Toward a New Paradigm of Ecosystem and Endemic Organism based on Spatial Zonation for Taka Bonerate Marine Protected Area

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ABSTRACT

Most of present approach by authorities in designing for any conservation programs was mainly achieving target based on the width of area and not for the endemic organisms in each area. The old zonation method used was usually not based upon an ecological delineation but mostly using the island border physically and without a rehabilitation zone. In the conservation zone such as in Taka Bonerate marine park there could be a limited use zone based on the traditional use and not an intensive use activities. The paper develop a new ecosystem and endemic organism based spatial scoring to built a new spatial zonation model which is specially dedicated for any conservation zone or a marine parks. Which would be used for a *management plan* and further *action plan*. A spatial based approach analysis with a reliable detail and adequate accuracy was needed as a guide in the zonation processes for the management of coastal or marine protected area. The spatial modeling was a combination of satellite and field data analysis. This spatial modeling analysis was also called as *Cell Based Modeling* based on raster/spatial data and 'spatial-scoring' method with emphasized on the specific ecosystem and endemic organism valuation and weight approach. The new paradigm on the "specific ecosystem and endemic organism based spatial-scoring for a new spatial model" and targeted existing knowledge for a beyond 'the usual-goals' for Marine Protected Area (MPA). In this case is preserving and conserving "marine living fossils": *Nautilus pompilus* for Taka Bonerate as well as for other cases of *Latimeria menadoensis* in north Sulawesi waters and Limulus.sp in Java and Kangean seas, should be designated as a "new concept of MPA-Plus". Considering the important of deep sea vulnerable reef and atolls and sand-dune ('bungin') ecosystem for a protected reef-fishes: napoleon wrasse (*Cheilinus undulatus)*,   and flying fish *Cypsilurus*.sp and others.

Key words : Endemic, spatial-scoring, MPA, Taka Bonerate

INTRODUCTION

Taka Bonerate (taka: reefs) located at the south of Sulawesi (Celebes) and belongs to south Sulawesi province, Selayar Regency. Taka Bonerate Marine Park was firstly announced as National Marine Park in 1989 based on the Ministry of Forestry decree No. 100/Kpts-II/1989, which then followed by decree No.280/KPTS-11/1992 dated on 26 February 1992. The wide of the area covers about 530.765 ha consist of 21 small islands, with numbers of small fringing reefs and atolls. These coral reefs area was stated as Marine Parks since its high biodiversity and also believed as the third wide of atoll in the world (Nontji, 2002; Azis *et al*., 1989; Tulungen *et al*., 2002; Lensa Taka Bonerate, 2006) after   Kwajifein atoll in Marshall island and Suvadiva atoll in Maldives with 500 km² wide of coral reefs. In order to manage thean a technical unit was set in 31 March 1997 a letter of Ministry of Forestry No: 185/Kpts-II/1997. After 10 June 2002 the unit was then changed into type-C National Marine Park unit No. 6186/Kpts-II/2002 for Organization scheme. Taka Bonerate Marine Parks was situated in Flores sea 79–206 mile at the south of Benteng, the capital of Selayar regency. Administratively belongs to the 2 district of Pasimaranu and Pasimasunggu. Geographically situated at 120'55"–121'00" E and 6'22"–7'4" S (TNL Taka Bonerate, 2002; Coremap and Unhas, 2006), at the south of Sulawesi, the north of Flores sea, at the east of Java sea and the west of Banda sea. The area was topographically unique with many atolls, sand dunes (bungin), wide reef–flat which will be submerge during high tides, surrounded with a narrowed deep and vertical straits. Inside of atolls consists with reef-flats consist of wide shallow seawater surrounded with reef-flats. There were about 15 islands designated for diving, snorkeling and other limited uses (Sawyer, 1992).

The islands topography were about 2-4 m high from mean sea level, mostly elongated of north-south direction range 200-2000 m, and wide 50-1,000 m. Bottom substrate was predominantly sand (BTN Taka Bonerate, 2002). About 61 genera and 17 family of coral were already identified such as *Pocillopora eydouxi, Montipora danae, Acropora palifera, Porites cylindrica, Pavona clavus, Fungia concinna,* and

others. About 295 genera of reef-fish had been identified such as (*Epinephelus spp.*), skipjack (*Katsuwonus spp.*), napoleon wrasse (*Cheilinus undulatus)*, (*Siganus sp*). With about 244 genera of endemic mollusk such as *Trochus niloticus*, *Cassis cornuta*, triton (*Charonia tritonis)*, *Turbo spp*., giant clams *Tridacna squamosa*, pearl oyster (*Pinctada spp.*). Sea turtle of *Eretmochelys imbricata*, green turtle (*Chelonia mydas*), and *Dermochelys coriacea*. Coastal vegetation among other dominated with coconuts (*Cocos nucifera*), *Pandanus sp*, *Casuarina equisetifolia* and *Terminalia catappa* (Anonim, 1991; 1997; Massi KAR, 1996; LIPI, 1995).

