Chapter 6

Towards the Bali MPA Network

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6.1 THE IMPORTANCE OF DATA FOR THE BALI MPA NETWORK

Throughout this report we have presented and explained the results of the Bali Marine Rapid Assessment Program 2011. Based on the status of its coral reefs and reef fishes alone, our conclusion is that Bali warrants a considerable effort with regard to marine conservation. Bali's coral reefs are divided into five major coral community types (Chapter 4) and are generally in good condition (Chapter 3). Bali's reef fish species richness is very high: the second highest in the Asia-Pacific (Chapter 5). On the other hand, the data showed a strong indication of serious overfishing in Bali: we only recorded three reef sharks and three Napoleon wrasses over more than 350 diving hours. All of the above, along with the discovery of 13 new fish species, one new coral species, and 13 coral species suspected to be new to Bali's waters warrants the immediate protection of Bali's marine resources.

Despite its apparent simplicity, the term "Marine Protected Area" (MPA) has several definitions. The International Union for Conservation of Nature (IUCN) defines an MPA as "Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment" (Kelleher 1999). Almost a decade later, the IUCN revised its definition of an MPA to "A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (IUCN-WCPA 2008). The Indonesian government has loosely translated the term MPA as an "aquatic conservation area", which is defined as "an aquatic area that is protected and managed with a zoning system to assist in the management of fisheries resources and its environment" (MMAF 2009, Article 1).

Bali as a province currently has one established MPA (the Bali Barat National Park in the Regency of Buleleng) and one declared MPA (the Nusa Penida MPA in the Regency of Klungkung, (see Darma et al.(2010)). Several village level MPAs have been initiated along the coasts of Bali, among others in the Tejakula District. These conservation areas, geographically so close to each other, cannot be managed separately without an understanding of the connectivity between them. To effectively manage such MPAs, the new concept of an "MPA Network" is introduced.

An MPA Network is defined as "A collection of individual MPAs or reserves operating cooperatively and synergistically, at various spatial scales, and with a range of protection levels that are designed to meet objectives that a single reserve cannot achieve" (IUCN-WCPA 2008). An MPA Network should be designed "to restore marine ecosystems and associated populations to their full productivity and diversity" (IUCN-WCPA 2008, p. 24). Eight methods or steps necessary to develop an MPA Network have been identified as follows (UNEP-WCMC 2008):

1. Identify and involve the stakeholders
2. Identify goals and objectives
3. Compile data
4. Establish conservation targets and design principles
5. Review existing protected areas
6. Select new protected areas
7. Implement the network
8. Maintain and monitor the protected area network

In addition, IUCN-WCPA (2008) has defined six best practices for the planning of an MPA network, some of which overlap with the UNEP-WCMC steps:

1. Clearly defined goals and objectives
2. Legal authority and long-term political commitment
3. Incorporate stakeholders
4. Use of best available information and precautionary approach
5. Integrated management framework
6. Adaptive management measures

The Bali MRAP 2011 was a major milestone for the Bali MPA Network. The results covered in this document are a part of the data collection process (#3 in the UNEP-WCMC steps and #4 in the IUCN-WCPA best practices). It is, admittedly, not a complete description of the current condition of coral reefs and reef fishes in Bali; the result of the necessity to collect data rapidly. Rather, the MRAP results serve more as a snapshot of this current condition.

The data on coral reef and reef fishes are important, yet insufficient to understand the overall richness of the coastal and marine biodiversity of Bali. Thus, we have tried to balance this report by incorporating secondary data on several migratory taxa in Section 6.2 below.

6.2 ADDITIONAL INFORMATION ON MARINE MEGAFAUNA IN BALI

6.2.1 Sea turtles

Despite the large number of documents on the green sea turtle trade in Bali (see Adnyana et al. 2010), we found very few publications on the status of sea turtles around the island. Anecdotal information that emerged in the late 20th century led to the belief that Bali had been abandoned by sea turtles, with only a few nesting sites remaining, such as Perancak (Negara Regency) and Pemuteran (Buleleng Regency). However, recent data indicate that Bali still has considerable nesting, and possible feeding, sites in need of protection.

