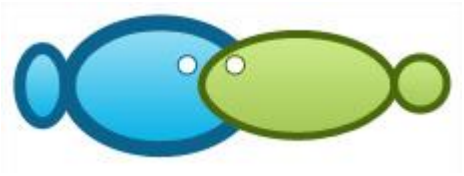

Marine Protected Areas *versus* Marine Nature Reserves: testing conservation area management effectivity in Indonesia

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Abstract. The role of the Marine Nature Reserves is very strategic in managing the benefits and for marine resources sustainability. Ironically, until today water resources condition recovery, particularly coral reefs, do not show a significant progress. Making of Marine Protected Areas at village level (MPA) since COREMAP II Project in Indonesia have not yet give a significant coral reefs condition recovery. Case study in coral reef at Buton District showed that in average the condition of coral reefs since 2007, 2008, and 2009 has progress of only 30.16%, 32.2%, and 30.61%, respectively. Fish population in the same years highlighted 201, 188, 147 species in the whole MPA. In 2011 Buton district has been determined Marine Nature Reserves through SK Major of Buton No. 938 Year 2011. From survey results in 2014 which has been done in several MPA's in Buton district showed that the average of living coral reefs covers 47.4%. While from LIPI research in 2016 it is shown that the average of coral reefs closure is 28.89%, and reef fish population is about 82 species. MPA establishment which seems bottom up has not been completely effective in returning coral reefs closure percentage. While Marine Nature Reserves establishment which seems to be top down also has few serious problems cocerning effective supervision. Conservation area management should be seen holistically and respectful collaboration between central government, local government, and local wisdom in each district is required, because people are capable to take care of coral reefs completely and continuously. People make living in the sea for their families and government with its parties will fully support them in order to maintain marine resources.

Key Words: coral reefs, marine resources, Buton, reef fish, resources sustainability.

Introduction. Indonesia has 85.707 km^2 coral reefs overlay which represents 15% of the total coral reefs in the world. As an ecosystem with quite high biological productivity, coral reefs hold important ecological roles, as are complex productive areas with high diversity of several biotas, and also function as place for nurturing, nourishment, protection of larva and juvenile fish. Coral reefs also contribute in protecting the beach from abrasion, flood, and other nature phenomenon which are caused by sea water. The beauty of coral reefs ecosystem also becomes one of the underwater tourist attractions for scuba diving and snorkeling.

In order to maintain continuous coral reefs condition, it requires a consistent effort of water conservation whether from an idea and acts of the people or an establishment which is conducted by central government in the form of water conservation area. One of the established village level conservation area is Marine Protected Areas or known as MPA (Maypa et al 2012; Cicin-Sain & Belfiore 2005; Jones 2014; Noel & Weigel 2007; Weeks et al 2010). MPA is a sea area which is set and determined as a completely protected area from people activities (Weeks et al 2010; Bennett & Dearden 2014). MPA is very important in order to maintain and recover biological diversity especially coral reefs, fish, plants and other sea organisms (Gaines 2010; Edgar et al 2014; Mascia et al 2010). MPA is believed to be one of the effective efforts to reduce the coastal ecosystem damage especially coral reefs and or other marine resources (Mascia et al 2010; Edgar et al 2014). MPA is very important for the people who live around the area, because this effort could increase fishery products, gain additional income by planting seaweed (Leisher et al 2012; Kasim et al 2016; Kasim &

Mustafa 2017; Kasim et al 2017), and empower the people to plan and manage their resources (McConney & Pena 2012; Edgar et al 2014; Russ et al 2004; Sanchiroco & Wilen 2002; White et al 2006). The presence of MPA is very good and of which it is proven to benefit the broader conservation areas. The benefits of fisheries and the availability of excellent resources will be an advantage as long as the community does not use the resources excessively. The MPA will regenerate resources in some time when the resources are preserved (Edgar et al 2014). For centuries, traditional coastal communities have used various forms of protected areas by closure and protected areas to manage resources and fisheries. MPAs created and managed locally by coastal communities include the extent, the resource-taking season, species protection, size limitation, and access to local control (Cinner et al 2005; Cohen & Foale 2013; Hauzer et al 2013). In 2006–2011 when Coral reef Rehabilitation and Management Project (COREMAP) II was planned, MPA was the main program implemented to sustain coral reefs condition. MPA tends to be one of bottom up activity which is initiated by the people and coached by local government. Other concept in coastal and sea area protection effort is the establishment of Marine Nature Reserves. The management of this conservation area is done by zoning and limiting fishing in protected areas so that fish utilization can be sustainable.

