh Besar to support marine protected areas in Aceh Besar. This study was conducted from April 2012 to October 2012, at eight locations in Aceh Besar, namely: Amat Aramanyang, Lhok Keutapang, Tuanku Island, Lampuuk, Leupung, Lhok Seudu, Deudap and Lamteng. The coral cover was examined using 3 replicates of 20 m line intercept transect (LIT) in two different depths (2-4 m and 6-8 m) in every sites. The condition of coral reefs in Aceh Besar, generally in moderate condition with the average percentage of coral covers above 45%. The coral reefs in Aceh Besar are categorized into good category (50%) and the remaining into moderate category (50%). The highest percentage of coral cover was located in the Lhok Keutapang (59%), while the lowest was in Lamteng (Nasi Island) with 33.38%. Coral life forms in Aceh Besar vary among locations. Coral reefs in Aceh Besar were dominated by *Acropora* branching (ACB) followed by massive corals. Mushroom coral was the lowest life form found in Aceh Besar (CMR).

Key Words: Aceh Besar, coral reef, composition, life form.

Introduction. Coral reefs are one of important marine ecosystems in Aceh. Bordered in three large bodies of water (the Andaman Sea, The Indian Ocean and the Straits of Malacca), Aceh waters are likely to be of high biogeographical significance (Brown 2007). Unfortunately, coral reefs in Aceh, including Aceh Besar are under risk due to human activities such as destructive fishing, anchoring, waste disposal and etc. In addition, there were natural factors that lead to the coral degradation in Aceh such as sedimentation and the excessive predation of spiny starfish *Acanthaster planci* and corallivorous snail *Drupella* sp. (Baird et al 2005; Baird et al 2013). Acehnese reefs also experienced mass coral bleaching caused by climate change in 2010 (Rudi et al 2012b). The healthy coral reefs provide important ecosystem services and also provide direct economic impacts to coastal communities. For instance, for Indonesia, the coral reefs benefit 1.6 million U.S. dollars per year either through fisheries, pharmaceuticals, ornamental fish and coral trade, tourism, etc. (Burke et al 2002). The tourism is share of GDP 1 percent in Indonesia (Burke et al 2012). Furthermore, corals also have many benefits that cannot be valued in money, including: as a place to recycle nutrients, providing food, shelter and spawning areas of fish and other marine organisms (Buddemeier et al 2004).

A number of interventions are made by the Government of Aceh Besar district to protect its coral reefs. One of the interventions is the establishment of a number of marine protected areas in Aceh Besar. However, the determination of the efforts is collided with some obstacles, including the lack of data of marine resources including the condition and the diversity of coral reef. The data of corals condition and biodiversity is one of important information to strategize a better conservation plan. Presently a number

of studies relating to the biodiversity in marine ecosystems in the Aceh Province have been reported by some researchers (Baird et al 2005; Rudi 2005; Ardiwijaya et al 2007; Campbell et al 2007; Rudi et al 2008). Baird et al (2012) and Rudi et al (2012a) reported that Aceh may also be a hotspot for coral biodiversity. They found 133 scleractinian species in shallow water of Weh Island, from which at least five species are potential new to science. However, the studies were focused on Weh Island and its surrounding waters. Limited information on the coral reef condition and other associated coral organisms in Aceh Besar district was available. Hence, the objective of the present study was to establish a baseline data on coral reefs in Aceh Besar to support marine protected areas in Aceh Besar district especially in the main coast of Aceh.

Material and Method. This study was conducted from April 2012 to October 2012 at eight locations in Aceh Besar, namely: Amat Aramanyang, Lhok Keutapang, Tuanku Island, Lampuuk, Leupung, Lhok Seudu, Deudap and Lamteng (Figure 1). The coral cover was examined using 3 replicates of 20 m line intercept transect (LIT) in two different depths (2-4 m and 6-8 m) in every site. The cover in cm of each hard coral colony was recorded. The coral colonies were categorized following the life form that suggested by English et al (1997). The coral cover was then expressed as the percentage of 20 m covered by each group on each transect.

