ZSL
LET'S WORK FOR WILDLIFE

EDGE

EVOLUTIONARILLY DISTINCT & GLOBALLY ENDANGERED

Survival Blueprint

Mushroom Coral, *Heliofungia actiniformis* Philippines

Compiler: Ditto Dela Rosa
Contributors: Gregorio E. Dela Rosa Jr. & Grace Quiton-Domingo

Suggested citation: Dela Rosa, G., Quiton-Domingo, G. 2015. A Survival Blueprint for the Mushrom Coral, *Heliofungia actiniformis*.
Compilation from the project: Conserving mushroom corals in Polillo Islands, Phillipines.

1. STATUS REVIEW

Phylum: Cnidaria

Class: Anthozoa

Order: Scleractinea

Family: Fungiidae

Genus: *Heliofungia*

1.1 Taxonomy:

Species: *Heliofungia actiniformis*
Common name English: Mushroom coral

1.2 Distribution and population status:

1.2.1 Global distribution: This species is found in the Indo-Pacific, South Japan, South China Sea, Oceanic West Pacific, northwest, north and eastern Australia

Table 1. Distribution, population estimates and trend of the mushroom coral per range country.

Country	Population estimate (plus references)	Distribution	Population trend (plus references)	Notes
Philippines		Cebu (Knittweis *et al* 2009)		
		Eastern Mindoro, Cebu, Southwest Mindanao, Sulu Island (Hoeksema 1989)		Based on examined records from museums
Malaysia		Sabah (Hoeksema 1989)		Based on examined records from museums
Indonesia	11-12 million (Wabnitz *et al.* 2003)	South Sulawesi (Hoeksema & Moka 1989, Hoeksema 1990)		
		Java, Northwest Java, Northwest and Southwest Sulawesi, Tiger Island, Paternoster Island, Sumbawa, Obi Latu, Maisel Island. Banda (Hoeksema 1989, Hoeksema 1991a)		Based on examined records from museums
		Barrang Lompo; Kapoposang; Lanyukang; Samalona; Sarappokeke (Knittweis *et al* 2009)		
		Adi, Gilli, Trawangan, Komodo, Manado, Pulau Seribu, Saboeda, Pulau Sembilan, Spermonde, Tilamuta (Knittweis *et al* 2009)		

		Barang Baringang, Gusung Trabanusu, Lae-Lae Keke, Lae-Lae, Bone Batang, Barang Caddi, Samalona, Bone Baku, Bone Tambung, Kapodasang, Kudingareng Keke, Lanyukang, Langkai (Hoeksema 2012)		
Thailand		Hoeksema 1989		Based on examined records from museums
Singapore		Southern islands (Hoeksema & Koh 2009)		
Palau		Abe 1937, Abe 1939, Abe 1940, Hoeksema 1989		
Papua New Guinea		Madang (Hoeksema 1993)		
		Bismark Sea (Hoeksema 1989)		Based on examined records from museums
Australia		Kimberley, Northern Territory, Northern Great Barrier Reef, Central Great Barrier Reef, South Great Barrier Reef (Hoeksema 1989)		Based on examined records from museums
Sri Lanka				
Solomon Islands		Hoeksema 1989		Based on examined records from museums
New Caledonia		Hoeksema 1989		Based on examined records from museums
Japan		Hoeksema 1989		Based on examined records from museums
India				
Myanmar				
Taiwan				
Vanuatu		Hoeksema 1989		Based on examined records from museums

1.2.2 Local distribution:

Table 2. Distribution, population size and level of protection of mushroom coral in the Philippines.