Material and Method. This research was conducted using primary data and secondary data approach. Primary data was obtained through interview and observation of coral reefs condition. Secondary data was obtained using analysis of research findings information regarding conservation area, Marine Nature Reserves, MPA and law policies related with conservation area.

Interview. The present research was conducted with two approaches. First approach was done by conducting interviews and discussions with some citizens located in the area of post COREMAP II Buton District. The location is limited to area with establishment of MPA such as Sub district in Batauga, Siompu, Kadatua, Mawasangka Tengah, Mawasangak Timur, Mawasangka Induk. These locations are also known as important area in MPA of Buton district. Interviews were performed randomly with some people who work as fisherman and as seaweed cultivation farmer with percentage of access to sea resources for 80%. Interviews were also conducted with some local officers from village, subdistrict, and district. Interview primary data was done to see the stake holders perception towards several important aspects that are essential in managing conservation area at one location.

Coral reefs condition in conservation area. Data collection of coral reefs condition was conducted in some MPAs. This research use some combined methods:

- Free Swimming Method to observe coral reefs condition in a location or observation station, including: coral reefs type, topography common shape, particular coral reefs domination and general condition. This observation result was utilized to determine the observation station option from a location of coral reefs.
- Line Intercept Transect Method (English et al 1997). This method is similar with reefcheck method. Transect length which is used in PIT method is 25 m with 4 repetitions in every observation station. Data recording is done with roller meter which record Coremap version category in below the meter point, start from 0 m, 0.5 m, 1 m, 1.5 m, 2 m, … until 25 m. Transect installation depth for coral reefs observation is 3–8 m depth according to field condition.
- Transect Belt Method determines to observe reef fish and other biota data in coral reefs ecosystem. Belt transect is installed equally in coral reefs observation area (Brock 1982). Reef fish observation was done until type level (species). Transect length which was used follows the coral reefs transect which is 50 m with 2.5 m left and 2.5 m right wide, so the size of transect belt is 250 m^2.
- Census of Fish reef determine counting fish number samples as in Green (1979) and Bros & Cowell (1987).

Results and Discussion. Based on the collected data from some of the research study in MPA of Buton District, it shows that coral reefs condition since the beginning of COREMAP II project in 2007, 2008, and 2009, recorded progress of only 30.16%, 32.2%, and 30.61% respectively (Figure 1). Fish population in entire MPA at the same years were only 201, 188, 147 species, respectively. According to the same years, the reef fish were dominated by the Pomacentridae family with 30, 31 and 31 species respectively (Table 1).