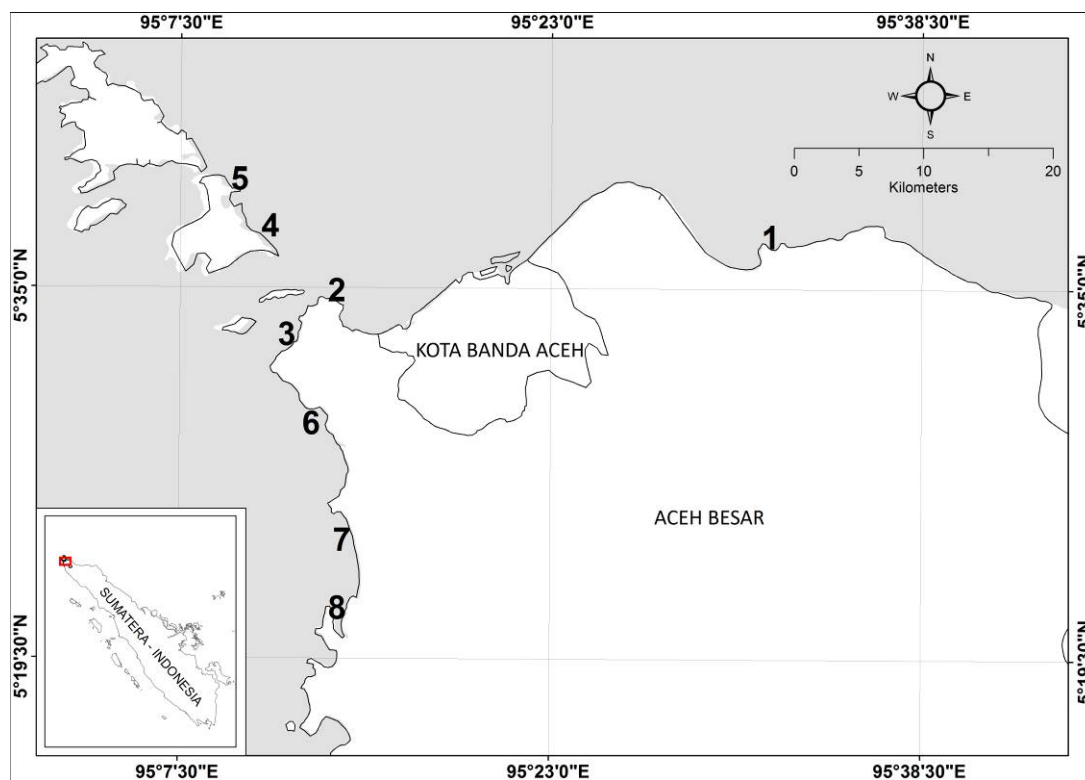


Figure 1. Map of study sites in the district of Aceh: 1. Amat Aramanyang; 2. Tuanku Island; 3. Lhok Keutapang; 4. Deudap; 5. Lamteng; 6. Lampuuk; 7. Leupung; 8. Lhok Seudu.

Results and Discussion

Percent cover. The coral reefs in Aceh Besar waters are generally in moderate conditions with the percentage of coral cover more than 45% in average. The highest percentage of coral cover was recorded in Lhok Keutapang (59%), while the lowest cover was found in Lamteng, Pulau Nasi (33.38%) (Figure 2). Based on the categories suggested by English et al (1997), 50% of observed coral reefs areas were in good condition and the rest was falling into the moderate category (Figure 3).