Country	Region / province	Site	Level of Protection	Population size	Reference(s)	Notes
Philippines	Batangas	Brgy. Hugom, San Juan	Community-conserved area	10 individuals	Personal observations	
		Brgy. Calubcob, San Juan		1 individual	Philippine National Museum	Collection records
		Brgy. Bagalangit, Mabini	Community-conserved area	9 individuals	Personal observations	
		Brgy. San Teodoro, Mabini	Community-conserved area	10 individuals	Personal observations	
		Brgy. Saguing, Mabini		4 individuals	Personal observations	
		Brgy. Talahib, Tingloy		12 individuals	Personal observations	
		Brgy. Maricaban, Tingloy		8 individuals	Personal observations	
	Quezon	Ikulong Island, Brgy. Aluyon, Burdeos		23 individuals	dela Rosa, Curnick & Koldewey *(in prep*)	
		Gumian, Brgy. Aluyon, Burdeos		52 individuals	dela Rosa, Curnick & Koldewey *(in prep*)	
		Brgy. Palasan, Burdeos		19 individuals	dela Rosa, Curnick & Koldewey *(in prep*)	
		Anawan Island, Brgy. Carlagan, Burdeos		1 individuals	dela Rosa, Curnick & Koldewey *(in prep*)	
		Maragakdak MPA, Brgy. Calutcot, Burdeos		5 individuals	dela Rosa, Curnick & Koldewey *(in prep*)	
		Malaguinoan Maliit, Brgy. Calutcot, Burdeos		4 individuals	dela Rosa, Curnick & Koldewey *(in prep*)	
		Malaguinoan Malaki, Brgy. Calutcot, Burdeos		16 individuals	Personal observations	
		Katakian Island, Patnanungan		4 individuals	Personal observations	
		Brgy. San Antonio, Verde Island, Batangas City		5 individuals	Personal observations	
	Bohol	Matabao Marine Protected Area, Tubigon	Community-conserved area	2 individuals	Personal observations	

		Bilangbilangan Marine Protected Area, Tubigon	Community-conserved area	9 individuals	Personal observations	
		Batasan Marine Protected Area, Tubigon	Community-conserved area	4 individuals	Personal observations	
		Tahong-Tahong, Talibon		3 individuals	Personal observations	
		Mahanay Island, Brgy. Mahanay, Talibon		2 individuals	Personal observations	
	Cebu	?	?	?	Knittweis *et al* 2009	
		Minantaw Marine Park and Santuary, Lapu Lapu City	Community-conserved area	4 individuals	Personal observations	
	Southern Leyte	Silago and Hinunangan	Community-conserved area	?	Quiton-Domingo *et al.* (pers. comm.)	
	Southern Leyte	Sogod Bay		?	Fenner *et al.* 2005	
	Surigao del Sur	General Island, Cantilan		1	Personal observations	
	Palawan	Meara Island, Puerto Princesa City		2 individuals	Personal observations	
	Palawan	Pandan Island, Puerto Princesa City		4 individuals	Personal observations	
	Palawan	Tadyo Island, Puerto Princesa		2 individuals	Personal observations	
	Surigao del Sur	Sabang, Brgy. Poblacion, Cortes		3 individuals	Personal observations	
	Surigao del Sur	Hinatuan		1	Personal observations	
	Davao del Sur	Davao Gulf		?	Bos 2012	

1.3 Protection status:
Mushroom corals are listed as Vulnerable on the IUCN Red List of threatened species and are included in Appendix II of CITES. In the Philippines, mushroom corals and other scleractinians are protected under Republic Act 8550 and the Fisheries Code of 1998. In addition, all wildlife, including scleractinian corals and its by-products and derivatives, are allowed for collection only for scientific, breeding or propagation purposes under Republic Act 9147 or the Wildlife Act of 2001 and the National Integrated Protected Areas System of 1992 or Republic Act 7586. Corals are also protected under local legislation within the 1,827 marine protected areas across the Philippines.

1.4 Habitat and resource assessment:
Mushroom corals inhabit coral reefs as free-living polyps between 1 and 25 meters (Gosliner *et al.* 1996, Veron 2000). They are often observed in rubble, sand patches and unconsolidated sediments (Knittweis *et al* 2009). Juveniles were often seen attached to massive and submassive forms of corals. Adult mushroom corals are also seen in between massive forms of corals. Large aggregations (up to eight individuals) and numerous mushroom corals were observed in back reefs and turbid waters. These were often observed adjacent to branching coral forms.

1.5 Biology and ecology:
Mushroom corals feed on zooplankton and fishes aside from the food provided by the symbiotic zooxanthellae. They can reproduce asexually by budding (Boschma 1923; Hoeksema, 1989; Knittweis *et al*., 2009). Mushroom corals exhibit locomotion by inflating their tissues and are able to move away when threatened (Hoeksema and de Voogd 2012). Mushroom corals serve as habitat to at least 25 associated species including acoel flatworms, the popcorn shrimp *Cuapates kororensis*, gall crabs, and the mushroom coral pipefish (*Siokunichthys nigrolineatus*; Hoeksema and Fransen 2011, Hoeksema *et al* 2012).

