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NINE YEARS IN LESSER SUNDA

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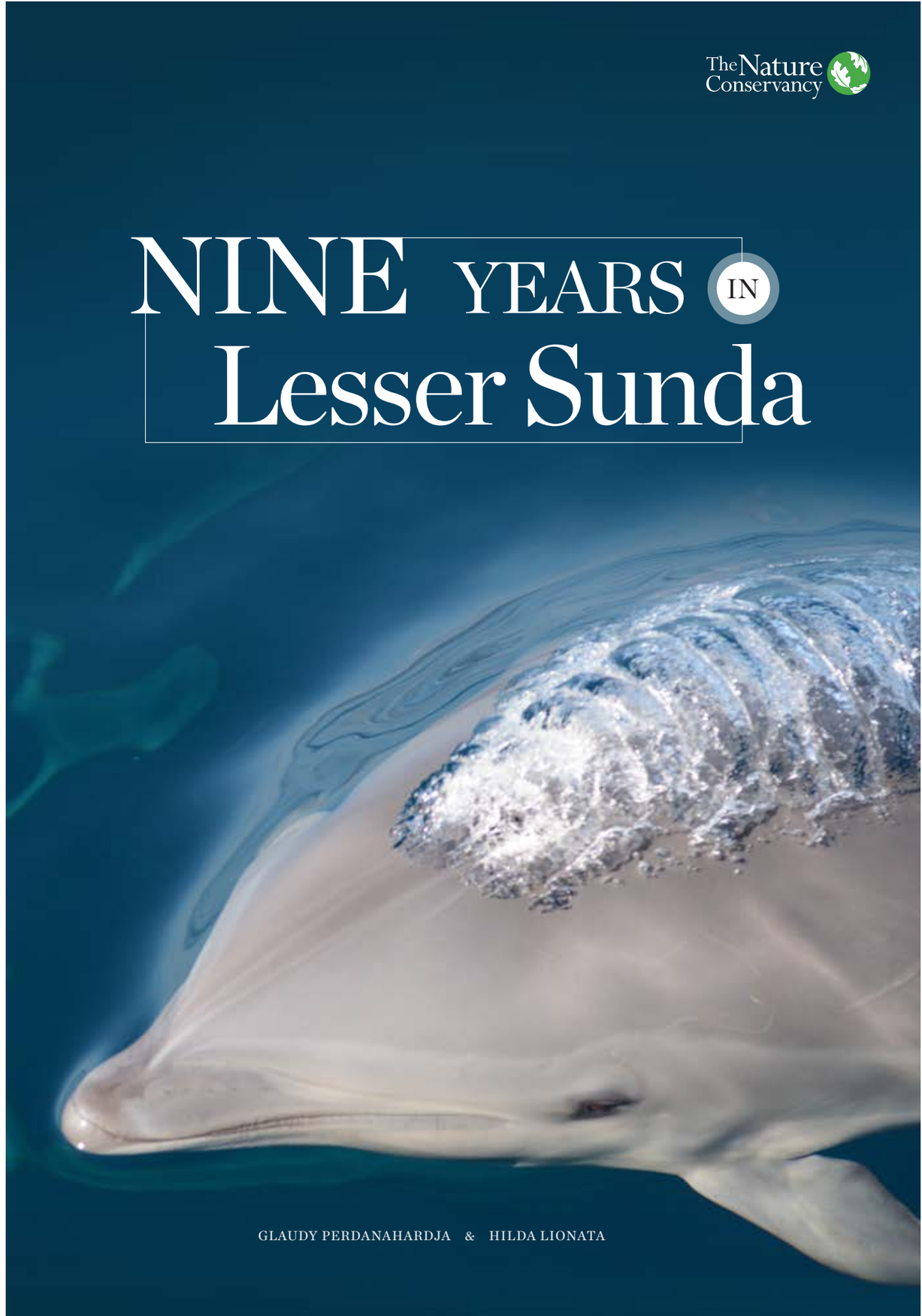

GLAUDY PERDANAHARDJA & HILDA LIONATA

NINE YEARS IN Lesser Sunda

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NINE YEARS IN LESSER SUNDA

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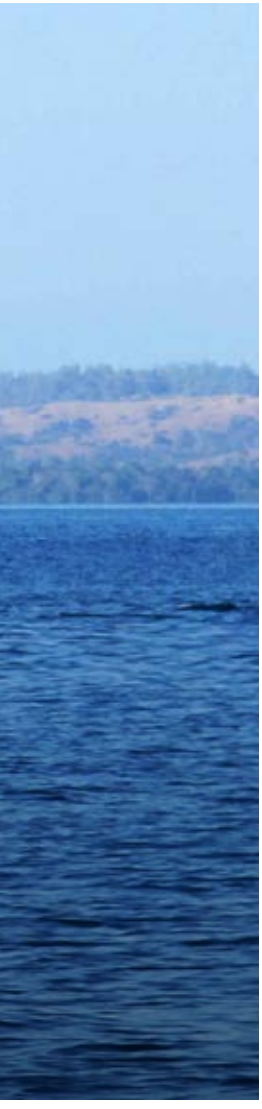

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Stretching from Bali to Timor Leste, covering an area of more than 110 million acres, the Lesser Sunda encompasses small rugged islands surrounded by jaw-dropping coral reefs bursting with abundant marine life. It sits at the crossroads of the Indian and Pacific Oceans, and has a combination of unique conditions — including channel depth, currents and temperatures — make this an extraordinarily rich hub for marine life.

Lesser Sunda has long been threatened by destructive fishing, overfishing, pollution and coastal development. This region is now also threatened by climate change impacts including increased sea temperatures, sea level rise, extreme weather and ocean acidification.

Since 2008, with generous support from German Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit, The Nature Conservancy has been helped the Government of Indonesia in Lesser Sunda to demonstrate a practical application of ecosystem-based management – an integrated, sustainable management of the full suite of human activities occurring in large, spatially defined areas. The Nature Conservancy has employed our three-pronged strategy to further ocean and coastal area based management, namely a multi-objective marine spatial planning (MSP); marine protected area (MPA) networks; and marine conservation agreements (MCAs). MSP can proactively identify and resolve conflicts between human uses and the environment. MPA networks can serve to protect biodiversity and enhance fisheries. While MCAs bring diverse stakeholders together to achieve mutually agreed upon conservation goals.

Nine years in Lesser Sunda presents a concise but informative story of our valuable learning process to demonstrate ecosystem-based management in large scale marine areas of Lesser Sunda in a more popular way. It tells you how we facilitate the development of Savu Sea MPA – one of the largest marine protected area in South East Asia and strategic roles of collaborative management towards the effective management of the park. It further states how to best use of the MPA in promoting socio-economic welfare to the locals.

The book also records how we evolve from scientific resilience Lesser Sunda MPA network design into a more the practical design. Furthermore, it guides the readers to get to know how ecosystem based adaptation will guide the economic development.

We hope public readers see this as our records of our long-term exercise, failure as well as achievement and valuable lesson learnt to move forward. ■

June 2017

Being the world's largest archipelagic state with immensely rich and diverse tropical marine ecosystems is both a blessing and a curse for Indonesia. The richness of tropical marine ecosystems provides the world with valuable biological capital, despite the lack of sufficient knowledge of their economic value. If properly managed, it will result in economic benefit for Indonesia and will make a significant contribution in combating the extinction of precious global species and protect the world from hunger. However, human activities remain the largest contributor to the loss of tropical ecosystems. In fact, massive exploitation of marine resources has continued to fail in addressing poverty and sustainable livelihoods for local people.

Ecosystem-based management has long been promoted as one of the ways to advance conservation and sustainable use in an equitable way. It focuses on maintaining human interactions to create a healthy, productive and resilient ecosystem that will continue to provide its services to people and nature. The Nature Conservancy has long been consistent in demonstrating ecosystem-based management. With generous support from the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety of Germany, we have been supporting the Government of Indonesia in demonstrating ecosystem-based management in Lesser Sunda since 2008.

The book 'Nine Years in Lesser Sunda' is a testimony to our commitment and long engagement in translating ecosystem-based management into a sustainable development context. It tells about how we applied various management regimes including resilient marine protected area networks that can serve to protect biodiversity and enhance fisheries; marine spatial planning to proactively identify and resolve conflicts between human uses and the environment; and marine conservation agreements to bring diverse stakeholders together to achieve mutually agreed upon conservation goals.

We supported the government in refining the scientific design of a marine protected area network that will connect 77 areas of interest in Lesser Sunda, potentially improving protection over 7.7 million hectares of marine waters. To date, we are supporting the protection of the 3.35-million hectare Savu Sea Marine National Park (MNP); and 229,000 hectares of nine newly designated marine protected areas in West Nusa Tenggara.

We are continuously inspired by the revival of traditional sustainable marine resources management in 10 districts within the Savu Sea MNP. We also demonstrated rights-based fisheries management using the Papadak and Hoholok customary law in Rote. We are hoping that our valuable learning process in Lesser Sunda will inspire people how nature's beauty and power is ingrained in our lives, our history and our culture. We would also like to illustrate that by conserving nature, we are helping nurture our artistic spirit and ensuring that future generations will continue to find inspiration in the natural world around us.