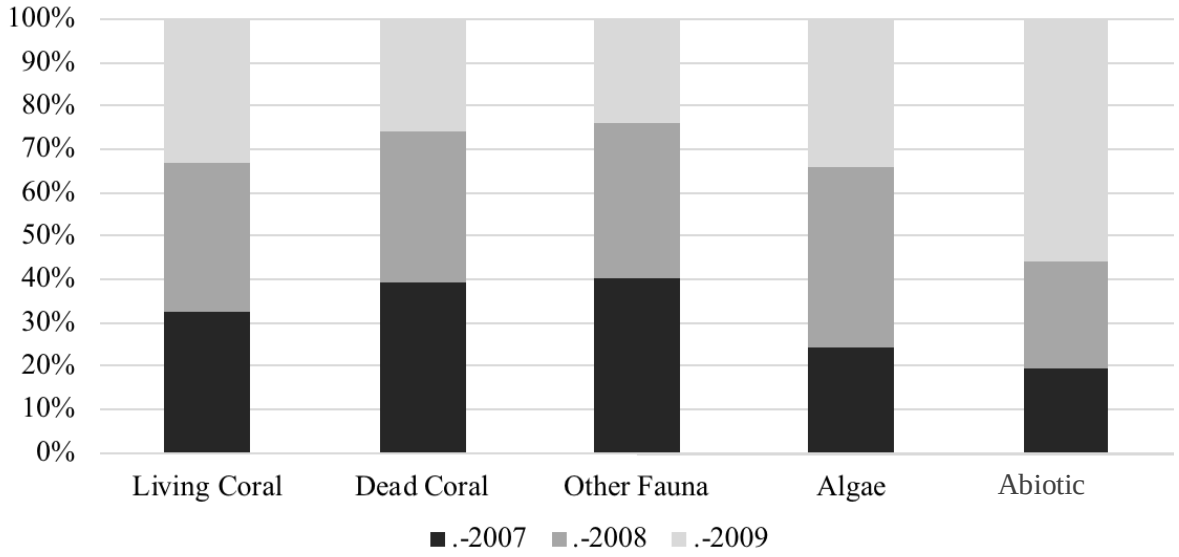

Figure 1. Coral reefs conditions in MPA in Buton district during 2007, 2008 and 2009 (Source: COREMAP II, Buton district).

Table 1

Reef fish condition in 2007, 2008 and 2009

Family	*Total number of species*			*Fish group*
	2007	2008	2009	
Pomacentridae	30	31	31	Major
Chaetodontidae	29	19	19	Indicator
Labridae	15	10	10	Target
Achanthuridae	14	9	9	Target
Lutjanidae	11	10	10	Target
Serranidae	11	10	10	Target

Coral reefs and reef fish condition in 2014. In May-August 2014, research findings during our observation on MPA in Buton District shows that living coral covers was about 47% out of the total areas (Figure 2).

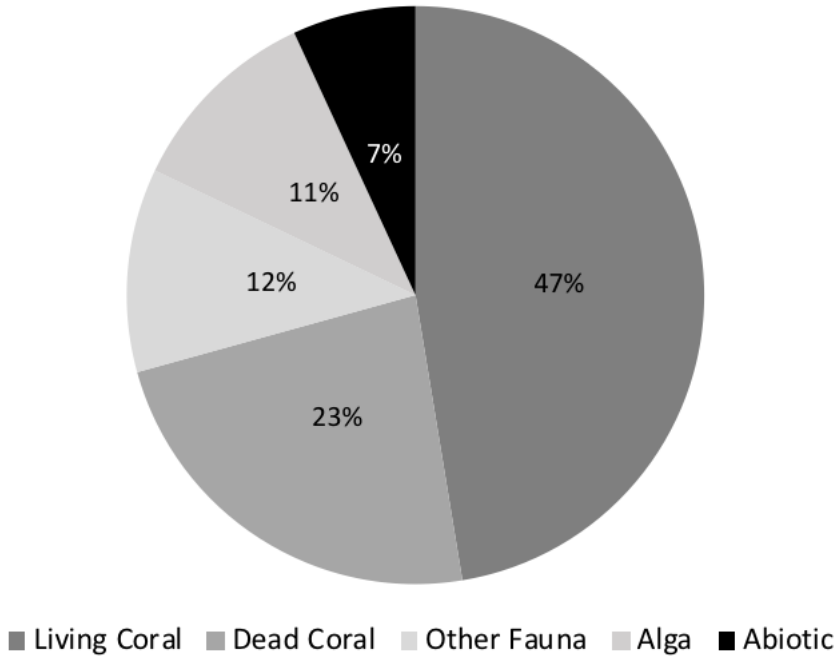

Figure 2. Coral reefs conditions during May-August 2014 in MPA of Buton district.

Reef fish condition. During the research, the total reef fish identified from three of the station consisted of 64 species, 40 genera, and 25 families (Table 2). The reef fish populations in the MPA, considering several locations, consisted of 25 families with several species. Within the 25 families of fish found in the research location, the highest percentage was represented by Pomacentridae family with 31% occurrence and 20 species. While families with the lowest percentage are: Anthiinae (*Pseudanthias huchtii*), Aulostomidae (*Aulostomus chinensis*), Balistidae (*Odonus niger*), Blenniidae (*Meiacanthus vittatus*), Caranidae (*Selar crumenophthalmus*), Cirrhitidae (*Cirrhitichthys falco*), Hybrids (*Halichoeres hortulanus*), Labridae (*Bodianus mesothorax*), Lutjanidae (*Macolor macularis*), Monacanthidae (*Oxymonacanthus longirostris*), Mullidae (*Mulloidichthys vanicolensis*), Pinguipepidae (*Parapercis tetracantha*), Pomacanthidae (*Centropyge bicolor*), Scaridae (*Scarus festivus*), Serranidae (*Epinephelus merra*), Synanciinae (*Synanceia horrida*), Tentraodontidae (*Canthigaster papua*) and Zanclidae (*Zanclus cornutus*) family with 2% and 1 species.