Problems and approach. Most of present approach by authorities in designing for any conservation programs was mainly achieving the target based on the wide of area. Such as Taka Bonerate marine parks and regarded as Marine Protected Area (MPA) as in Figure 1, still do not have a clear 'ecosystem' zonation and delineation, nucleus zone was not supported with a buffer zone and not based on the protected endemic organism approach. The zonation used was not based upon an ecological delineation but mostly using the island border physically and there was no rehabilitation zone. In this conservation zone such as in Taka Bonerate marine park there could be a limited use zone based on the traditional use and not an intensive use activities. The paper will develop an ecosystem and endemic organism based spatial scoring to built a new zonation model which is specially dedicated for any conservation zone or a marine parks. Which would be used for a *management plan* and further *action plan*. In the zonation process as a guide for the management of the area, therefore a spatial-based approach analysis with a reliable detail and adequate accuracy was the needed. The spatial modeling was a combination of satellite and field data analysis. This spatial modeling analysis was also called as *Cell Based Modelling* based on raster/spatial data and 'spatial-scoring' method with emphasized on the specific ecosystem and endemic organism valuation and weight approach (Hartoko *et al.,* 2004a; 2004b; Hartoko and Helmi, 2004c; Helmi, 2006; Hartoko and Kangkan, 2009).
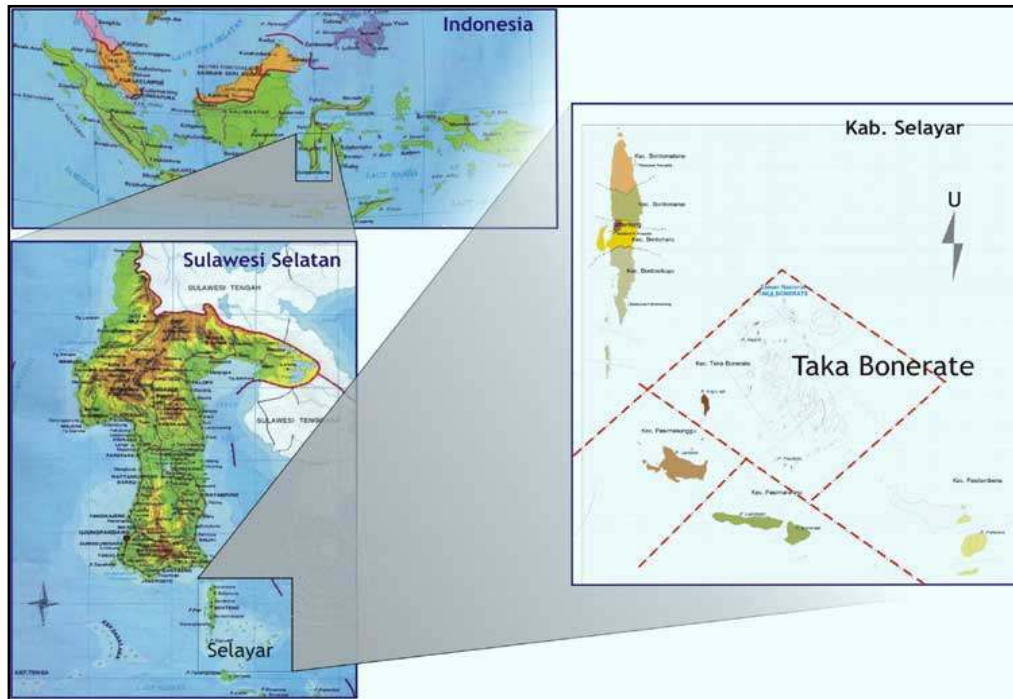

Figure 1. Taka Bonerate Marine Parks, south Sulawesi (Celebes)

MATERIAL AND METHOD

The study area is the Taka Bonerate marine parks, Selayar Regency, south Sulawesi Resort Latondu Besar Conservation Section I with wide of 66.346 ha, geographically situated at 120º54'8.09"–121º1'11.91" E and 6º22'59.61"–6º34'12.8" S, an Indonesia Reference Map (Peta Rupabumi Indonesia) scale 1: 250,000, from Bakosurtanal. Reports from local institutions, map of local spatial planning (Peta Rencana Umum Tata Ruang Wilayah Kabupaten Selayar), collection of demographic and social-economic data from demographic office (BPS) of Selayar regency. The represent for the ecosystem analysis, this study also supported with the field ecosystem data such as depth, transparency, seawater temperature, TSS, current, salinity, pH, nitrate, phosphate, dissolved oxygen (DO), and plankton (Nybakken 1988; Odum 1993; Supriharyono 2000). Analysis of Landsat_TM satellite data of 1998 with algorithms for composite band of RGB 321 and 431 to highlight the ecosystem characteristics such as chlorophyll-a and sea grass beds analysis. The basic concept of vegetation index was Normalised Difference Vegetation Index (NDVI) using the spectral of band-3 and band-4 and as well as the later use of chlorophyll photosynthetic activity (CPA) algorithm of band-4 and band-2 for chlorophyll-a or MIRI (*Midle Infra Red Index*) band rationing using of band-3 and band-7 (Hartoko and Honey, 2000 in Hartoko and Helmi, 2008).

$$\text{NDVI} = \frac{\text{B4} - \text{B3}}{\text{B4} + \text{B3}}$$

or the

$$CPA = \frac{\text{B4} - \text{B2}}{\text{B4} + \text{B2}}$$

Chlorophyll-a = a + b (cv_NDVI)
Chlorophyll-a = a + b (cv_CPA)

or

Chlorophyll-a $= a + b(CPA) + c(CPA)^2$ (Hartoko 2012)

where cv is '*cell value*' in the NDVI or CPA algoritms.