Populations between Central Visayas, Philippines and the Flores Sea in Indonesia, show genetic connectivity maintained by the Indonesia Through Flow (Knittweis et al 2009). On the other hand, populations between Tomini Bay, New Guinea and Jakarta, Indonesia are genetically distinct.

1.6 Threat analysis:

Destructive fishing, overharvesting and coastal development are the top three direct threats to mushroom corals (Jones 1997; Jones and Steven 1997; Wabritz *et al.* 2003; Tun *et al.* 2008; Knittweis *et al.,* 2009b; Knittweis & Wolff, 2010; Burke *et al.* 2011). Other threats include boat grounding and anchor damage, and collection for construction purposes. The mushroom coral is currently not protected in its entire range with the exception of a ban on collection, sale and export of scleractian corals in the Philippines.

Connectivity between the populations in Central Visayas, Philippines and in Flores Sea in Indonesia make the populations down of The Indonesia Through Flow vulnerable from overharvesting of the upstream populations (Knittweis *et al.* 2009) with the consequent loss of larval export and genetic variability.

In addition to anthropogenic threats, the mushroom coral and coral species in general are threatened by coral bleaching episodes due to rising sea surface temperatures (Carpenter *et al.* 2008; Burke *et al*. 2011).

Table 3. Degree of priority of threats to the mushroom corals in the Philippines.

THREATS	Priority
Anthropogenic	
Overfishing	High
Unsustainable extraction for aquarium and live fish trade	Critical
Illegal fishing methods (cyanide and dynamite)	Critical
Poaching in marine protected areas	Low
Improper waste disposal and no recycling of wastes	Medium
Sedimentation	High
Weak management capacity of local government and community	High
Natural	
Coral bleaching	Critical
Crown-of-Thorns	Low

1.7 Stakeholder analysis:

Table 4. Stakeholder analysis for the mushroom coral conservation in the Philippines.

Country	Stakeholder	Interest	Current activities	Impact	Intensity	Proposed activities
International	US AID	Development	Funder	+	Low	Submit proposals
	GIZ	Development	Funder	+	Low	Submit proposals
	UNDP-GEF	Development	Funder	+	Medium	Submit proposals
	Conservation International	Conservation	Practitioners	+	High	Collaborate
	Zoological Society of London	Conservation	Practitioners	+	High	Collaborate
	Coral Cay Conservation Foundation	Conservation	Practitioners	+	High	Collaborate
	World Wildlife Fund	Conservation	Practitioners	+	High	Collaborate
	Fauna and Flora International	Conservation	Practitioners	+	High	Collaborate
	California Academy of Sciences	Research	Research	+	Low	Collaborate
Regional	Asian Development Bank	Development	Funder	+	Medium	Submit proposals
Philippines	Local government of Burdeos	Government	Conservation, law enforcement, resource manager	+	Critical	Collaborate
	Local government of Patnanungan	Government	Conservation, law enforcement, resource manager	-	Critical	Collaborate
	Local government of Polillo	Government	Conservation, law enforcement, resource manager	+	Critical	Collaborate
	Local government of Jomalig	Government	Conservation, law enforcement, resource manager	+	Critical	Collaborate
	Local government of Panukulan	Government	Conservation, law enforcement, resource manager	+	Critical	Collaborate
	Local government of Mauban	Government	Conservation, law enforcement, resource manager	-	Critical	Collaborate
	Local government of Real	Government	Conservation, law enforcement, resource manager	+	Critical	Collaborate
Philippines	Local government of Infanta	Government	Conservation, law enforcement, resource manager	+	Critical	Collaborate
	Fish buyers in Real, Infanta, Patnanungan and Burdeos	Commercial	Funder, buyer and exporter of fishes and marine ornamentals	+/-	Critical	Collaborate