The positive effects of MPA are strongly related to the increase of fish and biomass resources within the MPA and contribute to the fisheries sector which has been widely reported in several places (Halpern 2003; Lester et al 2009). The existence of evidence of MPA presence to increase fishery production has also existed and this condition has an impact on areas outside the MPA on a high scale (Gell & Roberts 2003; Halpern et al 2009). The benefits of MPA procurement in returning certain fish species and the subsequent increase in recruitment and spillover of fish from within the MPA have also occurred in some places (FAO 2011). One of the protected areas in the Philippines at the Apo Island Marine Reserve in the Philippines gives an example that protected areas can increase fish populations which has an impact on increasing fishermen's income around the area (Russ et al 2004). The positive fisheries impact of MPA can lead to increased food security and livelihoods in local fishing communities (Roberts et al 2001; Sanchiroco & Wilen 2002).

Table 2

Composition of reef fish in several MPA of Buton District in 2014

No	*Family*	*Total number of individuals*	*Fish categories*
1	Achanturidae	75	Target Fish
2	Anthiinae	7	Major Fish
3	Apogonidae	620	Major Fish
4	Aulostomidae	1	Major Fish
5	Balistidae	49	Target Fish
6	Caesionidae	110	Target Fish
7	Caranidae	30	Target Fish
8	Chaetodontidae	47	Indicator Fish
9	Cirrhitidae	3	Major Fish
10	Ephippidae	2	Target Fish
11	Holocentridae	5	Major Fish
12	Hybrids	4	Target Fish
13	Labridae	2	Major Fish
14	Lutjanidae	2	Target Fish
15	Monacanthidae	2	Major Fish
16	Mullidae	15	Target Fish
17	Nemipteridae	19	Target Fish
18	Pinguipedidae	20	Major Fish
19	Pomacanthidae	1,368	Major Fish
20	Pteroninae	42	Major Fish
21	Scaridae	8	Target Fish
22	Serranidae	3	Target Fish
23	Synanciinae	1	Major Fish
24	Tentraodontidae	3	Major Fish
25	Zanclidae	4	Major Fish

Reef fish classification based on its role. Based on research findings toward fish group classification according to its roles were divided into three big groups: indicator fish, target fish and major fish. Fish classification based on its role identified in research location emphasized a total of 9 indicator fish species, 16 target fish species, and 39 major fish species. Reef fish based on the categorization on its role showed 40 species, which of 10 target fish species (25%), 7 species of indicator fish (17%) and 23 major fish species (58%) (Figure 3).

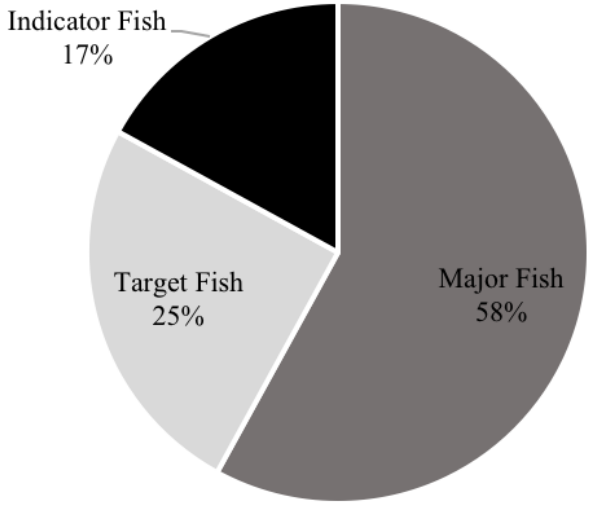

Figure 3. Reef fish percentage in all stations during 2014.