Band-1 and band-2 rationing and for the turbidity and TSS analysis was used (ER_Mapper Mannual, 1995; Hartoko and M Helmi, 2008). On latter study can use MODIS AquaTerra, ASTER, IKONOS, QuickBirds and others satellite data as well as TRITON Buoy, ARGO Float and other in-situ data.

Tu $= -24.47 + (1.03 * B1) - (1.65 * B2) + (1.46 * B3) + (0.30 * B4)$

TSS $= 161.1629 - 14.4619 (B2) + 1.39262 (B1) (B2) - 0.625 (B1)^2$

Coral reef and sea grass bed mapping. Landsat_TM satellite data analysis for shallow water transformation to highlight the coral reef area and delineating of dead and live coral then the Lyzenga was applied. This '*Water Attenuation Model*' was primarily used to reduce the effect of shallow water column effect and strengthen the coral reef and sea grass spectral.

$Y = \ln (B1) + Ki/Kj * \ln (B2)$

dimana: $a = (var\ B1 - var\ B2) / (2 * covar\ B1B2)$

$Ki / Kj = a + (a^2 + 1)^{1/2}$

The spatial database and modeling after Hartoko *et al.* (2004a; 2004b) Hartoko and Helmi (2004c) methods. The earlier original zonation of the Taka Bonerate marine parks was as in Figure 2 below, and the scoring matrix was shown as in Table 1, 2 and 3.
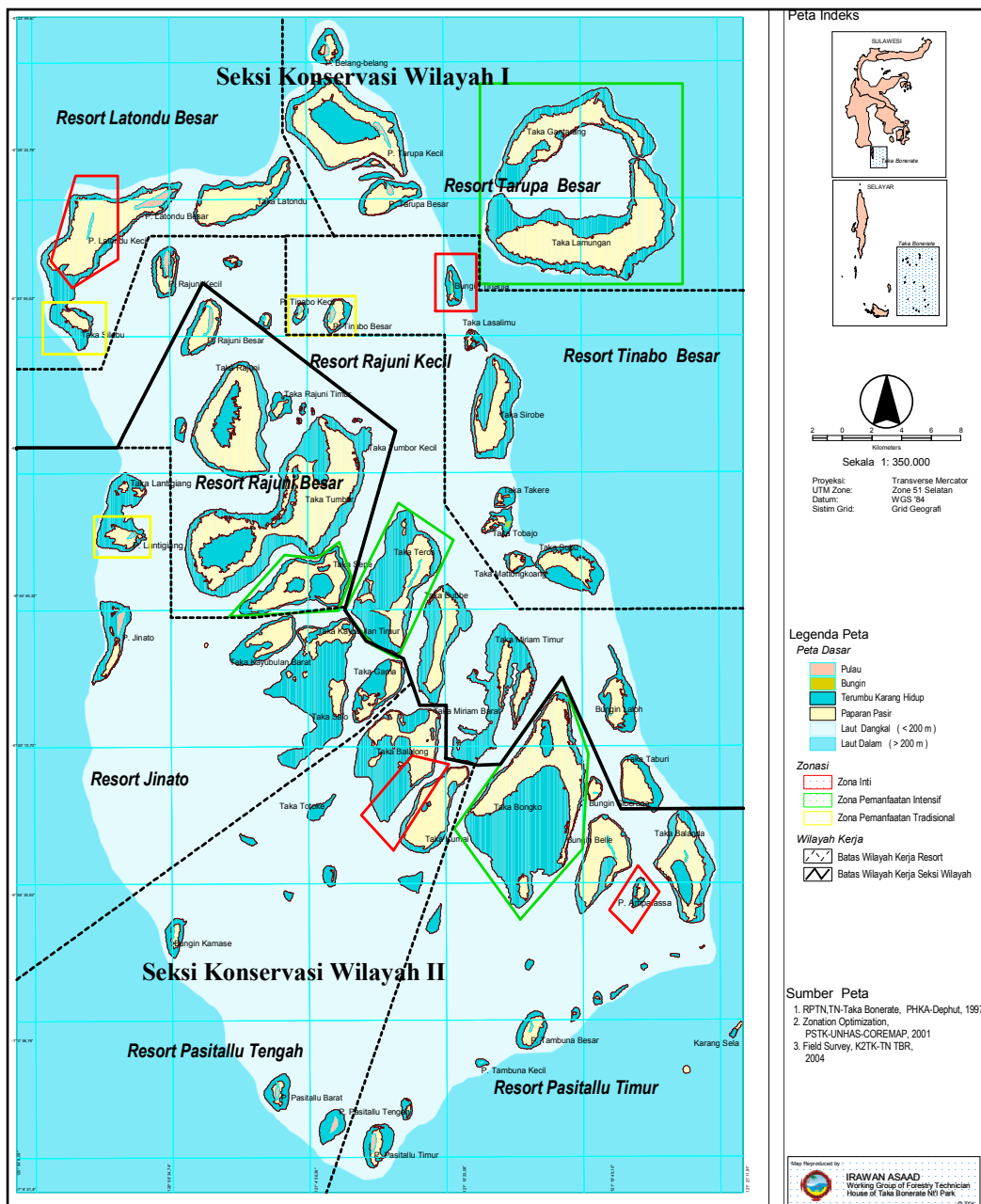