	Fish buyers and exporters in Parañaque	Commercial	Funder, buyer and exporter of fishes and marine ornamentals	+/-	Critical	Collaborate
	Indigenous communities	Conservation	Practitioners	+	Critical	Collaborate
	Northern Lamon Bay Integrated Patrol Team	Conservation	Law enforcement	+	Critical	Collaborate
	Haribon Foundation	Conservation	Practitioners	+	High	Collaborate
	Project Seahorse Foundation	Conservation	Practitioners	+	High	Collaborate
	Sentro ng Ikauunlad ng Katutubong Teknolohiya (SIKAT)	Conservation	Practitioners	+	High	Collaborate
	Institute for Social Order	Conservation	Practitioners	+	High	Collaborate
	Ocean Action Resource Center (ORC)	Conservation	Practitioners	+	High	Collaborate
	University of the Philippines Marine Science Institute (UP MSI)	Research	Research	+	Medium	Collaborate
	Western Philippines University (WPU)	Research	Research	+	Medium	Collaborate
	University of the Philippines Visayas	Research	Research	+	Medium	Collaborate
	Mindanao State University Naawan	Research	Research	+	Medium	Collaborate
	De La Salle University Bro. Alfred Shields Marine Station	Research	Research	+	Medium	Collaborate
	Silliman University Angelo King Center for Research and Environmental Management (SUAKCREM)	Research	Research		Medium	Collaborate
	Tetra-Tech EMI	Conservation	Practitioner (per project)	+	Medium	Collaborate
	MarcVentures Holdings, Inc., Adnama Mining Resources Inc. (AMRI), Shenzhou Mining Group Corporation (SMGC), etc.	Commercial	Mining	-	Critical	Collaborate
Philippines	Chamber of Mines of the Philippines	Commercial	Mining	+	Medium	Collaborate
	National Commission on Indigenous Peoples	Government	Conservation	+	Medium	Collaborate
	National Commission on Indigenous Peoples Region IV	Government	Conservation	+	Medium	Collaborate
	Bureau of Fisheries and Aquatic Resoruces Region IV-A	Government	Law enforcement	+	High	Collaborate

	Department of Environment and Natural Resources Region IV-A	Government	Protected area managers, law enforcement	+	High	Collaborate
	Department of Agriculture Bureau of Fisheries and Aquatic Resources (DA-BFAR)	Government	Law enforcement	+/-	Medium	Collaborate
	Department of Environment and Natural Resources Protected Areas and Wildlife Bureau (DENR-PAWB)	Government	Protected area managers, legislation	+	Medium	Collaborate
	Department of Environment and Natural Resources Coastal and Marine Management Office (DENR-CMMO)	Government	Protected area managers, conservation	+	Medium	Collaborate
	National Fisheries and Development Institute (NFRDI)	Government	Research	+	Low	Collaborate
	Department of Science and Technology Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARD)	Government	Research, funder	+	Low	Submit proposals
	Marine Protected Area Support Network (MSN)	Conservation	Advocacy	+	Medium	Lobby and collaborate
	NGOs for Fisheries Reform (NFR)	Conservation	Advocacy	+	Medium	Lobby and collaborate

1.8 Factors influencing success of survival blueprint implementation:

Table 5. Opportunities and threats to the different factors affecting mushroom coral conservation in the Philippines.

	Description	Threats	Opportunities
Socio-cultural effects	Seafood an important source of protein in the Philippines. Most of the fishing areas in the Philippines are heavily exploited (Green *et al.* 2003; Nañola *et al.* 2010). Overexploitation of the fishery resources has led to the use of destructive methods such as dynamite and cyanide fishing in coral reefs.	Destructive fishing is one of the main causes of the decline of Philippine reefs (Tun *et al.* 2008; Burke *et al.* 2011). This decline reduces the ability of coral reefs to reduce effects of storm surges, decreases its aesthetic value, and as a habitat to fishes.	There are an increasing number of areas in the Philippines that are establishing local or community- and local government-conserved reef areas to protect and conserved coral reef resources (Arceo *et al.*2008). These are supported and recognized by the local and national governments, non-government organizations and other stakeholders.