We hope that people are willing to do more to transform how we use and develop our marine resources, working with the people whose very lives depend on it. Knowing that today people are looking ever more to our oceans to meet our basic needs and for continued economic growth. The Marine Conservation Council in East Nusa Tenggara is the proven example of transformation in collaborative actions toward the effective management of Savu Sea MNP.

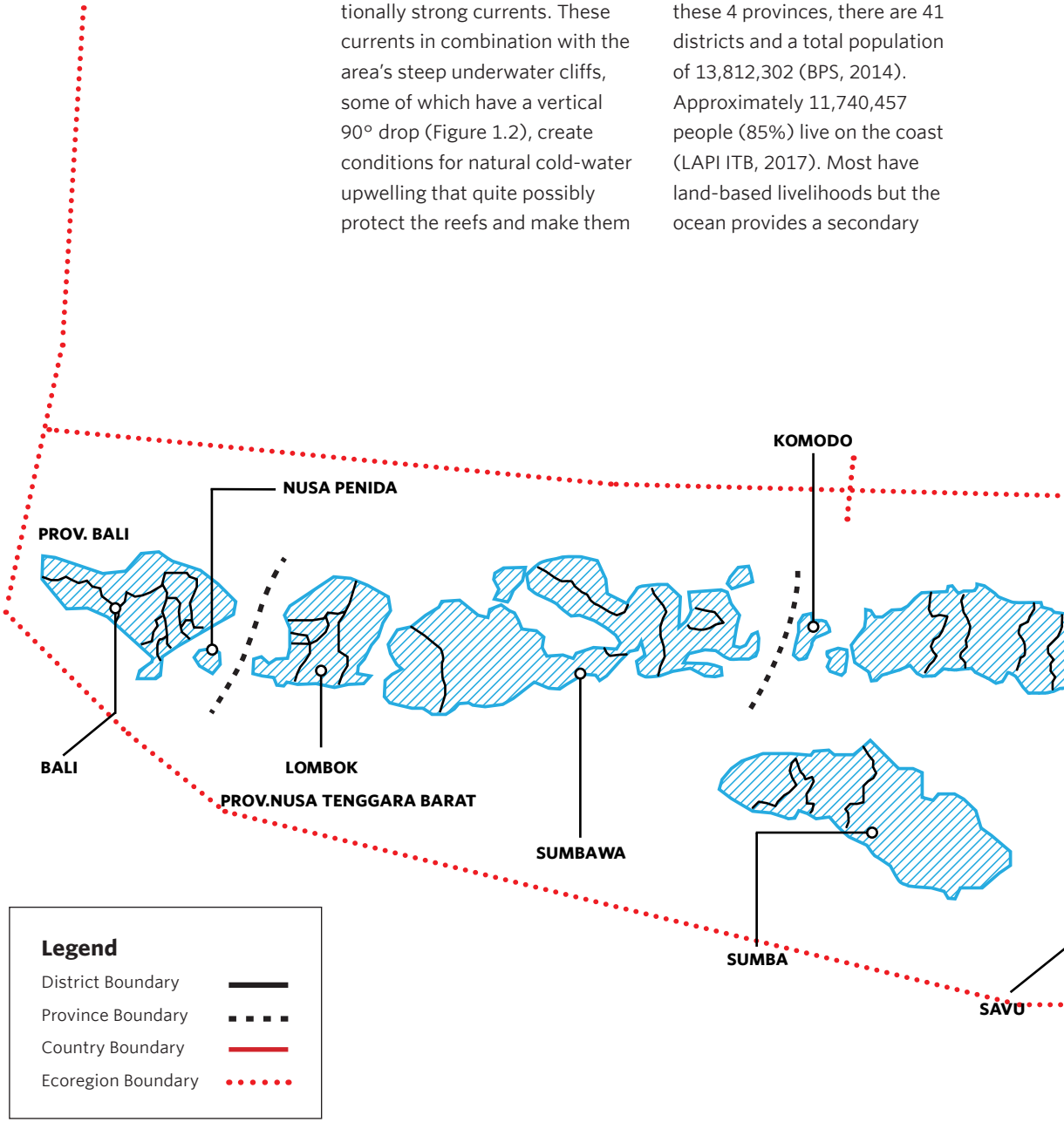
June 2017

Rizal Algamar

I.
INTRODUCTION

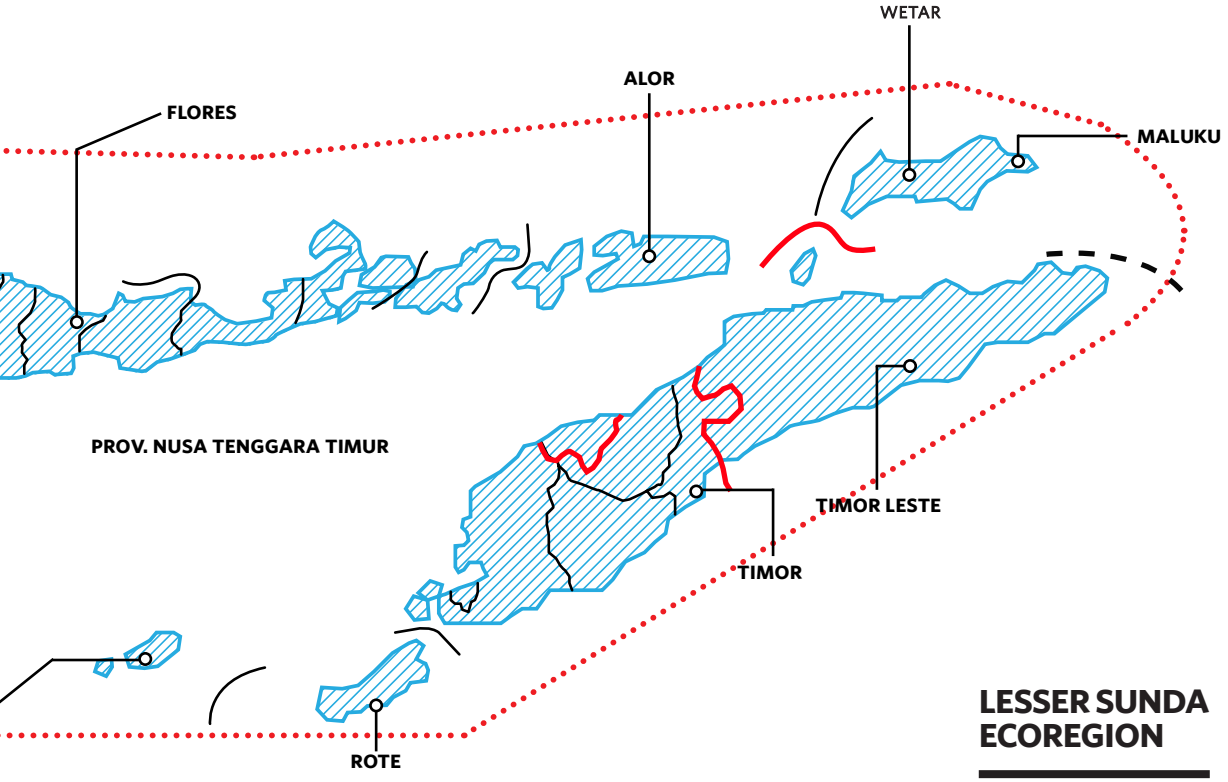
Stretching from Bali to Timor Leste, the Lesser Sundas region encompasses an area of over 44.5 million hectares (Figure 1.1). The landscape is characterized by small rugged islands, each ringed by jaw-dropping coral reefs. Divers from around the world flock here to see the spectacular marine life despite the region's exceptionally strong currents. These currents in combination with the area's steep underwater cliffs, some of which have a vertical 90° drop (Figure 1.2), create conditions for natural cold-water upwelling that quite possibly protect the reefs and make them resilient to the growing threat of rising sea surface temperatures associated with climate change.

Administratively, the Lesser Sunda Ecoregion (LSE) spans 4 Indonesian provinces and one country. These are Bali, West Nusa Tenggara, East Nusa Tenggara and Maluku, and the country of Timor Leste. Within these 4 provinces, there are 41 districts and a total population of 13,812,302 (BPS, 2014). Approximately 11,740,457 people (85%) live on the coast (LAPI ITB, 2017). Most have land-based livelihoods but the ocean provides a secondary



source of income. They also farm seaweed, grouper, salt, milkfish and pearls. A small portion works in the tourism sector, acting as guides for such activities as sport fishing, diving, snorkeling and surfing. The main Lesser Sunda Islands are Bali, Lombok, Sumbawa, Flores, Sumba, Timor, Alor archipelago and Wetar Islands. The islands are part of a volcanic arc formed by subduction along the Sunda Trench in the Java Sea, known as the Sunda Arc.