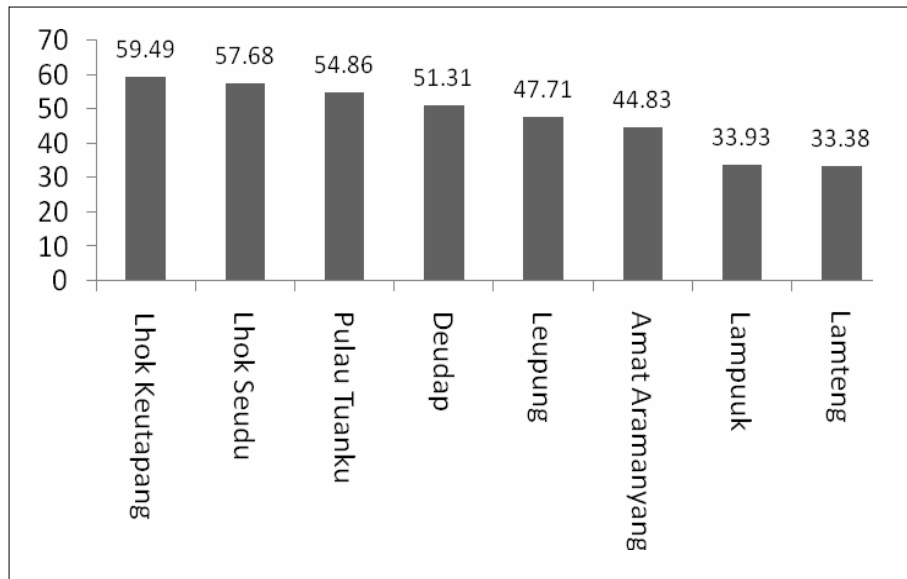


Figure 2. The percentages of live coral cover in the study site.

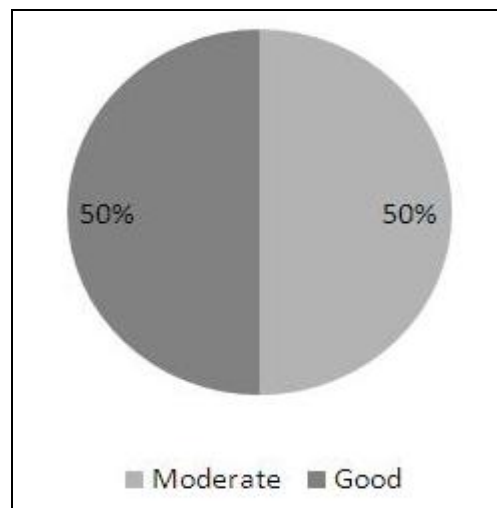


Figure 3. The condition of coral reefs in the waters of Aceh Besar district.

Life form composition. Coral reefs in Aceh Besar were dominated by *Acropora* branching (ACB) and followed by massive corals (CM). The life form that has the lowest number was coral mushroom (CMR) (Figure 4). In addition, the coral life forms that were found in Aceh Besar were varied among locations. Lhok Keutapang was dominated by sub massive corals (CS) followed by *Acropora* branching (Figure 5a). In contrast, Lhok Seudu reefs was dominated by *Acropora* tabulate (ACT) followed by *Acropora* branching (Figure 5b). In addition, the numbers of colonies of each coral life form in Tuanku Island is presented in Figure 5c. The coral life form that was found in this location was dominated by ACB (29 colonies), followed by ACT (21 colonies). Foliose coral (CF) was the least coral life form that was found in this location (2 colonies). Furthermore, in Deudap, ACT was the most common life form that was found in the waters followed by CM. *Heliopora* (CHL) was the least life form that was found at this location (Figure 5d). A much different of coral life form were found at Amat Aramanyang and Leupung. Massive coral (CM) dominated the Leupung coral reefs and followed by CHL (Figure 5e). In Amat Aramanyang, the coral was dominated by CM (Figure 5f). The number of CM growth forms that live on this site is related to mass bleaching events (bleaching) in May-July 2010. The bleaching event caused mass mortality of vulnerable corals groups such as *Acropora* (Rudi et al 2012b). The massive coral like *Porites* is resistant in temperature changes (McClanahan et al 2001). Lampuuk coral reefs were dominated by ACB and

followed by CS (Figure 5g). While Lamteng reefs were dominated by ACB and followed by CM (Figure 5h).