Economic implications	Mushroom corals and coral reefs in general are affected by the live reef food fish and marine ornamental trades. In addition, coastal development for tourism, mining activities and ports development also affects coral reefs in general. They also provide protection of houses and other structures from storm surges by decreasing wave energy.	Coastal development and siltation smothers reefs. Cyanide reduces the photosynthetic ability of the symbiotic zooxanthellae and slowly detaches coral tissue from the skeleton over time (Jones 1997; Jones and Steven 1997; Wabritz *et al*. 2003). Corals are used as home décor in some areas, particularly in Burdeos and in remote areas in the Philippines.	The total monetary value of the coral reefs is 352,915 Int.$/ha/year (de Groot *et al.* 2012*).* By informing and lobbying with local government units and legislators businesses will benefit from the indirect economic effects of conserving reefs, this will increase support. This could create and increase sustainable livelihood opportunities such as tourism, medical research and other derivatives through equitable access and benefit sharing.
Existing conservation measures	There are several legislations that have been enacted in support of coral reef and coastal management in general. One of these is the presidential Executive Order No. 533, enacted in 2007, stating that the Integrated Coastal Management (ICM) mechanism be used as a planning and management tool for all cities and municipalities in the Philippines. Other existing laws include the Fisheries Code of 1998 or Republic Act 8550 which includes sections on establishing at least 25% of the municipal waters as a Marine Protected Area (MPA), ban on coral exploitation and exportation, and the ban of fishing methods and fishing gears that are destructive to coral reefs.	There is a lack of additional funds at the local level, particularly for patrolling and enforcement. There are also conflicting laws that allow extractive activities such as mining that severely affect coral reefs. In addition, there is weak implementation for the monitoring and evaluation of these laws.	At the local level, the local government can improve conservation by establishing management zones, including MPAs, through the comprehensive land use planning and ICM planning. This will reduce adverse effects to coral reefs. Other local opportunities include the establishment of flagship species for conservation through municipal and barangay ordinances focusing on protecting mushroom corals.
Administrative/ political set-up	Government focus on generating revenues from development projects such as mining. Lack of funds for the monitoring of mining and patrolling and enforcement activities. Mining areas overlap with terrestrial and marine conservation priority areas.	Weak law enforcement and corruption. Conservation activities not a priority in some areas.	Some of the local government units are enthusiastic to engage in conservation and even ask to have projects implemented in their area.

Local expertise and interest	There is a high awareness of the importance of expertise on coral reefs both in research and the diving industry as well as photography enthusiasts. On the other hand, there is a low awareness of the importance of the mushroom coral to coral reefs.		Researchers, photographers and the wider public may be influenced to look at conserving this species. There are currently a small number of mushroom coral experts in the Philippines and there are only a small percentage of organizations working specifically on mushroom corals. In addition, photographers and their dive guides may be influenced to note species abundance per dive site.
Appeal of species			Mushroom corals can be used as flagship species in several conservation programs. They can become iconic species on a dive site (i.e. “mushroom coral city”) or as an icon in town celebrations.
Resources			There is a need to elevate the status of the mushroom coral as a flagship species to increase awareness amongst the wider public. In addition, population studies can be integrated into monitoring protocols of several institutions. There is also a need to develop and/or increase the number of mushroom coral and/or coral taxonomists.

2. ACTION PROGRAMME

Vision (30-50 years)	
The mushroom coral is protected and conserved as a flagship species in the Philippines in healthy coral reefs through effective and collaborative management while providing social, economic and ecological benefits to the present and future generations.	
Goal(s) (5-10 years)	
To assess the current status of the mushroom coral throughout its range, ensure its protection and conserve its habitat.	
Objectives	**Prioritisation**
1. Status in each marine biogeographic zone assessed	Critical
2. Cause of habitat degradation reduced	Critical
3. Mushroom coral populations are protected in effectively managed network of marine protected areas	High
4. Mushroom corals recognized as flagship species in the Philippines and as a keystone species in coral reefs at the local and national levels	Medium
5. Existing legislation effectively enforced including coral poaching at the local and national levels	High
6. Southeast Asia regional coordination in place and integrated in the Coral Triangle Initiative National Plan of Action for each country	Medium
7. National action plan for mushroom coral produced and supported at all levels	High
8. Coordinated and sustained conservation strategy	High