The Lesser Sunda region has 1,056 islands, most of them are small islands. Many of which are separated by oceanic trenches. The deep waters limit the movement of flora and fauna between islands, which in turn has given rise to a high level of localized speciation. In 2013, the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF) seascape technical working group identified the Lesser Sunda Ecoregion as a priority seascape for the CTI-CFF. Of special note were the ecoregion's shallow coastal habitats (coral reef, mangroves, seagrass and estuary), deep sea habitat features (seamounts and underwater canyons) and diverse marine life. ■



LESSER SUNDA ECOREGION

FIGURE 1.1
Lesser Sunda Ecoregion showing provincial and national boundaries

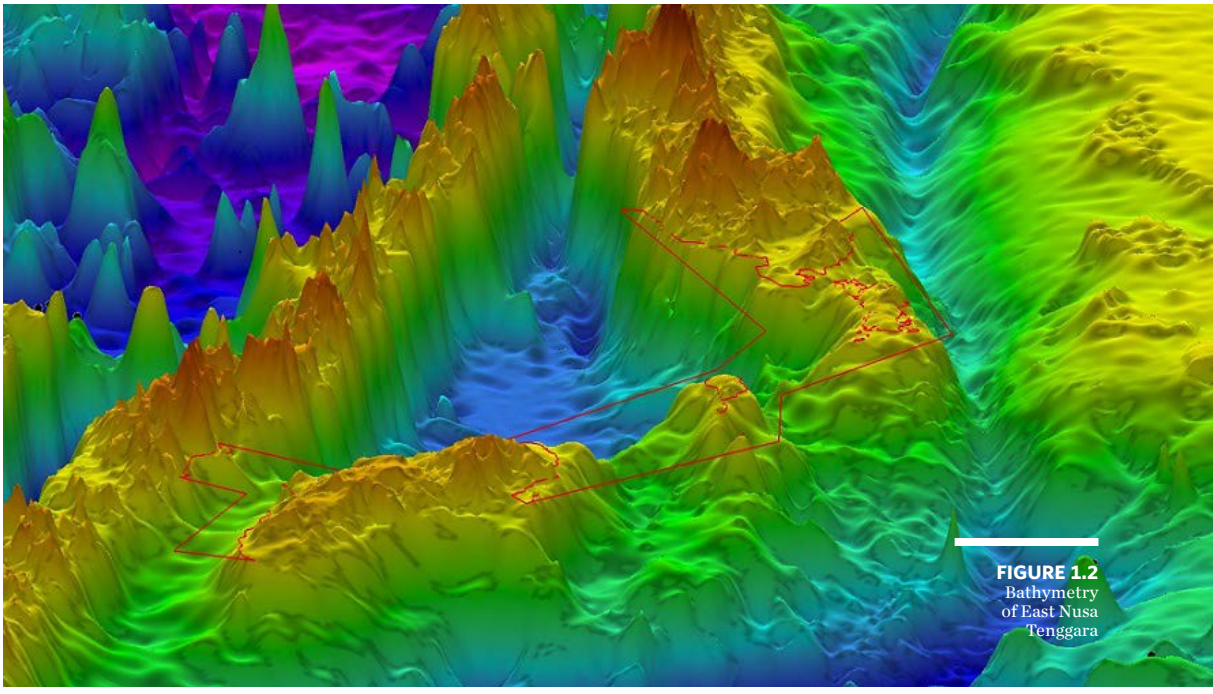


FIGURE 1.2
Bathymetry of East Nusa Tenggara

I.1 WHY LESSER SUNDA?

In 2011, The Nature Conservancy (TNC), in collaboration with the Government of Indonesia, produced the Scientific Design of a Resilient Network of Marine Protected Areas (MPAs) for the Lesser Sunda Ecoregion report (Wilson et al., 2011). This document identifies existing MPAs and listed additional areas to be considered as new MPAs. An innovative feature of the suggested MPA network is the identification of potential "deep sea" MPAs which would protect migratory corridors, pelagic habitat and sustainable fisheries. The report identifies almost 10 million hectares of potential conservation areas, divided into 100 MPAs. If implemented, this network of MPAs would protect coastal and deep sea biodiversity, increase local resilience to the threat of climate change and benefit local people.

The Lesser Sunda is home to beautiful seascapes and various species. But it is also home to people. The area is increasingly exposed to development pressure, which in turn has led to unanticipated environmental degradation. Deforestation has led to the clouding of coastal waters. Seismic oil and gas exploration and production has introduced underwater noise pollution (acoustic habitat degradation). Construction associated with growing populations

has brought urban and industrial waste. Frequent anchoring and grounding of tourist boats have damaged local reefs. Reef blasting has further degraded local habitat (Kahn, 2014). Then, there are natural pressures such as volcanic activity, earthquakes, landslides and cyclones. Working with local populations, the provincial and central governments Ministry of Marine Affairs and Fisheries (MMAF), TNC has conserved the area, ensuring ecosystem services remain intact and local people can continue to have sustainable livelihoods. TNC believes that the conservation of Lesser Sunda ecoregion is vital for marine mammals and fish in the context of global climate change. The survival of wildlife and people are inextricably bound to the sea. ■

I.1.1 ECOLOGICAL IMPORTANCE OF LESSER SUNDA

Lesser Sunda Ecoregion is one of Indonesia's least studied regions. Around 523 species of coral have been recorded here. Eleven are endemic. Lesser Sunda coral represent 76% of all reef building coral species (Veron et al., 2009). There are 1,783 fish species recorded, 25 of which are endemic (Allen, 2007). The steep underwater landscape and upwelling-driven productivity of the Lesser Sunda provide a unique habitat for resident and migratory large marine fauna such as whales, dolphins, dugongs, sharks, turtles and manta rays (Figure 1.3). Twenty-two species of marine mammal (cetacean) are recorded in the Lesser Sunda (Figure 1.4). These include seven dolphin species,

14 whale species and one dugong species (Kahn, 2013). The resident populations of dugong and sperm whale species are listed as vulnerable on the IUCN Red list of threatened species. The locally present blue whale is considered endangered (IUCN, 2016). Lesser Sunda is also home to 17 other globally threatened marine species.

This statistic includes turtles, fish, mollusks, sea birds, 176 species of corals and 10 species of sea cucumber as listed in Table 1.1. Most of the species on the list are also in Appendix I and II of CITES and protected under Indonesian regulations on the preservation of flora and fauna. ■

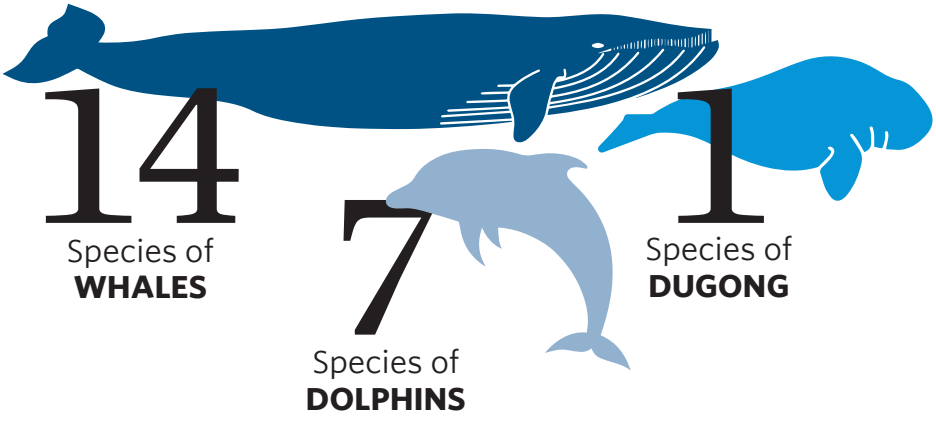
TABLE 1.1
LIST OF SPECIES IN LESSER SUNDA AND THE PROTECTION STATUS ACCORDING TO IUCN, CITES AND GOVT REG NO. 7/99

SPECIES NAME	COMMON NAME	SPECIES GROUP	IUCN STATUS 2016	CITES APPENDIX	GOVT REG 7/99
Eretmochelys imbricata	Hawksbill Turtle	Reptiles	CR	I	Yes
Caretta caretta	Loggerhead Turtle	Reptiles	VU	I	Yes
Chelonia mydas	Green Turtle	Reptiles	EN	I	Yes
Dermochelys coriacea	Leatherback	Reptiles	VU	I	Yes
Lepidochelys olivacea	Olive Ridley	Reptiles	VU	I	Yes
Balaenoptera musculus	Blue Whale	Marine mammals	EN	I	Yes
Physeter macrocephalus	Sperm Whale	Marine mammals	VU	I	Yes
Balaenoptera physalus	Fin Whale	Marine mammals	EN	I	Yes
Dugong dugon	Dugong	Marine mammals	VU	I	Yes
Cheilinus undulatus	Humphead Wrasse	Marine fish	EN	II	No
Pristis clavata	Dwarf Sawfish	Marine fish	EN	I	Yes
Carcharhinus longimanus	Oceanic Whitetip Shark	Marine fish	VU	II	No
Manta alfredi	Reef Manta Ray	Marine fish	VU	II	No
Manta birostris	Giant Manta Ray	Marine fish	VU	II	No
Bolbometopon muricatum	Green Humphead Parrotfish	Marine Fish	VU	None	No
Rhincodon typus	Whale Shark	Marine fish	EN	II	No
Mola mola	Ocean Sunfish	Marine fish	VU	None	No
Pristis pristis	Largetooth Sawfish	Marine fish	CR	II	Yes
Pristis zijsron	Green Sawfish	Marine fish	CR	I	Yes
Anoxypristis cuspidate	Knifetooth Sawfish	Marine fish	EN	I	No
Tridacna derasa	Southern Giant Clam	Marine moluscs	VU	II	Yes
Tridacna gigas	Giant Clam	Marine moluscs	VU	II	Yes
Hydrobates matsudairae	Matsudaira's storm petrel	Sea bird	VU	None	No
Fregata andrewsi	Christmas frigate	Sea bird	CR	I	Yes
Papasula abbotti	Abbots booby	Sea bird	EN	I	No
Coral spp (176 spp)		Coral	EN (9)	II	No
			VU (167)		
Holothuria spp, Actonipyga spp, Stichopus herrmanii, Thelenota ananas		Sea cucumber 10 Spp	EN (5)	none	No
			VU (5)		

Note. VU: vulnerable, EN: endangered, CR: critically endangered
Source: Burung, 2014 and Kahn, 2013

CETACEAN'S DIVERSITY IN LESSER SUNDA ECOREGION

Rapid Ecological assessment results carried out by TNC in 2013 both in Savu Sea and Lesser Sunda Ecoregion has revealed that there are:



TNC in collaboration with Tourism Agency, East Nusa Tenggara Province studied the potential of a whale watching in three areas. They are **Solor-Lewatobi (east Flores District), Ile Ape-Lamalera (Lembata District) and Alor- Pantar (Alor District).**

THREATS

Unsustainable fisheries practices and net entangements, plastic waste, ship strikes with migrating whales, underwater noise pollution from shipping lanes, seismic and operational activities from the oil and gas industry, as well as large-scale coastal infrastructure development (ports and minings).