Coral reefs and reef fish condition in 2016. Coral reef ecosystem is an intermediate category with an average living coral reef closure from 15 station 28.89%, with approximate of 8.5-52.9%. Reef fish recorded were 82 species from seven chosen fish families, while total species in every station range between 30 and 50 species (COREMAP 2016).

MPA vs. Marine Nature Reserves. Since the establishment of MPA was implemented by the government and agreed by the local community, the MPA is still familiar to people especially to the one who participate in COREMAP II Project activities. It is proved by how familiar the location is and there are consequences when people are forced to catch fish in MPA area. From several MPA areas of Buton district, the MPA still gives important role in their marine resource management. Presently supervision for some protected areas is decreasing. This condition describes that coaching factor need to be continuously conducted by local government to maintain ecosystem continuity in MPA. In several MPA locations it is showed that fish traps are still installed although it is done secretly. This real condition gives depiction that MPA concept is still fully recognizable by the people, although the implementation of MPA supervision is very lacking. Various forms of MPA deployment such as area closure and the presence of no-take zones can be useful for protecting critical habitats or life stages of commercial species (e.g. spawning sites), or restricting catches by closing areas of high picking intensity. The MPA can also control the mortality of rare species of fish or endemic species that have limited distribution and preferences of specific habitats. The benefits of MPA can be used to reduce the potential of conflicts for people who use a particular location with a view to obtaining resources (Hilborn et al 2004; FAO 2011).

In some other MPA locations, people consistency still maintained their MPA and indicates that there are no activities of fishing or cultivation in MPA main zone. This condition is realized to give positive value because people have felt that in 4 years after MPA establishment fish population in their area increased significantly.

In 2011, Buton District has been decided Marine Nature Reserves through SK Bupati Buton No. 938 year 2011. In this decision, size of MPA area is 176.05 ha, protected areas are 262.36 ha. Total size of Marine Nature Reserves of Buton district is 283,577.33 ha. Coral reefs areas in Marine Nature Reserves of Buton district until 2011 was 217.93 ha. From the total of coral reefs in Buton district until 2011 there were only ±2.1% protected.

This condition shows that coral reefs protection efforts in Buton district are very low. In 2014 during survey of coral reefs condition in some of MPAs and Marine Nature Reserves of Buton district a 47.7% of reefs protection efforts was established. Water areas that have been designated as MPA areas, are quite effective in controlling fish resources and have successfully reduced the use of environmentally destructive tools however, some other areas outside the MPA still suffered significant damage. Assessment of MPA gives awareness of the community in utilizing marine resources. It can be seen there are some people who use MPA area in particular side as boat transportation lane into the sea or the way return, basically fishermen. Obviously that some MPA before the establishment has gone a pretty substantial coral reefs damage caused by fishing using detonator and potassium. The abundance of fish becomes the main reason why fisherman used harmful harvesting methods for the environment. Prohibition of fish catching and any natural resources utilization in MPA area is meant for coral reefs ecosystem to keep its conservation by protecting coral reefs so it increases fish population (COREMAP II 2007). To protect coral reefs is equal with giving chance to reef fish to grow and to reproduce.

In 2016, during Minster of Marine and Fisheries survey, coral reefs ecosystem were in the intermediate category with living coral reefs closure in average from 15 station of 28.89%, with a range of 8.5-52.9%. Living corals are generally massive species from Poritidae and Faviidae family, followed by branched Acropora. Bleaching phenomena are not quite visible in every observation station. Coral reefs damage is also assumed because of a harmful fishing, especially the one that use bomb. During baseline study in Kabupaten Buton waters, it can be heard the detonating sound in the water

body. Reef fishes were recorded 82 species from seven selected families, while species amount in each station were between 30 and 50. The amount of cockatoo and snapper fish was the most common. The highest fish biomass comes from butana fish (Acanthuridae) group and cockatoo (Scaridae). Among those 82 species, the 10 most frequent are *Ctenochaetus striatus, Naso hexacanthus, Ctenochaetus binotatus, Naso thynnoides, Zebrasoma scopas, Chlorurus sordidus, Scarus ghobban, Acanthurus pyroferus, Scarus niger, Chlorurus bleekeri*.