Anecdotal information indicates that Bali seems to be the nesting and foraging site for four sea turtle species: the green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), olive ridley's turtle (*Lepidochelys olivacea*) and leatherback turtle (*Dermochelys coriacea*). Bali has at least 11 sea turtle nesting sites around the island. The KSDA (*Konservasi Sumber Daya Alam* The Agency for Conservation of Natural Resources, http://www.ksda-bali.go.id/?page_id=26) provides a list of managed nesting sites as follows: Kuta (Badung), Lepang (Klungkung), Perancak (Jembrana) and Pemuteran (Buleleng). However, Bali has more unmanaged nesting grounds, scattered across Kedonganan (Jimbaran, Badung), Nusa Dua (Badung), Sanur (Denpasar), Serangan (Denpasar), Saba (Gianyar), Tembok (Karangasem) and Yeh Gangga (Tabanan).

The Bali MRAP 2011 scientists recorded sea turtle sightings at five sites: Terora/Sanur (one large green turtle), Gili Biaha/Tanjung Pasir Putih (Padang Bai, one large hawksbill turtle), Gili Selang (Seraya, one large hawksbill turtle), Menjangan (Anchor Wreck and Coral Garden, two hawksbill turtles). Hawksbill turtles (*Eretmochelys imbricata*) are often found foraging in coral reefs; hence their sighting locations might be foraging grounds for this species. Terora has a considerable sea grass ecosystem; it is thus a candidate as a green turtles' (*Chelonia mydas*) foraging site. In addition, in 2009 a green turtle was released from Serangan Island with a satellite tracker which showed a foraging path around Sanur (UNUD-WWF 2009).

Table 6.1 details the sea turtle species currently found in Bali. This information also indicates the importance of immediate on-site management for sea turtle nesting and foraging grounds, particularly for prominent ones such as Perancak (the Kuta nesting site has been so far managed by Profauna, KSDA and the local coast guard). Consequently, Perancak has been included in the list of important sites to be managed in the Bali MPA Network (see Section 6.3).

6.2.2 Marine mammals

The waters off Bali are apparently suitable for marine mammals, in this case cetaceans (whales and dolphins) and dugongs. The waters off the island support at least 11 species of cetaceans (including two sub-species of spinner dolphins), at least one unidentified species of baleen whale and dugongs (the only member of the Sirenia order in the Indo-Pacific) (Table 6.2).

Marine mammal tourism is increasingly an important economic sector in Bali. The main dolphin watching tourism sites in Bali are in Lovina (Buleleng) and the Peninsula (Badung). The primary target species for both sites are spinner dolphins, although the Hawaiian form (*Stenella longirostris longirostris*) is less common for Lovina (Mustika 2011). No marine mammal hunting occurs in Bali, although we have observed occasional use of stranded whale meat post mortem in several areas.

Lovina is the collective name for several villages westward of Singaraja (Buleleng) which belong to two districts: Banjar and Buleleng. The villages of Temukus and Kaliasem are located in Banjar District. The villages of Kalibukbuk, Anturan, Tukad Mungga and Pemaron are located in Buleleng District. Lovina was the first location for dolphin watching tourism in Bali and Indonesia (Gouyon 2005). The industry started in 1987 when, prompted by foreign backpackers, local fishers in the village of Kaliasem formed a dolphin watching association (Mustika 2011). Since that time, the industry has grown exponentially, now with four dolphin watching associations (Kaliasem, Kalibukbuk, Aneka and Banyualit) and no less than 179 dolphin tour boats available to take tourists every day.

As with many marine wildlife viewing activities (Zwirn et al. 2005; Carlson 2010), dolphin watching tourism in Lovina must be regulated. To date, no formal management regime is in place in Lovina, although Mustika's (2011) research has prompted discussion around sustainable dolphin

watching practices among local boatmen. As a result, the boatmen have agreed on three in-principle agreements: 1) turning off the engine (or, if this is impractical, lifting the propeller), 2) keeping their distance from the dolphins and 3) avoiding cutting across dolphins' routes.