Savu Sea functions as marine corridors and a migratory pathway for baleen whales. It is also an important upwelling zone in Indo-Pacific region.

COMPARISON OF CETACEAN'S SIZE

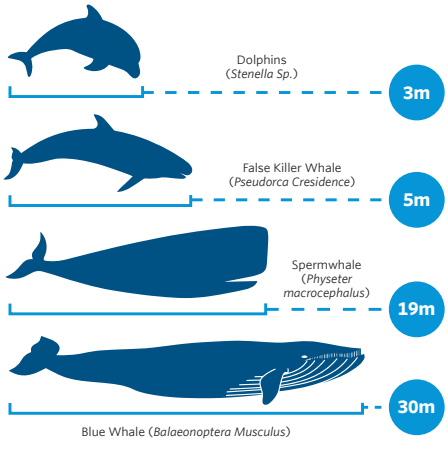


FIGURE 1.4
Cetacean Diversity in Savu Sea

Lesser Sunda has approximately 25,901 hectares of mangrove forest (GeoEye 2011 & Rapid-Eye 2014). Mangroves act as a nursery for juvenile fish. These ecosystems also provide people with shrimp and crab to eat and protection against waves and tides. There are at least 15 species of mangroves in Lesser Sunda. There are also 10 recorded sea grass species distributed over 56,414 hectare. Sea grasses are habitat for dugongs and turtles. They are also a source of food for fish and crustaceans. There are 78,975 ha of coral cover in the Lesser Sundas. The coral in the Lesser Sundas are home to 350 species of fish. It offers a number of ecosystem services such as a barrier to waves and abrasion for coastal villages. It also draws tourists interested in snorkeling and diving (Figure 1.5). ■

FIGURE 1.5
Source of food and barrier to abrasion as ecosystem services.

I.1.2 ECONOMIC IMPORTANCE OF LESSER SUNDA

A unique mix of deep channels, currents and cool water temperature give the area the ideal conditions for marine upwelling. The mixture of cold, nutrient-rich, deep-sea water with the warm, surface water allows plankton to thrive, creating a robust base to the local food chain. The Savu Sea pelagic fish fishery is an estimated 156,000 ton/year, with a realized catch of 65,331,5 ton (41,88 %). Demersal fish is estimated at 84.000 ton/year with a realized catch of 17,778,7 ton (21,17%) (TNC, 2015a). Commercial fish species such as snapper, grouper, parrotfish, tuna, barracuda, rabbitfish and trevally fill local fishermen's nets or auction houses. Although the islands are sparsely populated, they are home to millions of people who depend on the sea for their livelihood (Figure 1.6). In the Savu Sea's Kupang, Rote Ndao and Manggarai districts, more than a thousand head of households rely on the ocean. Most of them fish daily at 12 miles or less from shore. Some, but not all, have boats with motors. For these coastal villagers, the ocean is not only a source for fish. People in the area farm seaweed and the production was 891,4 ton in 2005. They raise fish in floating net cages (KJA, keramba jaring apung) and the production of caged fish in 1998 reached to 2,001 ton (TNC, 2015a). The area also holds 73% of Indonesia's fish exports, making it the biggest source of exported fish in Indonesia. ■

FIGURE 1.6
A school of trevallies and seaweeds mariculture as source of livelihoods for the people in Lesser Sunda Ecoregion

FIGURE 1.7
Developing marine tourism industries in Lesser Sunda.

The beauty of Indonesia's coral, beaches and the marine life has drawn tourists both domestic and international. After Papua's Raja Ampat – which has 100 dive and snorkel sites – the Lesser Sunda comes in second with 50 spots (MAMF in Samudra, 2016a). Many locations, such as Bali, the Gilis of Lombok, Komodo islands, Riung islands, Maumere, Rote and Alor, have developed marine tourism industries (Figure 1.7). Forty percent of international tourists coming to Indonesia visit Lesser Sunda islands (LAPI ITB, 2017). Consistent sightings of cetaceans in East Nusa Tenggara waters could provide coastal communities with a valuable opportunity to establish new eco-ventures such as responsible whale and dolphin watching. Local and provincial governments, NGOs, as well as marine tourism operators, have already expressed interest in developing a responsible whale watching industry in East Nusa Tenggara. The sector should be developed alongside operator-endorsed codes of conduct and appropriate regulatory frameworks, including the establishment of Marine Protected Areas or MPAs. Otherwise, whale watching could turn into whale harassment (Kahn 2013).

In a participatory mapping study carried out in 36 districts in Lesser Sunda, marine areas were dominated by public facilities such as government and private-owned ports and infrastructures (found in 50% of the 36 districts). Other buildings on the coastline included hotels and restaurants (30%), and residences (19%). Port infrastructure is found along most of the Lesser Sunda coastline. MMAF plans to invest IDR 2.7 trillion in 2017 to upgrade these facilities (MMAF in Samudra, 2016b). Our 2015 mapping study shows that most of the coastal infrastructure development is driven by private sector (76%) then the government (24%) (Meryanto et al., 2015). ■

FIGURE 1.8
Lesser Sunda Ecoregion within Coral Triangle Ecoregions

I.1.3
LESSER SUNDA IN THE BIGGER CONTEXT

Indonesia is one of the six Indo-Pacific countries within the Coral Triangle, which has been recognized as an epicenter of marine diversity and global priority for conservation (Figure 1.8). Of all the Coral Triangle countries, Indonesia has the most extensive and diverse coral reefs. Indonesia is also home to the world's most diverse seagrass and mangrove communities, and supports viable populations of globally threatened species including sea turtles, whales, dolphins and dugongs. The Plans of Action of Coral Triangle Initiative for Coral Reefs, Fisheries and Food Security (CTI CCF) translated the high-level political commitments of six Coral Triangle countries into a single sustainable management plan of action. The plan was developed around five explicit goals, namely: (1) Designating and effectively managing priority seascapes, (2) Fully applying an Ecosystem Approach of management to fisheries and other marine resources, (3) Establishing and effectively managing Marine Protected Areas, (4) Climate Change Adaptation measures and (5) Improving threatened species status. By working in Lesser Sunda, TNC is helping achieve these five goals.

Indonesia fulfilled its commitment to the Convention on Biological Diversity's Program of Work on Protected Areas to create 10 million hectares of Marine Protected Areas (MPAs) in 2010, with the declaration of the 3.35 million hectare Savu Sea Marine National Park within the Lesser Sunda Ecoregion. The Government of Indonesia has demonstrated its commitment to establishing a regional network of MPAs through its leadership in the Coral Triangle Initiative. ■

Go to:
www.cti-secretariat.net
For futher informations.

I.2 TNC'S FOOTPATH IN LESSER SUNDA

Sustainable ocean and coastal management must simultaneously protect biodiversity and the competing resource demands for infrastructure, commerce, social services, water, energy, agriculture, and recreation. Scale is a particularly important factor in ensuring that ecosystem processes remain intact. Ocean management must be done with biophysical, socioeconomic, and jurisdictional considerations in mind. No-impact and low-use areas may be necessary elements of biodiversity protection.

Despite their utility and benefits, protected areas alone are insufficient to comprehensively address problems caused by human activities in ocean and coastal areas. The long-term sustainable use of waters and landscapes will only be realized when there are well-designed and well-managed protected areas. Ocean and coastal area-based management (ABM) address this need. The Nature Conservancy is employing three tools to further ocean and coastal ABM: 1) multi-objective marine spatial planning (MSP); 2) marine protected area (MPA) networks; and 3) marine conservation agreements (MCAs). Planning proactively identifies and resolves conflicting policies about human use and the environment. MPA networks can serve to protect biodiversity and enhance fisheries. Conservation agreements bring diverse stakeholders together. These three tools can be harnessed individually or in concert.