Figure 2. The original zonation of the Taka Bonerate marine park

Table 1. Spatial score based on ecosystem variables

Ecosystem variabels :	Range :	Value : (A)	Weight (%) : (B)	Score : (AxB)	References :
Living coral cover (%)	75-100	4	15	60	Brown (1986) *in* Tandipayuk (2006)
	50-74.9	3		45	
	25-49.9	2		30	
	0.0-24.9	1		15	
Seagrass cover (%)	75-100	4	15	60	Brown (1986) *in* Tandipayuk (2006)
	50-74.9	3		45	
	25-49.9	2		30	
	0.0-24.9	1		15	
Seawater temperature (^{0}C)	28-30	4	5	20	Ministry of Environment .No. 51 year 2004
	25-27	3		15	
	31-32	2		10	
	< 25 ; > 32	1		5	
Salinity (‰)	30-35	4	5	20	SNI : 01–6487.3– 000 ; Dir-gen of Fisheries (1994)
	20-29	3		15	
	< 20	2		10	
	> 35	1		5	
TSS (mg L^{-1})	< 25	4	10	40	Ministry of Environment. No. 51 year 2004
	25-49	3		30	
	50-75	2		20	
	> 75	1		10	
Current (m sec^{-1})	0.2-0.3	4	10	40	Dir-gen of Fisheries (1982); Gufron and Kordi (2005)
	0.1-0.19	3		30	
	0.31-0.4	2		20	
	< 0.1 ; > 0.4	1		10	
Transparency (%)	75-100	4	5	20	Field data 2008
	50-74.9	3		15	
	25-49.9	2		10	
	0.0-24.9	1		5	
pH	6.5-8.5	4	5	20	SNI : 01–6487.3–2000 ; Akbar *et al.* (2001)
	4-6.4	3		15	
	8.5-9	2		10	
	< 4 ; > 9.5	1		5	
Dissolved oxygen /DO (mg L^{-1})	> 6	4	10	40	SNI : 01–6487.3–2000 ; Akbar *et al.* (2001)
	4-6	3		30	
	< 4	2		20	
	2	1		10	
Nitrate (mg L^{-1})	0.9-3.2	4	10	40	Ministry of Environment. No. 51 year 2004
	0.7-0.8	3		30	
	3.3-3.4	2		20	
	< 0.7 ; > 3.4	1		10	
Phosphate (mg L^{-1})	0.3-0.5	4	10	40	Romimohtarto (2003)
	0.1-0.2	3		30	
	0.6-1	2		20	
	< 0.1 ; > 1	1		10	
Total			**100**	**375**	

Table 2. Spatial score based on endemic organism

`	Range :	Value : (A)	Weight (%) : (B)	Score (AxB)	References :
Living Hard Coral	75-100	4		80	
	50-74.9	3	20	60	Brown (1986) *vide*
	25-49.9	2		40	Tandipayuk (2006)
	0.0-24.9	1		20	
Soft Coral	75-100	4		80	
	50-74.9	3	20	60	Brown (1986) *vide*
	25-49.9	2		40	Tandipayuk (2006)
	0.0-24.9	1		20	
Endemic organism	> 1	4		120	
	1	3	30	90	Field data 2008
	< 1	2		60	
	0	1		30	
Seagrass cover	75-100	4		60	
	50-74.9	3	15	45	Brown (1986) *vide*
	25-49.9	2		30	Tandipayuk (2006)
	0.0-24.9	1		15	
Dissolved Oxygen (mg L^{-1})	> 6	4		12	
	4-6	3	3	9	SNI : 01–6487.3–2000 ;
	< 4	2		6	Akbar *et al.* (2001)
	2	1		3	
Nitrate (mg L^{-1})	0.9-3.2	4		12	
	0.7-0.8	3	3	9	Ministry of Environment
	3.3-3.4	2		6	No. 51 year 2004
	< 0.7 ; > 3.4	1		3	
Phosphate (mg L^{-1})	0.3-0.5	4		12	
	0.1-0.2	3	3	9	Romimohtarto 2003
	0.6-1	2		6	
	< 0.1; > 1	1		3	
TSS (mg L^{-1})	< 25	4		6	
	25-49	3	1.5	4.5	Ministry of Environment
	50-75	2		3	No. 51 year 2004
	> 75	1		1.5	
Transparency (%)	75-100	4		6	
	50-74.9	3	1.5	4.5	Field data 2008
	25-49.9	2		3	
	0.0-24.9	1		1.5	
Salinity (‰)	30-35	4		6	
	20-29	3	1.5	4.5	SNI : 01–6487.3–2000 ;
	< 20	2		3	Dir-gen of Fieheries (1994)
	> 35	1		1.5	
pH	6.5-8.5	4		6	
	4-6.4	3	1.5	4.5	SNI : 01–6487.3–2000 ;
	8.5-9	2		3	Akbar *et al.* (2001)
	< 4 ; > 9.5	1		1.5	
Total			**100**		