The Central Buleleng MPA (which basically covers the whole of Lovina) was declared on 22 August 2011 by the Regent of Buleleng with a special design as a marine tourism park. With this in view, it is imperative to implement best practices within the local dolphin watching industry, although it may take more than one year of continuous community engagement and training before all boatmen put the three agreements (and perhaps other codes of practice to be agreed upon later) into effect.

6.2.3 Sharks and other marine megafauna

Written information on the distribution of other marine megafauna is sparse. However, four species of shark (black tip shark, white tip shark, bamboo shark and Wobbegong shark), four species of rays (*Manta birostris*, eagle ray and blue spotted ray) and the iconic sunfish (*Mola mola*) can be found at Nusa Penida in the Klungkung Regency (Darma et al. 2010). Independent observations by Conservation International and Reef Check Indonesia have moreover confirmed the presence of whale sharks (*Rhincodon typus*) in Nusa Penida. Additional anecdotal information from Yayasan Alam Lestari (LINI Foundation) and Mustika's personal observations also confirmed the presence of this species in Tejakula and Lovina, respectively.

The severe depletion of sharks in Bali's waters is an urgent marine conservation management issue due to the important role sharks play in keeping ocean ecosystems healthy (Stevens et al. 2000; Baum & Worm 2009), and is especially so due to the lost opportunity to establish lucrative shark-based tourism in Bali. While reef shark populations in Bali have already been decimated by fishing, certain fishers in southeast Bali are now heavily targeting deepwater and pelagic sharks, including thresher sharks. In just September and October 2011 alone, up to 4,500 thresher sharks (*Alopias sp.*) were estimated to have been harvested in the waters off Nusa Penida, between Klungkung and Karangasem Regencies (Shingler & Perez 2011). All three species of *Alopias* are currently listed as 'vulnerable' in the IUCN Red List (version 2011.1). Because 90 % of the sharks harvested in southeast Bali were pregnant females (Shingler & Perez 2011), it is feared that the current harvest rate will deplete Bali of its sharks in the near future.

Table 6.1. List of sea turtle species and their current nesting and foraging grounds in Bali.

No.	Species	IUCN Red List status	Nesting ground (alphabetical)	Foraging ground (alphabetical)
1	Green turtle (*Chelonia mydas*)	**Endangered (v 3.1)**		Nusa Penida (Klungkung)
				Sanur (Denpasar)
2	Hawksbill turtle (*Eretmochelys imbricata*)	Critically endangered (v 3.1)	Pemuteran (Buleleng) Saba (Gianyar)	Gili Selang (Seraya, Karangasem)
				Menjangan (Buleleng)
				Nusa Penida (Klungkung)
				Padang Bai (Karangasem)
3	Olive ridley's turtle (*Lepidochelys olivacea*)	Vulnerable (v 3.1)	Kedonganan (Jimbaran, Badung)	
			Kuta (Badung)	
			Lepang (Klungkung)	
			Nusa Dua (Badung)	
			Pemuteran (Buleleng)	
			Perancak (Jembrana)	
			Saba (Gianyar)	
			Sanur (Denpasar)	
			Serangan (Denpasar)	
			Yeh Gangga (Tabanan)	
4	Leatherback turtle (*Dermochelys coriacea*)	Critically endangered (v 2.3)	Perancak (Jembrana)	
5	**Unidentified species**		Nusa Penida (Klungkung)	
			Tembok (Karangasem)	

Source: UNUD-WWF (2009), KSDA (KSDA 2009), Darma et al. (2010)

Shark Sanctuary

In the light of recent intelligence received about the island's shark population and the shark fishing around the island, we urge the Bali government to implement legislation to create a shark sanctuary that outlaws the capture or killing of any shark species in Bali provincial waters (inclusion of manta rays in this harvest ban is also strongly encouraged, given the high economic value of manta tourism in Nusa Penida in particular). The creation of a Bali shark sanctuary will be well-received by the international press at a time when Bali is increasingly criticized for its environmental problems, and will prevent even further criticism when information on the thresher shark slaughter is exposed internationally. Moreover, such a move would keep Bali in good stead with its competitor destinations for marine tourism, as many of these (including the Maldives, Palau, Micronesia, the Bahamas, and Guam) have recently declared shark sanctuaries to strong international praise. In October 2011 alone, the Marshall Islands created the world's largest shark sanctuary at 1,990,530 km^2. Bali would be well-served to follow suit,