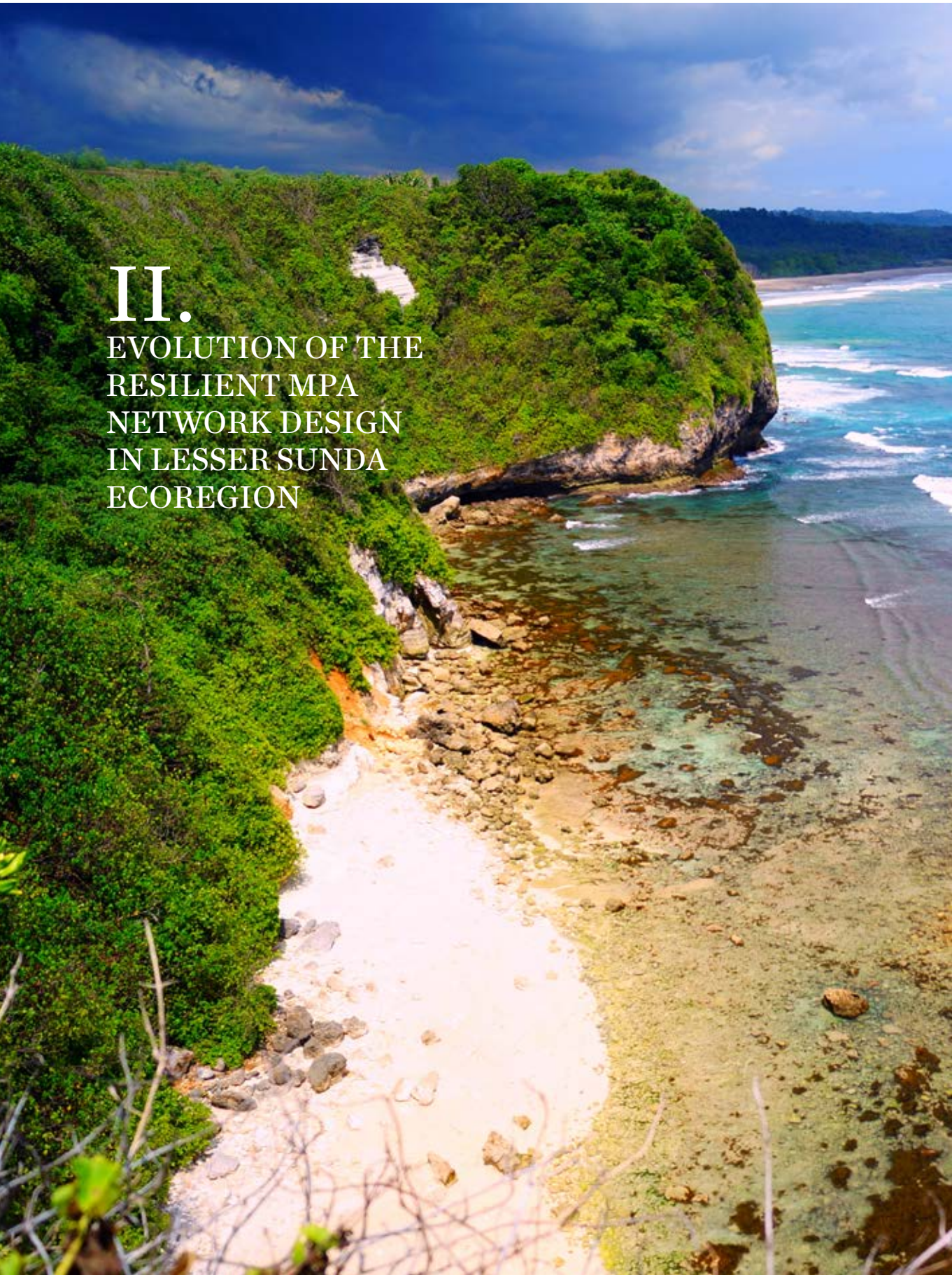
To find out more, go to: www.coraltriangleinitiative.org

Balancing multiple objectives is a major challenge for marine planners and managers, especially in a region with various economic sectors such as energy, fisheries, hazard mitigation, transportation and tourism. To address this challenge, many practitioners weigh whether to employ ecosystem-based management (EBM) or marine spatial planning (MSP). Interactive decision support for MSP can guide practitioners impartially. MSP represents and accounts for different objectives in a credible, flexible, and transparent way. Decision support for MSP provides alternative future management scenarios. MSP analyzes tradeoffs among objectives and highlights the common ground between objectives. MSP ensures that the burden of proof is distributed appropriately among groups and sectors. MSP practices by TNC in Lesser Sunda are showcased later on in chapter 5.

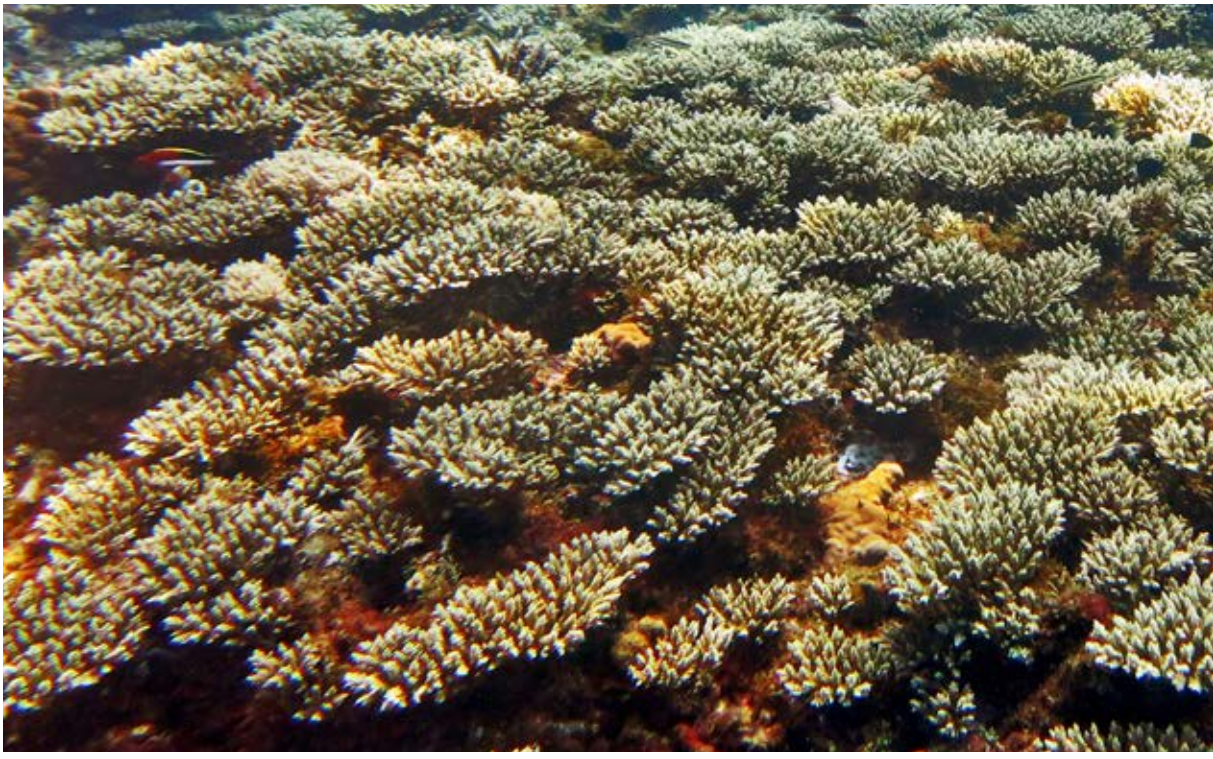
MPA design and implementation in Indonesia is mainly used to conserve coral reefs and coastal habitat. Destructive and illegal harvesting of reef fish, endangered species and other resources are common throughout Indonesia. MPAs reduce the threat from such illegal harvesting. MPAs also create the enabling conditions for sustainable industries such as tourism,

sustainable fisheries and aquaculture. The principles of 'resilient MPA' design, and TNC's experience in MPA design are elaborated on in chapter 2. A resilient MPA considers biophysical and socioeconomic principles in the design and management. Biophysical principles take key biological and physical processes into account. Socioeconomic principles consider local communities and sustainable industries. Chapter 2 will provide the reasons for TNC's motivation for scaling up individual MPAs to become resilient MPA networks.

NGOs are increasingly integrating Marine Conservation Agreements (MCAs) into ocean and coastal protection efforts. The reason is that decades of programs have proved that the creation of formal protected areas may not be sufficient to protect ocean and coastal biodiversity, particularly in areas where rights have already been granted to specific owners and users. MCAs can be defined as any formal or informal contractual arrangement concerning ocean or coastal conservation where one or more parties (usually rights-holders) voluntarily commit to refraining from certain actions, or transferring certain rights and responsibilities in exchange for economic incentives from conservation or other outside organizations. In chapter 4, TNC experiences in facilitating MCA together with the partners, are elaborated.■