Activities	Country / region	Priority	Time scale	Responsible stakeholders	Indicators	Opportunities and threats	Activity type
1. Status in each marine biogeographic zone assessed							
1.1 Carry out a threat analysis of each marine biogeographic region	Philippines	Critical	2014	Government agencies, NGOs	Reports per site		Improving knowledge
1.2 Develop a mitigation plan for each marine biogeographic region	Philippines	High	2015	Government agencies, NGOs	Mitigation plan per site		Integrated coastal resource management
1.3 Develop standardized field techniques for survey and monitoring	Philippines	Medium	2014	ZSL, Haribon, ORC	Methodology established and disseminated		Improving knowledge
1.4 Build adequate capacity to conduct surveys	Philippines	High	2015	Government agencies, NGOs, communities, local government units	Numbers of trained and actively participating personnel	Finding interested personnel	Livelihood, Economic & Other Incentives
1.5 Conduct habitat and population surveys	Philippines	Critical	2015	Government agencies, NGOs, communities, local government units	Mushroom coral population estimates established; status of habitat; reports		Research
1.6 Establish long-term monitoring programs at priority sites	Philippines	High	2015	Government agencies, NGOs, communities, local government units	Methods and data collection in place at each site, sustained personnel plans	Need baseline data in other sites	Species and habitat management
2. Cause of habitat degradation reduced							
2.1 Engage mining, fishing and agriculture sector in mushroom coral conservation	Philippines	Critical	From 2014		Workshop held with each group and promotional literature developed. Develop engagement plans.	Disinterest. Commercial priorities.	Livelihood, Economic & Other Incentives

2.2 Promote sustainable livelihoods and alternative livelihood programs in coastal communities	Philippines	High	From 2014	Government agencies, NGOs	Implement and model sustainable and alternative livelihood options. Duplicate implementation in other sites with similar situations. Develop framework for sustainable and alternative livelihood options. Produce lessons learned publication.		Livelihood, Economic & Other Incentives
3. Mushroom coral populations are protected in effectively managed network of marine protected areas							
3.1 Engage key groups (communities, media, decision makers, private sector) in integrated coastal resource management	Philippines	Critical	From 2014	Government agencies, NGOs, indigenous communities	Technical working groups formed under local development councils	Conflicts amongst stakeholders	Integrated coastal resource management
3.2 Identify priority sites for MPAs	Philippines	Low	From 2015	NGOs, researchers, government agencies	Recommendations for new sites	Fishing ground displacement, loss of livelihoods, resource use conflicts, funds for patrolling and enforcement?	Land/water protection
3.3 Establish MPA networks for mushroom corals	Philippines	High	2015	Local government, NGOs, communities	MPA networks established		Water protection
4. Mushroom corals recognized as flagship species in the Philippines and as a keystone species in coral reefs at the local and national levels							

4.2. Develop communication and training modules on mushroom corals conservation for different sectors (e.g. media, teachers, schools, youth clubs, corporate partners)	Philippines	High	2015	Government agencies, NGOs	Coral reef conservation integrated in primary school education; training modules established for coastal management practitioners		Education & awareness
2.2. Develop IEC materials specific to target groups (e.g. media, women, indigenous peoples, teachers, schools, youth clubs, corporate partners)	Philippines	High	2015	Government agencies, NGOs	Communication plans established per site	Disinterest	Education & awareness
5. Existing legislation effectively enforced including coral poaching at the local and national levels							
5.1 Intensify law enforcement activities against poaching in priority sites	Philippines	Critical	2014-2025	Government agencies, NGOs, communities, local government	Monitoring illegal activities over time. Numbers of patrols & hours patrolled. Total hectares covered.	**Heavy conflict**	Law & Policy
5.2 Train community law enforcement officers at every level (minimum 3 persons per MPA)	Philippines	Critical	2014-2018	Government agencies, NGOs, local government	Train 3 people per MPA.	Finding interested personnel. Maintaining interest in the long term. Safety of officers.	Livelihood, Economic & Other Incentives
5.3 Support sustainable livelihood and alternative livelihood programs where appropriate	Philippines	High	2014-2025	Government agencies, NGOs, local government	Source, develop and fund new programs.		Livelihood, Economic & Other Incentives
6. Southeast Asia regional coordination in place and integrated in the Coral Triangle Initiative National Plan of Action for each country							

6.1 Integrate mushroom coral species action plan in the Coral Triangle Initiative National Plan of Action (CTI-NPOA)	All	High	2016	Government agencies, NGOs	Workshops held for CTI-NPOA chairs - reports	Government buy-in	Regional species management
7. National action plan for mushroom corals produced and supported							
7.1 National mushroom coral action plans produced and endorsed	Philippines	Critical	2015	Government agencies, NGOs	National Action Plan	Government buy-in; lack of implementation	Species management

References

Abe, N. 1939. Migration and righting reaction of the coral, Fungia actiniformis var. palawensis Doederlein. Palao Trop Biol Stn Stud 4:671–694.