Table 3. Spatial scoring based on combination of ecosystem and endemic organism variables

Ecosystem variabels :	Range :	Value : (A)	Weight : (%) (B)	Score : (AxB)	References :
Living Hard Coral	75-100	4	15	60	Brown (1986) *vide* Tandipayuk (2006)
	50-74.9	3		45	
	25-49.9	2		30	
	0.0-24.9	1		15	
Soft Coral	75-100	4	12.5	50	Brown (1986) *vide* Tandipayuk (2006)
	50-74.9	3		37.5	
	25-49.9	2		25	
	0.0-24.9	1		12.5	
Endemic organism	> 1	4	20	80	Field data 2008
	1	3		60	
	< 1	2		40	
	0	1		20	
Seagrass cover	75-100	4	10	60	Brown (1986) *vide* Tandipayuk (2006)
	50-74.9	3		45	
	25-49.9	2		30	
	0.0-24.9	1		15	
TSS (mg L^{-1})	< 25	4	5.75	23	Ministry of Environment. 51 tahun 2004
	25-49	3		17.25	
	50-75	2		11.5	
	> 75	1		5.75	
Transparency (%)	75-100	4	5.75	23	Field data 2008
	50-74.9	3		17.25	
	25-49.9	2		11.5	
	0.0-24.9	1		5.75	
Salinity (‰)	30-35	4	5.75	23	SNI : 01–6487.3–2000 ; Dir-gen of Fisheries (1994)
	20-29	3		17.25	
	< 20	2		11.5	
	> 35	1		5.75	
Seawater temperature (^{0}C)	28-30	4	5	20	Ministry of Environment No. 51 tahun 2004
	25-27.9	3		15	
	31-32	2		10	
	< 25 ; > 32	1		5	
Current (m sec^{-1})	0.2-0.3	4	5	20	Dir-gen of Fisheries (1982); Gufron dan Kordi (2005)
	0.1-0.19	3		15	
	0.31-0.4	2		10	
	< 0.1 ; > 0.4	1		5	
Dissolved oxygen (mg L^{-1})	> 6	4	4	16	SNI : 01–6487.3–2000 ; Akbar *et al.* (2001)
	4-6	3		12	
	< 4	2		8	
	2	1		4	
Nitrate (mg L^{-1})	0.9-3.2	4	4	16	Ministry of Environment No. 51 tahun 2004
	0.7-0.8	3		12	
	3.3-3.4	2		8	
	< 0.7 ; > 3.4	1		4	
Phosphate (mg L^{-1})	0.3-0.5	4	4	16	Romimohtarto (2003)
	0.1-0.2	3		12	
	0.6-1	2		8	
	< 0.1 ; > 1	1		4	
pH	6.5-8.5	4	3.25	13	SNI : 01–6487.3–2000 ; Akbar *et al.* (2001) ;
	4-6.4	3		9.75	
	8.5-9	2		6.5	
	< 4 ; > 9.5	1		3.25	
Total			**100**		

Note :
1. Value class based on Dir-gen of Fisheries (1982) :
   4 : Very good
   3 : Good
   2 : Fair
   1 : Inadequate
2. Weight based on dominant variabels, range : 3.25 - 30
3. Score :

$$\sum_{i=1}^{n} = AxB$$

RESULT AND DISCUSSION

As a representation of a deep water reef ecosystem as found in Taka Bonerate was characterized with the presence of some atolls and sand-dune (bungin). This mean that the reef ecosystem was surrounded by deep water ecosystem. This kind of deep sea coral reef ecosystem was regarded as a vulnerable ecosystem since this kind of ecosystem would be highly sensitive to any environmental changes such as seawater temperature anomaly, tide ranges, etc. Results of scoring and suitability classes were presented as in Table 4, 5 and 6 below.

Table 4. Result of score and suitability class based on ecosystem variables

Range of Score	Suitability Class	Evaluation
301-400	S1 : highly suitable	Nucleus zone
191-300	S2 : good	Buffer zone
91-190	S3 : moderate	Rehabilitation zone
< 90	N : not suitable	Limited use zone

Table 5. Result of score and suitability class based on endemic organism variables

Range of Score	Suitability Class	Evaluation
301-400	S1 : highly suitable	Nucleus zone
201-300	S2 : good	Buffer zone
101-200	S3 : moderate	Rehabilitation zone
< 100	N : not suitable	Limited use zone

Table 6. Result of score and suitability class based on ecosystem and endemic organism variables

Range of Score	Suitability Class	Evaluation
316-420	S1 : highly suitable	Nucleus zone
211-315	S2 : good	Buffer zone
106-210	S3 : moderate	Rehabilitation zone
< 105	N : not suitable	Limited use zone