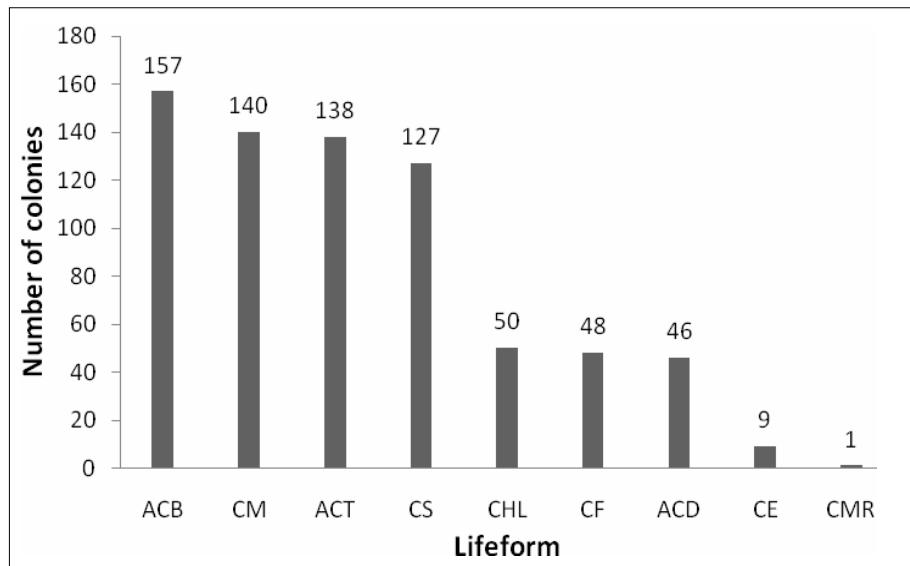


Figure 4. Total number of colonies of coral life form in the study sites.

In general, the average percentage of coral cover in Aceh Besar is better than average percentage of coral in Weh Island. Campbell et al (2007) showed the average percentage of coral cover in Pulau Weh ranged between 32-35%. However, some locations in Weh island had higher coral cover than in Aceh Besar (> 75%) like in Sumur Tiga, Benteng and Rubiah Sea Garden (Baird et al 2005). In addition, Baird et al (2005) and Campbell et al (2007) found that the coral reef in some islands in Aceh Besar were under threat with the conditions of hard coral cover less than 10% compared to Weh Island.

The main factor that damaged the coral in Aceh Besar was human activities. Destructive fishing (bombing and cyanide) is still observed in this area. This observation is also supported by Baird et al (2005) that found destructive fishing and waste disposal into the sea were two of the factors of coral damage in some small islands in Aceh Besar. Furthermore, the low live coral cover in Lamteng in Nasi Island is caused by the use of ship's anchor. This location is a harbor for boat landing in this island. In addition to the human factor, there were also natural factors such as sedimentation and excessive predation of spiny starfish that can damage coral reefs (Baird et al 2005). In Amat Aramanyang example, in May-July 2010, the region experienced bleaching events that cause mass death of corals groups which are vulnerable in sea surface temperatures changes such as Acropora (Rudi et al 2012b). In addition, at the time of observation, the spiny starfish was also found in the region. Spiny starfish is also one of the major natural factors that damage coral reefs in several locations in Aceh waters. Herdiana et al (2008) have reported a large-scale predation by the spiny starfish at Banyak Islands. Starfish populations in these waters have been categorized into the dangerous category. Baird et al (2005) also reported this spiny starfish damaged several coral locations on the Weh island. Coral bleaching becomes more common in world waters. Marianas reefs for example, have experienced unprecedented coral bleaching. This region has not experienced coral bleaching after the past two decades (Reynolds et al 2014).