Abe, N. 1939. Migration and righting reaction of the coral, *Fungia actiniformis* var. palawensis Doederlein. Palao Trop. Biol Stn. Stud 4:671-684.

Abe, N. 1940. Growth of *Fungia actiniformis* var. palawensis Doederlein and its environmental conditions. Palao Trop Biol Stn Stud 5:105-145.

Arceo, H.O., P.M. Aliño and R.O.M. Gonzales. 2008. Where are we now with marine protected areas? In Coral Reef Information Network in the Philippines (PhilReefs). 2008. Reefs Through Time 2008: Initiative the State of the Coasts Reports. Coral Reef Information Network of the Philippines (PhilReefs), MPA Support Network, Marine Environment and Resources Foundation, Inc. and the Marine Science Institute, University of the Philippines, Diliman, Quezon City. 152pp.

Bos, A.R. 2012 Fishes (Gobiidae and Labridae) associated with the mushroom coral *Heliofungia actiniformis* (Scleractinia: Fungiidae) in the Philippines. Coral Reefs 31:133.

Boschma, H. 1922. On budding and coalescence of buds in *Fungia fungites* and *Fungia actiniformis*. Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen 24:257–268

Burke, L., K. Reytar, M. Spalding, A. Perry. 2011. Reefs at Risk Revisited. World Resources Institute.

Carpenter, K.E., M. Abrar, G. Aeby, R.B. Aronson, S. Banks, A. Bruckner, A. Chiriboga, J. Cortés, J.C. Delbeek, L. DeVantier, G.J. Edgar, A.J. Edwards, D. Fenner, H.M. Guzmán, B.W. Hoeksema, G. Hodgson, O. Johan, W.. Licuanan, S.R. Livingstone, E.R. Lovell, J.A. Moore, D.O. Obura, D. Ochavillo, B.A. Polidoro, W.F. Precht, M.C. Quibilan, C. Reboton, Z.T. Richards, A.D. Rogers, J. Sanciangco, A. Sheppard, C. Sheppard, J. Smith, S. Stuart, E. Turak, J.E. N. Veron, C. Wallace, E. Weil, E. Wood. 2008. One-Third of Reef-Building Corals Face Elevated Extinction Risk from Climate Change and Local Impacts.*Science* 321, 560.

Fenner, D., R. Walker, P. Raines. 2005 . A checklist of stony corals from the Malitbog area of Western Sogod Bay, Southern Leyte, Philippines. *S*illiman *J*ournal Vol. 46 No. 1.

Gosliner, T.M., D.W. Behrens and G.W. Williams. 1996. Coral reef animals of the Indo-Pacific. Sea Challengers.

Green, S.J., J.O. Flores, J.Q. Dizon-Corrales, R.T. Martinez, D.R.M. Nuñal, N.B. Armada and A.T. White. 2004. The fisheries of Central Visayas, Philippines: Status and trends. Coastal Resources Management Project of the Department of Environment and Natural Resources and the Bureau of Fisheries and Aquatic Resources of the Department of Agriculture, Cebu City, Philippines, 159 p.

de Groot, R., L. Brander, P. Sandervander, R. Costanza, F. Bernard, L. Braat, M. Christie, N. Crossman, A. Ghermandi, L. Hein, S. Hussain, P. Kumar, A. McVittie, R. Portela, L.C. Rodriguez, P. Brinkm, P. van Beukering. 2012. Global estimates of the value of ecosystems and their services in monetary units. Ecosystem Services1(2012)50–61.

Hoeksema, B.W. and W. Moka, 1989. Species assemblages and ecomorph variation of mushroom corals (Scleractinia: Fungiidae) related to reef habitats in the Flores Sea. Netherlands Journal of Sea Research 23:149-160.

Hoeksema, B.W., 1989. Taxonomy, phylogeny and biogeography of mushroom corals (Scleractinia: Fungiidae). Zoologische Verhandelingen, Leiden 254: 1-295.

Hoeksema, B.W. 1990. Cross-shelf distribution patterns of mushroom corals (Fungiidae) in the southern Makassar Strait. In: Hoeksema (chapter 3.3) Systematics and ecology of mushroom corals (Scleractinia: Fungiidae). Ph.D. thesis, Leiden University, pp 361–452.