Table 6.2. List of marine mammal species sighted in Bali since 2001

No.	Species (Latin name)	Species (English name)	IUCN Red list status (v 3.1)	Location	Regency
1a	*Stenella longirostris longirostris*[2]	Hawaiian spinner dolphin	Data deficient	Peninsula	Badung
				Lovina	Buleleng
1b	*Stenella longirostris roseiventris*[2]	Dwarf/Southeast Asian spinner dolphin	Data deficient	Peninsula	Badung
				Lovina	Buleleng
2	*Stenella attenuata*[2]	Pan-tropical spotted dolphin	Least concern	Peninsula	Badung
				Lovina	Buleleng
3	*Grampus griseus* [124]	Risso's dolphin	Least concern	Peninsula	Badung
				Lovina	Buleleng
4	*Lagenodelphis hosei* [2]	Fraser's dolphin	Least concern	Lovina	Buleleng
5	*Globicephala macrorhynchus* [234]	Short-finned pilot whale	Data deficient	Lovina	Buleleng
				Serangan	Denpasar
6	*Pseudorca crassidens*[25]	False killer whale	Data deficient	Nusa Penida	Klungkung
				Peninsula	Badung
7	*Tursiops sp.* [25]	Bottlenose dolphin	Data deficient (*T. aduncus*), least concern (*T. truncatus*)	Lovina	Buleleng
				Nusa Penida	Klungkung
				Peninsula	Badung
8	*Feresa attenuata*[1234]	Pygmy killer whale	Data deficient	Peninsula	Badung
				Semawang	Denpasar
9	*Steno bredanensis*[3]	Rough-toothed dolphin	Least concern	Suwung	Badung
10	*Physeter macrocephalus*[134]	Sperm whale	Vulnerable		Badung, Jembrana, Klungkung
11	*Megaptera novaeangliae* [134]	Humpback whale	Least concern	Tanah Lot	Tabanan
12	*Balaenoptera sp.* [2]	Baleen whale	Depends on the species	Peninsula	Badung
				Lovina	Buleleng
13	*Dugong dugon*[345]	Dugong	Vulnerable	Tanjung Benoa	Badung
				Nusa Penida	Klungkung

Note:
[1] found stranded (Mustika et al. 2009)
[2] sighted during boat surveys (Mustika 2011)
[3] Ratha personal data 2011
[4] Marine Mammals Indonesia data
[5] sighted during boat survey (Darma et al. 2010)

noting that a shark sanctuary will not only create a strong positive media impression of the political will to act decisively on serious environmental problems, it will also over time (as shark populations recover) contribute significantly to increasing the value of Bali's marine tourism.

Shark diving tourism has become a popular choice for international divers around the world. A single live shark is worth USD 179,000 for diving tourism in Palau per annum; in very sharp contrast to the worth of a single dead shark which sells for a maximum of USD 274 in shark markets (Vianna et al. 2010). For diving tourism to replace shark fishing, finding the exact location(s) to view sharks (e.g., cleaning stations) is therefore recommended, as tourists would only be willing to pay for expensive shark diving packages if the shark sighting probability is high (see Topelko & Dearden 2005; Vianna et al. 2010). The relative position of the shark viewing station is also important: if viewing stations are too far offshore (so that they are not accessible by day-boats), then shark viewing tourism will not be able to make a significant economic contribution towards the local community (Topelko & Dearden 2005).