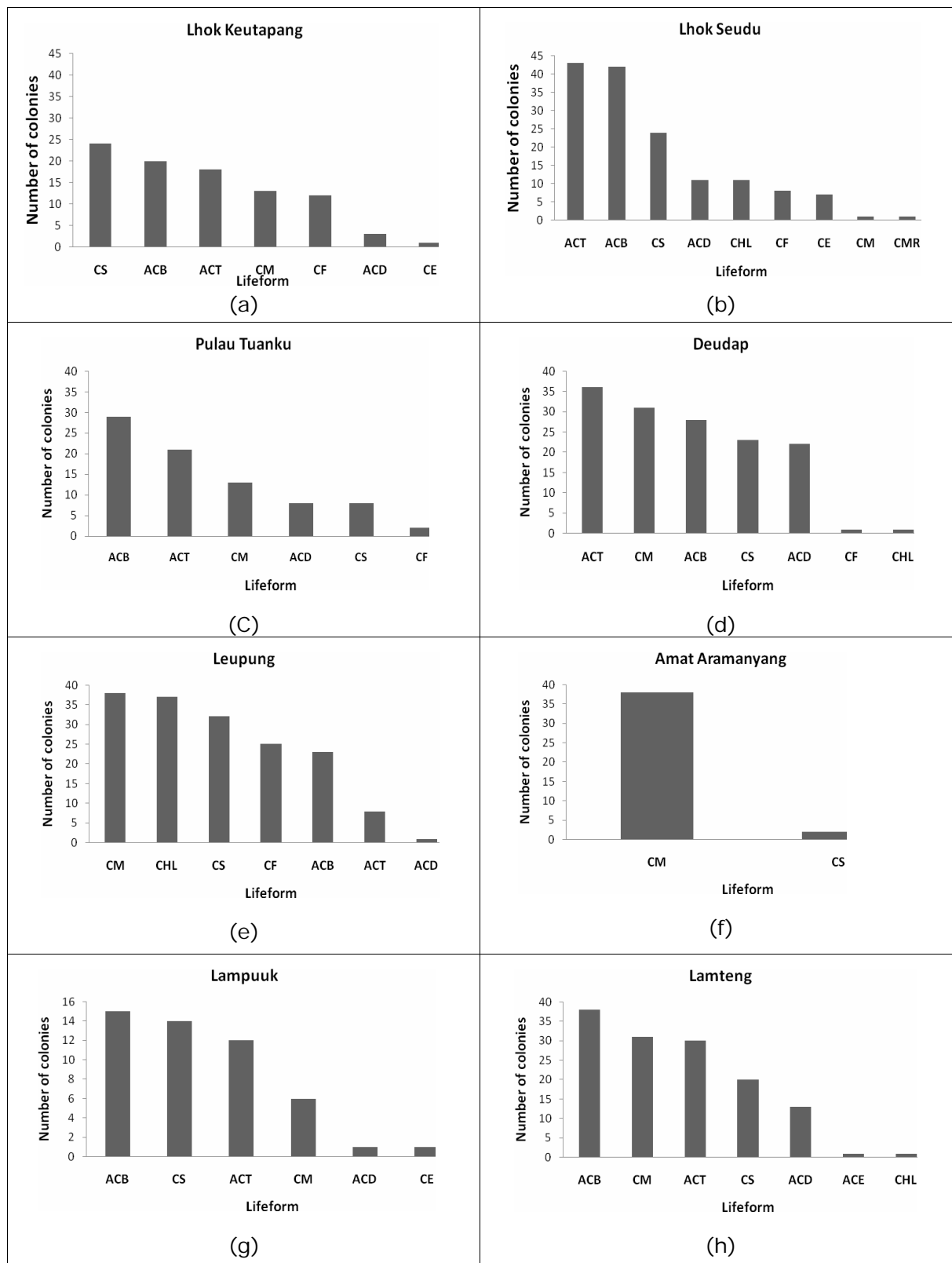


Figure 5. Live coral growth forms (lifecycle) in Aceh Besar.

Conclusions. The coral reefs in the waters of Aceh Besar are generally in moderate condition with the percentage of coral covers on average over 45%. The coral reefs in Aceh Besar are categorized into good category (50%) and the remaining into moderate category (50%). The highest percentage of coral cover was located in the Lhok Keutapang (59%) while the region with the lowest percentage of coral cover was in the region is Lamteng Nasi Island (33.38%). Life form of the reefs in Aceh Besar waters vary

between locations. Coral reefs in the waters of Aceh Besar are dominated by life form of the group of *Acropora* branching followed by massive corals. Mushroom coral is the lowest form of life form found in Aceh Besar. Providing a baseline data of coral reefs condition in Aceh Besar may become a good support to the establishment of marine protected areas. These areas give the opportunity to coral to survive and support eco friendly industries such as marine tourism.

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Authors:

Nur Fadli, Department of Marine Science, Faculty of Marine and Fisheries, Syiah Kuala University, Banda Aceh 23111, Indonesia, e-mail: ivad29@yahoo.com

Zainal A. Muchlisin, Department of Aquaculture, Faculty of Marine and Fisheries, Syiah Kuala University, Banda Aceh 23111, Indonesia, e-mail: muchlisinza@yahoo.com

Muzailin Affan, Department of Informatics, Faculty of Mathematic and Natural Science, Syiah Kuala University, Indonesia, Banda Aceh 23111, e-mail: muzailinaffan@gmail.com

Sayyid Afdhal El Rahimi, Department of Marine Science, Faculty of Marine and Fisheries, Syiah Kuala University, Banda Aceh 23111, Indonesia, e-mail: sayyid_afel@yahoo.co.id

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