MPA establishment which has been done successfully in COREMAP II program can give a very significant meaning towards the coral reefs management although it is realized that covered location on the program was still very small. However, MPA establishment as conservation area is initiated more by the local people on village level (although it is facilitated by the government) seems very well because people are still having the sense of belonging towards the location. Positive impact that comes from that initiation is the sense of belonging and responsibility to take care in group of people give excellent values in management practice of conservation area. In the last few decades, the MPA-making process has continued well and improved its management. This policy encourages sustainable development (Noel & Weigel 2007).

Looking at the Marine Nature Reserves size area it is larger and includes a very vast area. Although in its establishment, there are strong different opinion between the people to determine location and size of Main Zone area. Main Zone determination as No Take Zone area seems like a very serious matter to discuss on village level. It is because people are actually do not understand the precise meaning of the location. Opinion arises as an antipathy about main zone area establishment which tends to refer on people concerns about losing fishing area or their life resources. Consequence of Marine Nature Reserves establishment in some area must be supported by a better supervision. Although it is realized that surveillance control is not very effective because of limited fund in every operational zone. The high operational cost of supervision by the authorities has an impact on reducing the intensity of protected area management. Nevertheless, the government's attention in supporting the MPA's decision is very good. This attention is also being undertaken by some governments that offer improvements in the environment. Significant support has been given to improve the effectiveness of MPA management (Pomeroy et al 2004; Hockings et al 2006). The development of MPA management is also evident from successful socio-economic indices or fishery outcomes and better perceptions of MPA by fishermen and fishing communities nding (Leisher et al 2012).

MPA as a seemingly bottom up area gives a good empowerment on fairly small level.

The coastal community always working with the parties involved in determining the MPA. Participation programs, building community relationships, outreach, education, and inter-community communication are often carried out to increase understanding of the potential benefits of MPA for fisherman (Leisher et al 2012).

Marine Nature Reserves as a seemingly top down program does not give a full sense of belonging to the coastal people. It is shown from the effectivity of establishment and from the continuous resources realization in every location. Currently, the definition of MPA procurement is often done by communities to support fisheries (Charles 2001; Cohen & Foale 2013), but these conditions tend to lead to more top-down and fragmented coastal fisheries and ecosystem management. Meanwhile, the community structure for traditional fisheries management is often broken and some traditional practices have been lost (McClenachan & Kittinger 2013). Conservation area management still needs to be improved in order to achieve better results. An important aspect to note is that the width of the conservation area is not the only consideration, but the most important is the value of diversity and scarcity of resources in one area. Weigel et al (2014) stated that fisheries systems in developing countries are more dominated by traditional fisheries and some MPAs are included in complex systems involving many formal and informal institutions, ranging from national and provincial institutions, laws, and policies to the community, governance structures and local norms. Effective governance systems in this context should encourage participation to incorporate a

diversity of perspectives on MPA functions and find effective ways to bridge the gap between all stakeholders in the MPA.

Conclusions. MPA that seems to be bottom up in its implementation still gives realization toward continuous resources availability good enough although it needs more serious coaching from local government level. Marine Nature Reserves as a conservation area vast enough with a seemingly top down establishment needs a serious and consistent supervision. It needs a good management strategy from facilities and initiation of low level management to get condition of conservation area, especially in coral reefs maintenance and a higher management level to assure that the supervision and management are performed at a high level.

Acknowledgements. The author is grateful to (COREMAP II Program) DKP Kabupaten Buton, Kepala Dinas Kelautan and Perikanan Kabupaten Buton, and related head of SKPD. I also would like to extend my appreciation to Bapak Abdul Rahim, Ibu Yulia Widiarti. Many thanks for some respondents in Kecamatan Batauga, Siompu, Kadatua, Sampolawa, Mawasangak Tengah, Mawasangka Induk.

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Received: 05 June 2018. Accepted: 12 December 2018. Published online: 17 December 2018.
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How to cite this article:
Kasim M., 2018 Marine Protected Areas *versus* Marine Nature Reserves: testing conservation area management effectivity in Indonesia. AACL Bioflux 11(6):1947-1956.