Towards the Bali MPA Network

The information contained in this report is considered a sufficient trigger to improve the management of existing MPAs and other conservation regimes. The findings that coral reefs in Bali cluster into five communities (Chapter 4) and that Bali supports the second largest reef fish diversity in Indo-Pacific (after Raja Ampat in West Papua – Chapter 5) warrant the development of an MPA network for the whole island because it will increase its source-sink resilience (UNEP-WCMC 2008). The brief information presented on several marine megafauna, particularly sea turtles and marine mammals (Section 6.2), also reflects the importance of an MPA network in Bali. Migratory species are best served by large MPAs that cover most of the, or the entire, life cycle; this approach is often impractical however, if not impossible. A collection of MPAs that are near to each other and ecologically connected can substitute the role of a large MPA by securing part of species' migratory routes and critical habitats (see Sciara 2007 for cetacean examples).

Admittedly, the report does not cover other important baseline data for an MPA network establishment, such as the distribution of mangroves and basic oceanographic information (particularly mid and bottom water column current patterns), the latter of which is desirable to form a better understanding of the connectivity between MPAs. Socio-cultural and economic analyses are also absent from this document. However, the Precautionary Principle dictates that conservation management should still be installed and implemented despite insufficient data (Lauck et al. 1998).

To complete the milestones towards an MPA network, Conservation International Indonesia has been identifying and engaging with local partners (*inter alia*, local communities, government agencies, NGOs and research institutions). Prior to the 2011 Bali MRAP, in June 2010 Conservation International Indonesia conducted a series of stakeholder meetings to identify MPA priority sites around Bali. The meeting produced 25 priority sites, from which seven MPA candidate sites were later recommended. Table 6.3 presents the nine candidate sites for Bali MPA network, including their ecological characteristics and management status. An additional site (Padang Bai – Candidasa) is added to the list, owing to the area's unique coral reef and reef fish compositions, possibly due to cold-water upwelling which is believed to provide better resilience to climate change. A new coral species *Euphyllia sp.* was found in the waters off Padang Bai – Candidasa (see Chapter 4); this species is currently considered endemic to this region of east Bali. The Bali Barat National Park is also included in the network list for it is an

Table 6.3. Priority sites for MPA network in Bali (clock-wise, eastward)

No.	Site name	Exact location	Biological characteristics	Management status
1	Bali Barat National Park	West Bali, Buleleng	Coral reef, reef fish, sea turtle, cetaceans	An official MPA
2	West Buleleng MPA	Pemuteran, Buleleng	Coral reef, reef fish, sea turtle	Declared as an MPA*
3	Central Buleleng MPA	Lovina, Buleleng	Coral reef, reef fish, cetaceans, whale shark	Declared as an MPA*
4	East Buleleng MPA	Tejakula, Buleleng	Coral reef, reef fish, whale shark	Declared as an MPA*
5	Amed – Tulamben	Karangasem	Coral reef, sea turtle, reef fish, shark	n.a.
6	Padang Bai – Candidasa	Karangasem	Coral reef	n.a.
7	Nusa Penida	Klungkung	Coral reef, mangroves, reef fish, cetaceans, whale shark, sea turtles, shark, manta, sunfish	Declared as an MPA**
8	The Peninsula (including Nusa Dua and Bukit Uluwatu)	Badung	Coral reef, reef fish, cetaceans, sea turtles	n.a.
9	Perancak	Negara	Sea turtles, mangroves	n.a.