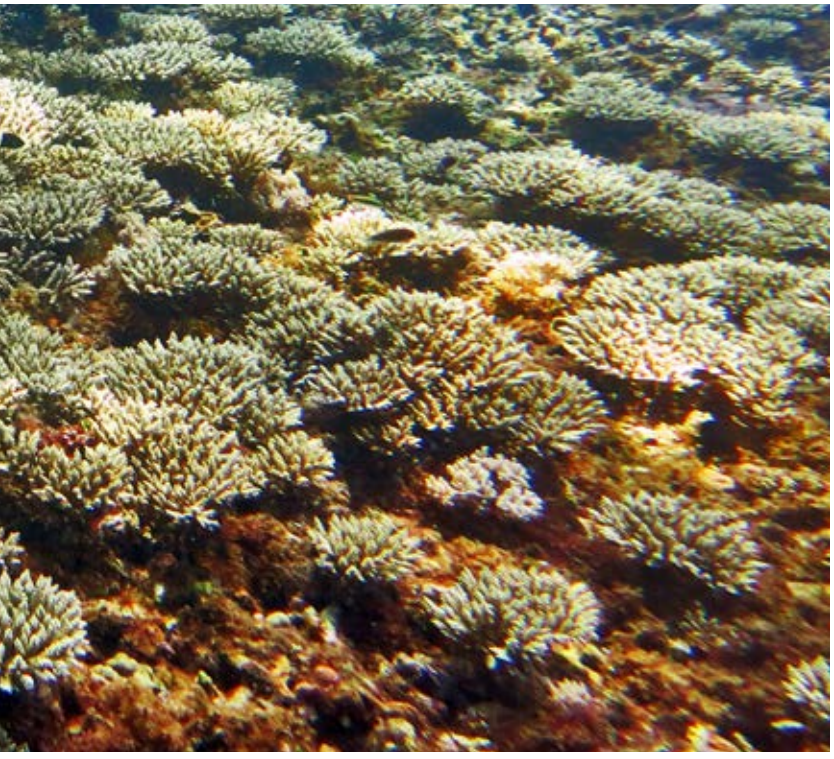
II.
EVOLUTION OF THE RESILIENT MPA NETWORK DESIGN IN LESSER SUNDA ECOREGION



II.
EVOLUTION OF THE RESILIENT MPA NETWORK DESIGN IN LESSER SUNDA ECOREGION

The Indonesian-Philippines archipelago is considered as a biodiversity hotspot given its high number of fish species. In August 2007, President Yudhoyono of Indonesia proposed a new, six-nation Coral Triangle Initiative (CTI), as a mechanism to conserve key components of this global center of coral reef diversity. At the CTI Summit in May of 2009, political commitments were made to coral reefs and marine conservation.

The Coral Triangle, its ecoregions and functional seascapes were delineated based on the best available biological and physical information at the time. The defined area became a focus of conservation planning. The advice of 30 international and local scientists, managers and conservationists was gathered through workshops. This included world experts on corals, reef fishes and other invertebrates. The workshop participants agreed to use coral reef fish as the basis for delineating the ecoregions of the Coral Triangle. There was already a large volume of high quality data on the species diversity at many locations within the Coral Triangle. Meanwhile the datasets available for other endemic species groups were smaller (Green & Mous, 2008). Eleven ecoregions were delineated and nominated for ecoregional conservation



The area has

244

turtle nesting sites identified,

44

manta aggregations,

196

transient fish spawning aggregations,

6 mi.

hectares of cetacean migration corridors.

assessments to identify priority areas for conservation. The Lesser Sunda Ecoregion (LSE) is one of the eleven ecoregions selected. The Lesser Sunda Ecoregion is fascinating from a physical oceanography and ecology perspective. Complex currents and waters with a steep temperature gradient ring the 1,056 islands of the region. The area also has 244 turtle nesting sites, 44 manta aggregations, 196 transient fish spawning aggregations, 6 million hectares of cetacean migration corridors, as well as reefs resilient to climate change related heat stress and coral bleaching.

The Nature Conservancy sets its conservation priorities at an ecoregional level (typically covering one to ten million hectares, containing a geographically distinct assemblage of species, natural communities, and environmental conditions). Functional seascapes are smaller areas (generally 100,000 to one million hectares) nested within ecoregions, where connectivity within functional seascapes is higher than connectivity with surrounding areas. Given their smaller size and higher degree of connectivity, functional seascapes provide a practical unit for marine conservation, allowing for the design and implementation of resilient networks of Marine Protected Areas (MPAs). ■

II.1 INITIAL DESIGN OF RESILIENT MPA NETWORK IN LESSER SUNDA ECOREGION

Despite the ecological importance of the LSE discussed in Chapter I, local reefs and their associated ecosystems have long been threatened by destructive fishing, overfishing, pollution and coastal development. These threats are in addition to the impacts of climate change such as increased sea surface temperature, sea level rise, extreme weather and ocean acidification. Thus, creating networks of marine protected areas (MPAs) is a key to improving the 'resilience' of these ecosystems to climate change impacts. The first steps toward such an MPA network are the identification and protection of areas most resilient to climate change. For example, this would include reefs with a demonstrated resistance to heat stress; or reefs that recover quickly from heat stress related coral bleaching. Once the features are identified, they need to be protected by reducing the number of local anthropogenic threats.

Consistent with Kelleher (1999 in IUCN, 2010) definition for protected areas, an MPA is defined as 'any area of intertidal or sub-tidal 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.' This definition encom-

passes a wide variety of MPAs, including no-take areas. It also includes a wide variety of governance types for protected areas, ranging from statutory to community-managed areas (IUCN, 2010). In Indonesia, MPAs can be established by national and provincial governments under either Fisheries Law No 45/2009 or the Management of Coastal Zone and Small Islands Law No 1/2014. These laws allow an MPA to be zoned and managed for multiple uses. A single MPA could have no-go, no-take and sustainable use zones.

The design process for LSE's MPA network was first initiated in 2009, following a detailed scientific assessment and an extensive stakeholder consultation process. This process included the development of a GIS database of best available information that identified key conservation features, threats and uses of the area. Specific biophysical design principles were also developed and used during the process. These are laid out in Table 2.1 (Wilson et al., 2011). The aim is to create a list of objectives that take key biological and physical process into account. ■

TABLE 2.1
BIOPHYSICAL MPA DESIGN PRINCIPLES FOR SHALLOW COASTAL AREAS AND DEEP SEA NEAR SHORES AREAS

DESIGN CRITERIA	APPLICATION
Risk Spreading (representation and replication)	Conserve 20-40% of shallow marine and coastal habitats (coral reefs, mangroves, seagrass and estuaries) and where possible, include community type within these habitats types (e.g., coral reef zones). Aim to include at least three representative examples of each habitat type in different locations, distributed over a large area to reduce the risk that the sites would be negatively impacted by a single environmental or anthropogenic event simultaneously.
Resilience to Climate Change	Incorporate sites that are more likely to be resistant or resilient to global environmental change. Areas that may be naturally more resistant or resilient to coral bleaching include: • Habitats that regularly experience high temperature variability. • Areas that experience upwelling and strong currents. • Areas that are shaded by coastal vegetation or cliffs. • Areas of high diversity and coral cover.
Protecting Key Sites and Species	Include special and unique sites such as: • Permanent or transient aggregations of species of economic importance (fish and invertebrates). • Important migratory, breeding, resting and feeding areas for large and vulnerable species. • Areas that support endemic species.
Connectivity within and among MPAs	Aim to include areas that contain a combination of shallow water habitat types (coral reefs, mangroves, estuaries and seagrass) to maintain ecological patterns of connectivity among them. Aim for MPAs to be spaced 100-200 km apart to maintain genetic connectivity. Within MPAs, space no take zones 15-20 km apart to maintain ecological connectivity.
Protecting Deep Sea yet nearshore Habitats	Critical habitat for oceanic cetaceans and other species, including seamounts, deep-water canyons, straits (migratory corridors), and large persistent pelagic habitats (e.g., upwellings). Select deep-water areas adjacent to important conservation areas in shallow water.

An important aspect of MPA design and implementation is the conservation of coral reefs and coastal habitats not only for their biodiversity value but also sustainable resource use for the benefit of local people. About 11,740,457 people live in coastal villages of the Lesser Sunda (BPS, 2014). Some of these people rely heavily on fishery resources as a source of daily protein and cash income. Therefore, it is important that MPAs accommodate sustainable fisheries for local communities and support increased fisheries productivity by improving or maintaining healthy, diverse coastal ecosystems. Besides fisheries, the ecosystems are also important for local culture and eco-tourism and were considered in MPA design, as listed in Table 2.2 (Wilson et al., 2011). These principles aim to maximize benefits and minimize costs to local communities and sustainable industries. During our analysis of the MPA network design using the Marxan decision support software, the principles were included as a 'cost' layer. The 'cost' layer for LSE was based on socio-economic factors that affect the conservation value of a MPA, such as shipping lanes, areas affected by blast fishing, areas affected by fishing using poisons, areas where corals were harvested from the wild and seaweed culture areas. ■

TABLE 2.2
SOCIO-ECONOMIC MPA DESIGN PRINCIPLES FOR SHALLOW COASTAL AREAS

DESIGN CRITERIA	APPLICATION
General	Allow for multiple activities, including sustainable fishing, tourism, aquaculture, education and research. Minimize negative impacts on existing livelihood strategies and maximize opportunities for alternative incomes.
Cultural	Respect local and traditional marine resource use and access. Recognize that local communities play an important role in decision-making and may be custodians over marine resources. Protect areas of cultural importance.
Fisheries	Recognize that MPAs can support sustainable subsistence and artisanal fisheries and sustainable commercial/industrial fisheries. Aim to maximize benefits to these fisheries through protection of fisheries habitat, spawning aggregations and creation of 'fish banks'. Protect areas and habitats that are important for all life history stages of commercially important fish species and their prey such as spawning grounds, nursery and juvenile habitats. Recognize that MPAs may provide resources for management (e.g., patrols for illegal fishing), where possible, benefits should be shared among local communities.
Nature-Based Tourism	Include nature-based tourism areas in, or close to, MPAs where tourism objectives are consistent with the objectives of the MPA (e.g., diving and whale watching) to provide income to local communities.
Infrastructure and Industry	Consider costs and benefits of placing MPAs near major towns and cities. Accommodate existing and planned shipping lanes and port infrastructure (wharves, channels). Avoid placing MPAs near existing and planned marine mining, oil and gas industries or near areas affected by runoff from land-based mine tailing disposal.
Effective Management	Consider existing and future patterns of resource use to reduce conflict among existing resource users. Consider opportunities for co-management with local communities, traditional leaders, stakeholders and relevant government agencies, that may strengthen broader management strategies to address overfishing and land-based threats that originate from outside the MPAs.