With an approach using ecosystem (water quality) variables for the spatial scoring and zonation as in Table 4 with special emphasis on weight of 50% for TSS, current, DO, nitrate and phosphate had resulted on the presence of real extent or wide area which is then can be regarded as the real ecosystem extent or border of the nucleus zone as seen in Ratondu Besar, Rajuni Kecil and Tinabo Besar island (Fig.1). This finding on the ecosystem based spatial scoring which then can shows and prove to us the real natural extent, the wide or the real ecological border of its specific ecosystem function such as the spatial distribution of specific endemic larvae or necton, and thus can be used to delineate or to add a buffer for the nucleus zone and not just a squared rigid delineation as always done so far. Spatial scoring using endemic organisms with total weight of 85% (hard and soft coral, sea grass and endemic organism) even had give more clear and ensure the S1 suitability class as nucleus zone had been confirmed at Ratondu Besar, Ratondu Kecil, Tinana islands as in the earlier marine park zonation and adding for Tarupa Kecil and Tarupa Besar after the new zonation (Table 5 and Fig 2). The category as nucleus zone with S1-suitability class was based on the score and consideration with presence of about 17 family, 61 genera and about 41 species of hard coral, soft corals, zoanthids (Appendix 1), the protected reef fish napoleon wrasse (*Cheilinus undulates*). Endemic mollusk such as *Trochus niloticus*, *Cassis cornuta*, triton (*Charonia tritonis)*, *Turbo spp*, several of giant clams *Tridacna spp*, pearl oyster (*Pinctada spp.*), and the most important of all was the presence of the living fossil hollowed nautilus (*Nautilus pompillius*). The presence of this endemic living fossil in this specific ecosystem should be regarded as a genetic richness of the area. Taking into account the importance of genetic richness of the living fossils such as *Nautilus pompillius, Limulus sp.* and *Latimeria menadoensis* had been found in Indonesian seas would be the new paradigm in designing and managing the so called as MPA-Plus by means of the level of marine biodiversity. This new concept of MPA-Plus should be recognized in the international, national as well as at the local level, in order to set new approach and management of this MPA-Plus since this new paradigm was poorly understood so far. A step by step guide and training modules for the local society, fisherman and authorities to know and understand the morphology of the living fossils, where to find, how to make active participatory management, preserve and conserve by means of in-situ rehabilitation programme should be take into actions in the future.

As well as the presence of the flying fish larvae (nekton) *Chypsilurus sp* and *Cheilinus undulates* was regarded that this deep sea atolls and reef ecosystem acting as the "spawning ground" of this specific fish and therefore emphasis every effort to state this ecosystem as a protected zone was

inevitable. While new zonation using combination of ecosystem and endemic organisms variables to some extent had also confirm for a new zone at Tarupa Besar and Tarupa Kecil islands (Table 6 and Fig. 3). The real problem on the field as found at Taka Bonerate marine park was actually Illegal fishing, there were about 23 events of bomb-fishing and 9 event use of poisons (TNL Taka Bonerate in Nur Asmiar 2005). As stated in SBSTTA-14-4, UNEP CBD (2010) a further emphasis on the impacts of destructive fishing practices, unsustainable fishing and illegal, unreported and unregulated (IUU) fishing on marine biodiversity, in collaboration with FAO and the regional fisheries management organizations (RFMOs) some firm regulation and actions should be made.

Priority should be given to the following, in order to overcome the identified barriers and constraints, *inter alia*, enhancing cross-sectoral coordination and policy planning in regard to marine and coastal areas; enhancing coordination between levels of Government, with emphasis on local implementation; developing and strengthening stakeholder networks; demonstrating the economic and social value of marine and coastal biodiversity; undertaking periodic review of the adequacy of policies and legislation and their implementation; securing resourcing and funding through forward planning; enhancing capacity of personnel through training; making scientific information and traditional knowledge easier to access through improved information management; scaling-up and replicating demonstration projects; developing regional collaboration to address scientific information needs; developing or further enhancing spatial approaches to data management; developing international scientific expertise and processes for assessing and managing poorly known ocean areas such as the deep sea, and providing information about the status of marine biodiversity globally, as well as management options; and identifying areas of global ecological and biological significance in marine areas beyond national jurisdiction. Drawing upon the findings and recommendations of the in-depth review and existing reports, the present note recommends some areas to be considered in updating the existing programme of work, in regards to, *inter alia* : (i) biodiversity conservation in marine areas beyond national jurisdiction; (ii) aspects of marine biodiversity related to climate change and addressing ocean acidification; (iii) impacts of unsustainable fishing; and (iv) improving the representativity of the global system of marine and coastal protected areas.