Note:
*declared on 22 August 2011
**declared in September 2010

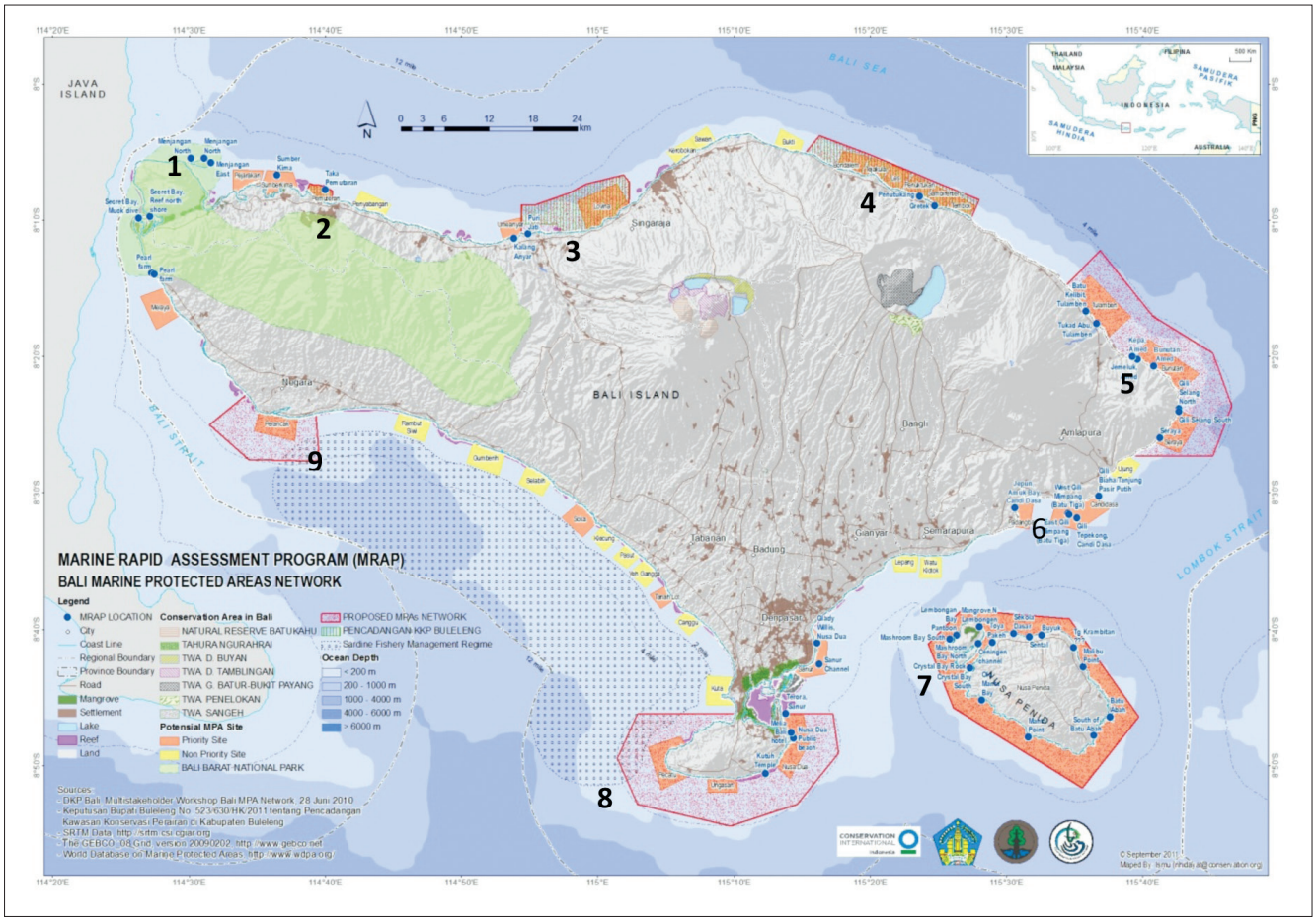

Figure 6.1. Proposed MPAs recommended for inclusion in the Bali MPA Network (see Table 6.3 for MPA names)

important site for coral reefs and reef fishes (Chapters 3–5). In addition to being the first protected area in Bali, the experiences gained from its establishment have much to offer for the development of other MPAs. Figure 6.1 gives a visual distribution of conservation sites listed in Table 6.3.

Of all nine priority sites, only one has an established management regime (Bali Barat National Park). Four other sites (the Buleleng MPAs and Nusa Penida MPA) have been declared as MPAs and now are undergoing planning and zoning processes. The four remaining sites (Amed - Tulamben, Padang Bai-Candidasa, the Peninsula and Perancak) are still devoid of formal management regimes. These sites need to be managed collaboratively by the government, local communities and private sectors, with the help of non-governmental organisations and research institutions. The creation of a provincial level shark sanctuary should also mesh nicely with the island-wide MPA Network concept, as the network will provide additional surveillance and enforcement regimes for the prohibition of shark fishing in Bali waters.

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