The use of Marxan, a computer based software program developed to aid in the design of protected areas and the networks, allowed the quick generation of alternative scenarios for MPA network design. Marxan uses GIS format spatial data to analyze the distribution of conservation targets and cost layers. Each conservation target used in the Marxan analysis was assigned a goal. Goals varied depending on the design criteria (Tables 2.1 and 2.2), the extent and distribution of each conservation feature and the importance or rarity of the target. ■

The design in 2011 used the following conservation targets:

30% of each shallow marine habitat (coral reefs, mangroves, seagrass and estuaries) and its sub-class.

80% of special and unique areas including confirmed turtle nesting and feeding areas and spawning aggregation sites for fish and shrimp.

5% of large scale persistent pelagic habitats (e.g., upwelling), satellite islands, straits.

5-80% known distribution of cetaceans and dugongs in shallow coastal waters.

50% of areas known to be important for dolphins (identified from expert mapping).

5% of areas identified as important to seabirds.

100% of small areas identified as important habitat for rare and/or endangered species such as Napoleon Wrasses and sharks.

80% of dive sites, since they are likely to be in coral reef areas that are still in good condition (although this still needs to be confirmed).

The existing and proposed MPAs in the region, including the 3.35 million hectares Savu Sea Marine National Park, were incorporated in the design. The MPA network design was based on a gap analysis that included the 37 existing and 19 proposed MPAs and 44 Areas of Interest (AOIs). AOIs are potential MPA sites in the future. The final design includes 100 protected areas covering 9.79 million ha (Figure 2.1). This acreage includes 85 shallow marine and coastal reserves; 2 million hectares of MPAs for coral reefs, mangroves and seagrass; the 3.35 million hectares Savu Sea MPA which includes both shallow coastal and deep sea habitats; and 14 larger offshore MPAs, covering 4.2 million hectares, with deep sea and nearshore habitat. Deep sea habitats are an important feature in the LSE and a unique feature of this MPA network because most other ecoregional plans and MPA network designs only encompass coastal nearshore habitats (Wilson et al., 2011). ■

"Deep sea habitats are an important feature in the LSE and a unique feature of this MPA network."

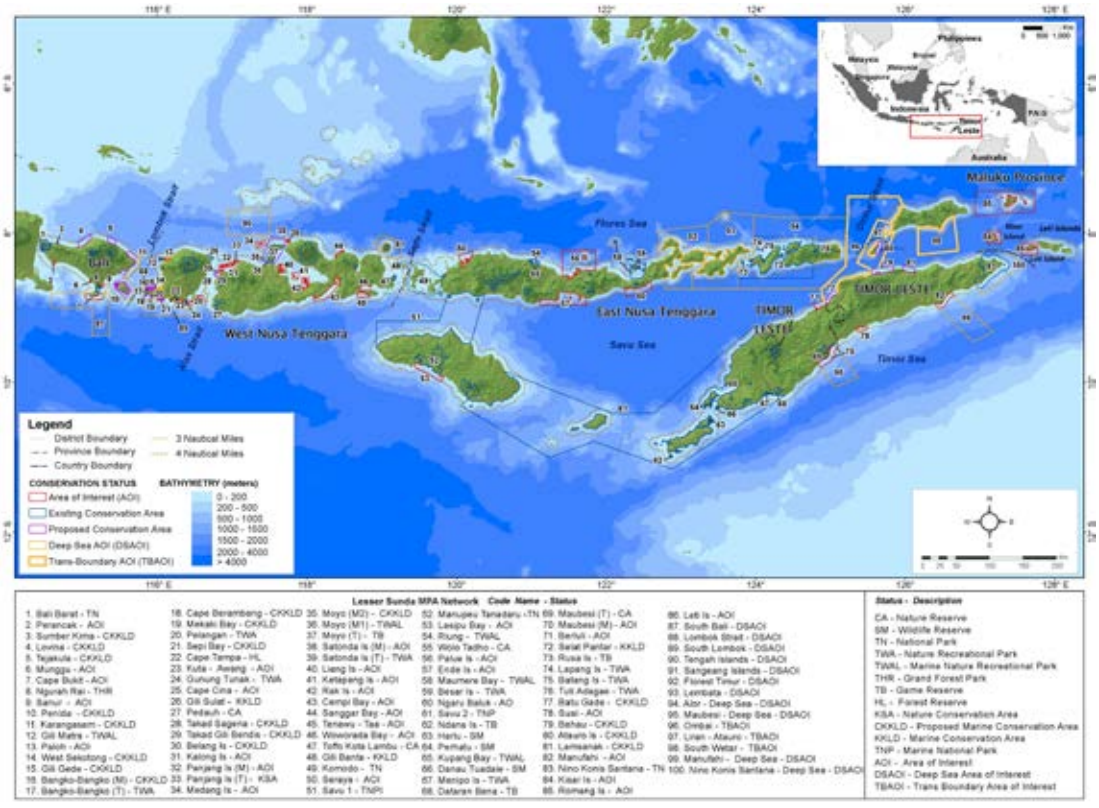


FIGURE 2.1
2011 Lesser Sunda MPA network with names and designations for all MPAs and AOIs.

The 2011 design of the Lesser Sunda MPA network and the accompanying information database were excellent resources for national, provincial and district government agencies to guide their coastal and marine planning in the Lesser Sunda Ecoregion. The 2011 design accommodated inputs from over 300 individual experts and stakeholders. These inputs boosted the likelihood of relevant government agencies implementing the MPA zoning plan. The various inputs also ensured there were no conflicts between the MPA network and existing spatial plans. The Ministry of Marine Affairs and Fisheries (MMAF) has already agreed to adopt the design as the primary reference or 'roadmap' for establishing MPAs in Lesser Sunda and will include the design in marine and coastal spatial planning at district, provincial and national levels.

It is important to note that the MPA network design identified in 2011 represents the views of scientists and key stakeholders, based on best available information at that time. The design was expected to meet resilient MPA design criteria while minimizing impact to local communities and other stakeholders. However, there has been no ground validation of the design. So the design will likely change following new field assessments or more detailed discussions with governments, local communities and other stakeholders. ■

II.2
REFINING THE 2011 MPA NETWORK DESIGN

More thorough data collection and analysis was needed to update the data for the 2011 design of Lesser Sunda Ecoregion MPA network. Several activities were carried out to gather the information (Figure 2.2). First, better imagery was acquired. Then there was participatory mapping and in-depth study of cetaceans. The gathered information was incorporated into the biophysical and socio-economic principles for the updated MPA network design. A revised habitat/coastal ecosystem map was derived from RapidEye imagery (2014) with 5 m resolution. Six classes of benthic habitat were recorded, namely live coral, dead coral, rubble, sand, macro alga and sea grass. The imagery was much more accurate than the former Landsat analysis that can only identify coral and seagrass ecosystem. In 2016, the analysis was also validated by ground-truth surveys implemented by the University of Gajah Mada. ■

PICTURE 1 & 2
Site visit, introducing one self, and explaining the purposes of the visit

PICTURE 3 & 4
Filling in the questionnaire

PICTURE 5 & 6
Drawing the spatial information from the respondents (fishermen)

FIGURE 2.2
1-6, Participatory mapping steps

Participatory mapping was conducted between June and December of 2015. The site visits, analysis of respondents' questionnaires and digitation of ground truthing activities provi-ded extensive, updated information on socio-economic data, resource uses, and threats in the ecoregion. TNC, in collaboration with East Nusa Tenggara UNICONSUFISH (a consortium of 6 universities for Sustainable Fisheries initiated by TNC) and additional 2 universities from Bali and West Nusa Tenggara, mapped 153 coastal villages in 36 out of LSE's 42 districts. The data collected on resource use during the participatory mapping process is presented in Table 2.3. The participatory mapping of coastal and marine resources shows mangrove logging to be the most pervasive threat. It occurred in 17 out of 36 districts surveyed. Coral reef destruction, through bombing and harvesting, was the second most pervasive threat. Cetacean studies provided information on migratory corridors (Figure 2.3 and Figure 2.4). The socio-economic and biophysical data gathered during the assessments informed conservation targets through a Marxan analysis. ■

TABLE 2.3
DATA CATEGORIES FOR RESOURCE USES RESULTING FROM PARTICIPATORY MAPPING (Meryanto et al., 2015)

FISHING	AQUACULTURE	TOURISM	MARINE MAMMAL SIGHTING	TURTLE NEST	FISH SPAWNING AGGREGATIONS
Area	Area	Area	Area	Area	Area
Distance	Scope	Size	Movement Direction	Number of eggs	Size
Season	Model/ technique	Types	Types	Types	Types
Period	Organism	Earnings	Period	Period	
Gear (type and size)	Production	Contributions	Season		Number of spawning aggregation
Fleet (type, size, docking)	Waste disposal				

FIGURE 2.3
Tail of sperm whale (picture on the left)and mix of melonheaded whale, spinner and fraser dolphins observed during cetacean monitoring in Lesser Sunda Ecoregion.