Hoeksema BW (1991a) Control of bleaching in mushroom coral populations (Scleractinia: Fungiidae) in the Java Sea: stress tolerance and interference by life history strategy. Mar Ecol Prog Ser 74:225–237.

Hoeksema, B.W. 1993. Mushroom corals (Scleractinia: Fungiidae) of Madang Lagoon, Northern Papua New Guinea: an annotated check-list with the description of *Cantharellus jebbi* spec. nov. Zoologische Mededelingen, Leiden 67: 1-19.

Hoeksema, B.W. and E.G.L. Koh. 2009. Depauperation of the mushroom coral fauna (Fungiidae) of Singapore (1860s–2006) in changing reef conditions. Raffles Bulletin of Zoology Suppl. 22: 91-101.

Hoeksema, B.W. and C.H.J.M Fransen. 2011. Space partitioning by symbiotic shrimp species cohabitating in the mushroom coral Heliofungia actiniformis at Semporna, eastern Sabah. Coral Reefs 30: 519.

Hoeksema, B. W. and de Voogd, N. J. 2012. *On the run: free-living mushroom corals avoiding interaction with sponges.* Journal of the international Society for Reef Studies. 31 (2): 455-459.

Hoeksema, B.W., S.E.T. van der meij and C.H.J.M. Fransen. 2012. The mushroom coral as habitat. Journal of the Marine Biological Association of the United Kingdom, 2012, 92(4), 647–663.

Hoeksema, B.W. 2012. Distribution patterns of mushroom corals (Scleractinia: Fungiidae) across the Spermode Shelf, South Sulawesi.. The Raffles Bulletin of Zoology 60(1): 183.

Hoeksema, B., Rogers, A. & Quibilan, M. 2008.*Heliofungia actiniformis*. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. Downloaded on 12 January 2014.

Knittweis, L., J. Jompa, C. Richter and M. Wolff. 2009. Population dynamics of the mushroom coral Heliofungia actiniformis in the Spermonde Archipelago, South Sulawesi, Indonesia. Coral Reefs (2009) 28:793–804.

Knittweis, L., W.E. Kraemer, J. Timm and M. Kochzius. 2009. Genetic structure of Heliofungia actiniformis (Scleractinia: Fungiidae) populations in the Indo-Malay Archipelago: implications for live coral trade management efforts. Conserv Genet (2009) 10:241–249.

Jones, R.J. 1997. Zooxanthellae loss as a bioassay for assessing stress in corals. *Marine Ecology Progress Series* 149: 163–171

Jones, R.J. and A. Steven. 1997. Effects of cyanide on corals in relation to cyanide fishing on reefs. Marine and Freshwater Research, 48, 517-522.

Nañola, C.L., P.M. Aliño and K.E. Carpenter. 2010. Exploitation-related reef fish species richness depletion in the epicenter of marine biodiversity. Environ. Biol. Fish. DOI 10.1007/s10641-010-9750-6

Rubec, P.J. 1986. The effects of sodium cyanide on coral reefs and marine fish in the Philippines, p. 297-302. In: J.L .Maclean, L.B. Dizon and L.V. Hosillos (eds.) The 1st Asian Fisheries Forum. Asian Fisheries Society, Manila, Philippines.

Tun, K., C.L. Ming, T. Yeemin, N. Phongsuwan, A.Y. Amri, N. Ho, K. Sour, N.V. Long, C. Nañola, D. Lane, and Y. Tuti. 2008. Status of Coral Reefs in Southeast Asia. In: Wilkinson, C (ed). 2008. *Status of coral reefs of the world: 2008.* Global Coral Reef Monitoring Network and Center, Townsville, Australia.

Wabnitz, C., M. Taylor, E. Green and T. Razak. 2003. From ocean to aquarium. United Nations Environment Program/World Conservation Monitoring Centre, Cambridge.

Wilkinson, C. 2008. *Status of coral reefs of the world: 2008.* Global Coral Reef Monitoring Network and Center, Townsville, Australia.

Veron, J.E.N. 2000 Corals of the world. Volume 2. Australian Institute of Marine Science and CRR Qld. Pty. Ltd. Australia. 429 p.