Noting that the world's oceans host 32 of the 34 known phyla on Earth and contain between 500,000 and 10 million species, and that new oceanic species are continuously being discovered, particularly in the deep sea, *requests* Parties, other Governments and organizations to further enhance globally networked scientific efforts, such as the Census of Marine Life, to continue to update a comprehensive global list of all forms of life in the sea, and further assess and map the distribution and abundance of species in the sea . The most up-to-date information about marine and coastal protected areas (MCPAs) can be found in the World Database on Marine Protected Areas (http://www.wdpa-marine.org/Default.aspx), which is maintained by UNEP-WCMC. Data for 2009 regarding numbers of MCPAs and area protected globally is not yet available, but the most recent information indicates that less than 1 per cent of the oceans globally are protected. The latest available statistics, from March 2008, show that there were then an estimated 4435 MCPAs worldwide. These MCPAs covered approximately 2.35 million km^2, which is equivalent to 0.65 per cent of the world's ocean surface or 1.6 per cent of the world's total EEZ coverage. Of the total area of MCPAs, a minority, or 12.8 per cent prohibit extractive activities. While it is likely that MCPA coverage has increased since 2008, with the declaration of new areas, it is evident that the world's oceans and coastal areas are still under-protected. (SBSTTA-14-4, UNEP CBD 2010).
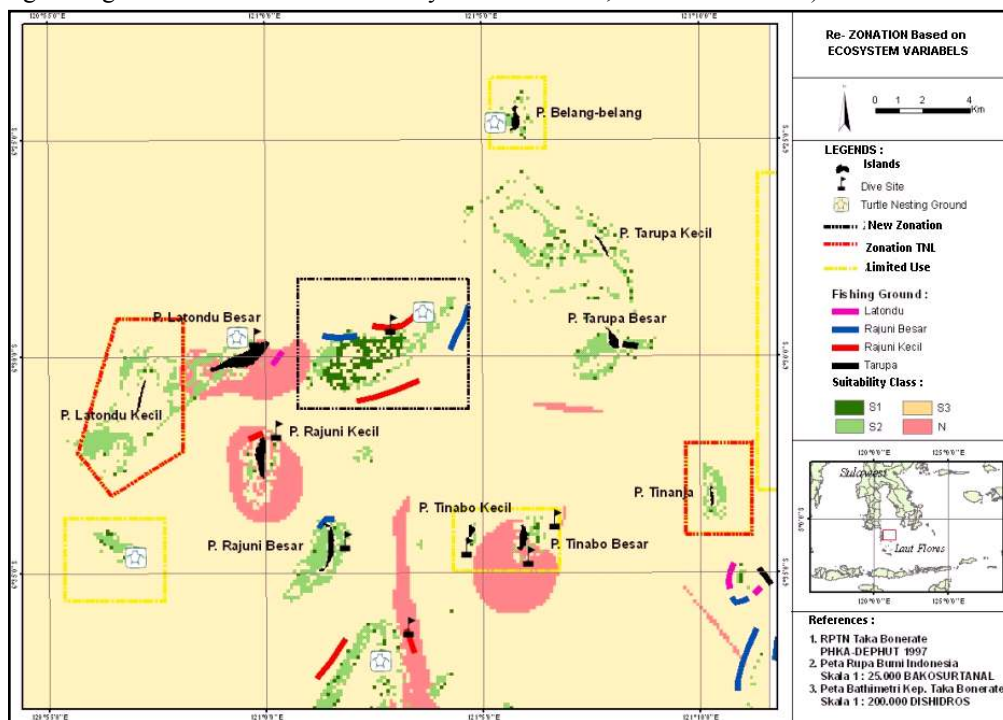

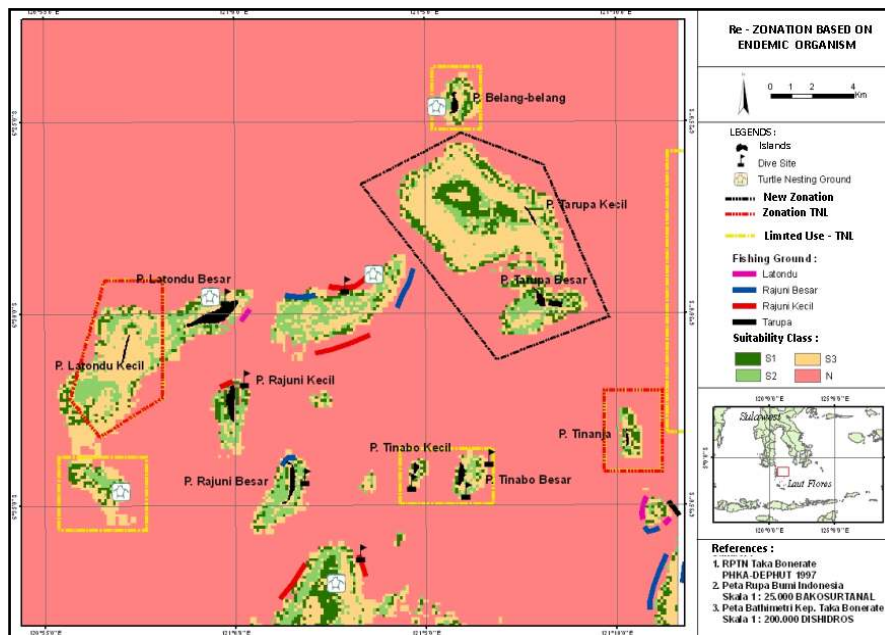Figure 3. New zonation based on water quality/ecosystem variables

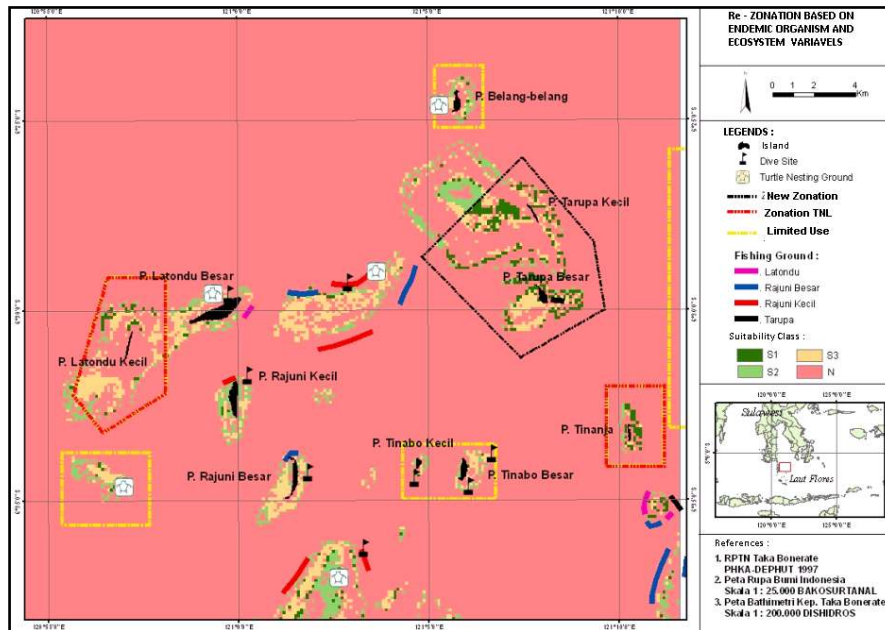Figure 4. New zonation based on endemic organisms variables

Figure 5. New zonation based on ecosystem and endemic organisms variables

Table 7. Appendix . Endemic Avertebrates of Taka Bonerate

NO	Comm. Name	Scientific Name	RK	LB	LK	TB	TJ	TP	Total
A	**SHRIMP**								
1	Fire shrimp	*Periclinemes spp*					2		2
B	**ZOANTHID**								
2	Yellow zoanthid	*Parazoanthus*					2	2	4
3	Trumpet brown	*Protopalythoa sp*					1		1
C	**ANEMON**								
4	Brown carpet	*Stychodactyla*	1						1
5	Red Corn	*Entacmea*		4				4	8

NO	Comm. Name	Scientific Name / Location	RK	LB	LK	TB	TJ	TP	Total
D	**SOFT CORAL**								
6	Short body	*Sarcophyton*		8	31	33	19	100	191
7	Soft cactus	*Sinularia*	2	6	16	8	18	3	53
8	Soft hair	*Alcyonium*	1	1					2
9	Soft X'mas	*Nepthea*	100						100
10	Soft rose	*Lobophyton*		18	20	6		2	46
11	Soft long body	*Sarcophyton*		12	17	5		22	56
12		*Dendronephthea sp*	10	5	3		2	20	40
13		*Xenia*	26			100	13	100	239
E	**HARD CORAL**								
14	Blue staghorn	*Acropora sp*		3	3				6
15	Green staghorn	*Acropora sp*					1		1
16		*Blastomussa*			1				1
17		*Euphyllia*		3				2	5
18	Durian Coral	*Galaxea*	4	3	2	1	1	7	18
19	Green, Brown,	*Goniopora*	7					1	8
20	red plate	*Heliofungia*	1	2	1		1	2	7
21	Pineapple red	*Favia sp*		3		7	2	1	13
22	Pca	*Montipora*		2	10	1	3		16
23	Root red	*Lobophyllia*	1	3	1	1	4	5	15
24	Rice bubble	*Physogyra*	1			1	2	1	5
25		*Plerogyra*	3	3	2		1	19	28
F	**ECHINODERM**								
26	Holothuria	*H. fuscopunctata*			1	1			2
27		*H. artha*				1	1		2
28		*Bochadschia graiffei*		2				1	3
G	**MOLLUSC**								
29	Gastropods	*Strombus*					1		1
30		*Cypraea*					1		1
		Nautilus pompilus							
31	Bivalvia	*Tridacna gigas*					1		1
32		*T. derasa*	1				3		4
33		*T. squamosa*	1	2	1	1	3		8
34		*T. maxima*	1				1		2
35		*T. crosea*	1				2	1	4
36		*H. hippopus*					1		1
37		*H. porcellanus*	1						1
38		*Pinctada margritifera*		2				1	3
39		*Pteria Penguin*	3						3
H	**NECTON**	*Eggs and larvae of :*							
40		*Chypsilurus sp.*				+++		+++	
41		*Cheilinus undulates*	++						

CONCLUSION

The paper emphasis the development of a new paradigm on the "specific ecosystem and endemic organism spatial model" and targeted existing knowledge for a beyond 'the usual-goals' for Marine Protected Area (MPA). In this case is preserving and conserving "marine living fossils" : *Nautilus pompilus* for

Taka Bonerate as well as *Latimeria menadoensis* in north Sulawesi waters and Limulus.sp in Java and Kangean seas, should be designated as a "new concept of MPA-Plus". Considering the important of deep sea vulnerable reef and atolls and sand-dune (bungin) ecosystem for a protected reef-fishes : napoleon wrasse (*Cheilinus undulatus)*, and the larvae of flying fish Cypsilurus.sp and others had confirm that this ecosystem is a spawning-ground.

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