FIGURE 2.4
Map of sightings and the directions of movements of whales in Lesser Sunda Ecoregion to be incorporated for the analysis

II.2.1 THE UPDATED MPA NETWORKS DESIGN

The refining and analysis of updated data resulted in 77 MPA networks covering 7,56 million hectares (Figure 2.5). Fourteen of them are Areas of Interest (AOI). Thirty-five are existing MPAs. Twenty-eight are proposed MPAs (Table 2.4). In this book, AOIs are referred as potential MPA network sites based on the analysis. Whereas existing MPAs are area that have been formally established as MPAs by Ministerial Decree, and proposed MPAs are area that haven't been gazette through Ministerial Decree.

Out of 14 AOIs in the updated design, nine are new. The older five AOIs are in Bali (Melaya Extend), NTB (Mangsit, Tatar Sepang) and NTT (Tarimbang and northern part of Wetar). The MPA network changed between 2011 and 2017. In 2017, sixteen AOIs changed their status into proposed MPA. By 2017, the proposed Nusa Penida MPA got legal recognition into existing MPA. We also found errors in the previous 2011 design. Satonda MPA was misclassified as an AOI in 2011 even though the area had been established as a protected area by Ministerial Decree in 2009 (SK 598/Menhut-II/2009). It is now classified as existing MPA in 2017 design. Also Batuidu MPA in Rote reverted to an AOI in 2017 because the area was omitted from the Savu Sea Marine National Park area (Hultera et al., 2017). ■

TABLE 2.4
THE UPDATED, 2017 MPA NETWORK DESIGN

STATUS	AREA (ha)	NUMBER OF SITES	REMARKS
AOI	247,154	14	Include 2 TB-DS (Transboundary Deep Sea) AOI P Liran & S Wetar
Proposed	2,935,187	28	Include 4 DS AOI & 1 TB-DS AOI
Existing	4,381,601	35	
Total	7,563,942	77	

Of the 77 MPAs in the 2017 updated design, 69 are shallow marine MPAs/AOIs. The 3.35 million hectares Savu Sea MNP includes both shallow coastal and deep sea habitats. There are also seven deep sea MPAs/AOIs, three of which are trans-boundary MPAs/AOIs. Deep sea habitat is critical for local marine mammal diversity.

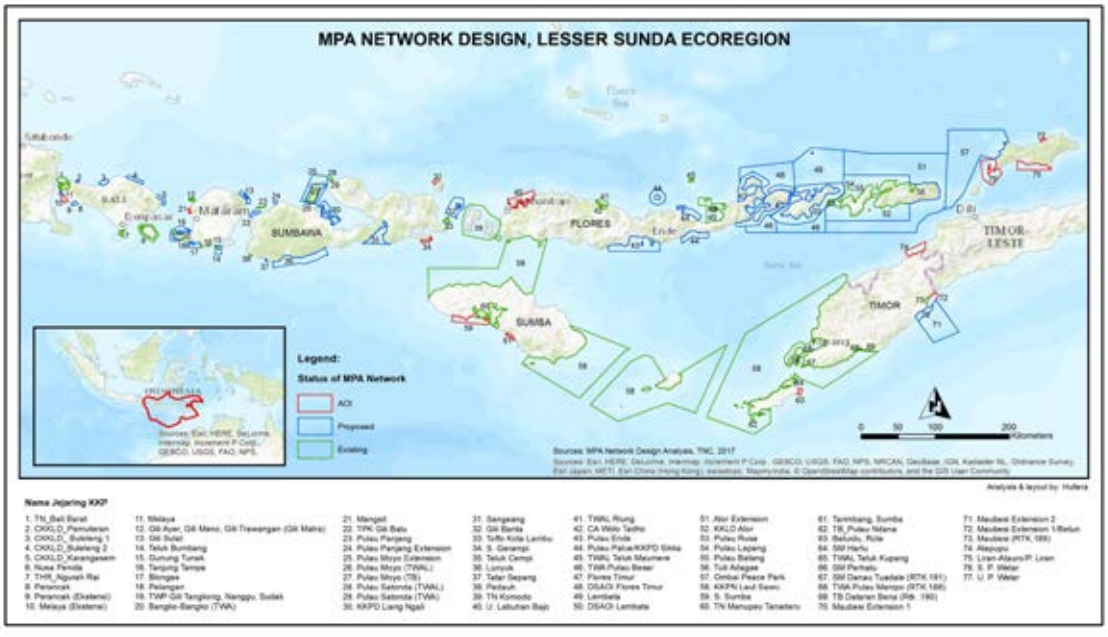


FIGURE 2.5
The refined MPAs network design in 2017

Fishing boats parking at the beach located in Yeh Sumbul Village, Jembrana, Bali

Mining of sea sand and gravel by fisherwomen in the beach of Ketewel Village, Gianyar, Bali

This updated design shows a 23% decrease in the number and area of MPAs in the network from the Wilson design (Wilson et al., 2011). The total area of the MPA Network in LSE in 2011 design was about 9.79 million ha. The design finalized in 2017 was 7.56 million hectares. This happened because the 2017 design uses the Ministry of Environment and Forestry (MoEF)'s delineation of LSE boundaries, which encompasses the waters of West and East Nusa Tenggara.

Seaweed seed being prepared at Labuhan Kertasari Village, Sumbawa Barat, WNT

Harbor at Wonreli Village, Kisar Island, Maluku Barat Daya

FIGURE 2.6
Samples of marine and coastal resources uses in Lesser Sunda Ecoregion

Thus, an area of 865 thousand ha incorporated during 2011 analysis is omitted in the 2017 design including 2 AOIs in Maluku Province, and 9 AOIs in Timor Leste. Additionally, 900 thousand hectares of deep sea AOIs in Bali and NTB (the Lombok Strait, Southern of Bali, Southern of Lombok, Northern of Sumba) were included in the 2011 design but omitted in the 2017 design. They are some of the busiest maritime highways in Indonesia. Pushing forward with the conversion of such AOIs into MPAs could lead to conflict between diverse interest of marine users (Figure 2.6). Another reason is because there are revision to AOIs' size due to better information or due to the Decree of Ministerial or Governor.

The 2017 design uses the same conservation targets as the 2011 design, however the percentages are based on more information thanks to groundtruthing. There is no change in conservation targets for turtle nesting areas, feeding areas, aggregation sites, pelagic habitats, important bird areas and dive sites. However, percentages for four other targets are modified for different reasons as seen in the notes in Table 2.5. All these conservation targets are relatively fulfilled through this 2017 Marxan analysis.

TABLE 2.5
DIFFERENCES OF CONSERVATION TARGETS PERCENTAGES IN DESIGN 2011 AND 2017

CONSERVATION TARGETS	PERCENTAGES IN DESIGN		NOTES
	2011	2017	
Shallow marine habitat (coral reefs, mangroves, seagrass and estuaries) and its sub-class.	30	30-40	Through better data and information from reef ecosystem assessment and data imagery, higher percentage (40%) is emphasized on hard live coral, indicating better condition of corals.
Whale and dugongs in shallow coastal waters.	80	65	Higher percentage of this target will lead only to conservation of deep sea. Better data from cetacean study showing the distribution of whale and dugong, important corridors and the whale's migration routes are the basic consideration of this new percentage.
Areas known to be important for dolphins.	50	5-10	Higher percentage of this target will lead only to conservation of deep sea. Better data from cetacean study showing the distribution of dolphins is the basic consideration of this new percentage.
Small areas identified as important habitat for rare and/or endangered species such as mola-mola, manta rays and sharks.	100	30	The more updated studies provide more information on these species' distribution.
Dive sites	80	30	Better data on coral reef condition based on spatial imagery provides more information on general condition of dive sites and becomes the basic consideration of the new target.

TNC has played a leadership role in developing and applying design principles to ensure that MPA networks are resilient to the threat of climate change. The updated 2017 design also incorporates result from a surface sea temperature study carried out by TNC in 2015. The study identified coral reefs that may be resilient to climate change. Areas of low and high historical exposure were identified based on historical temperature data. An area is categorized as low historical exposure if the thermal stress events are <3 events (1985-2012) and has low past rates of temperature increase (<0.1 °C/decade). Whereas it is categorized as high historical exposure if the thermal stress events are >6 events (1985-2012) and has high past rates of temperature increase (>0.3 °C/decade). However, past temperature patterns may not be indicative of future patterns, so areas with lower projected future exposure to thermal stress (<13 events 2040-2060) were also identified using dynamical climate model downscaling. The result showed 26% have lower projected future exposure, 8% have low historical exposure and 4% have high historical exposure as laid out in the map (Figure 2.7).

The 2017 MPA network design covers 48% area of the low and high historical exposures as well the low projected future exposures as seen in Table 2.6. The inclusion of high historical exposures areas (7%) into MPA network design will help conserving proven resilient coral reefs. Whereas the inclusion of lower projected future exposure (35%), the areas with good mixing, upwelling and currents, into MPA network design will ensure the availability of coral refugee. This coral refugee can act as coral larval stocks for adjacent areas that might be prone to thermal stress thus enabling a resilient MPA network design. ■

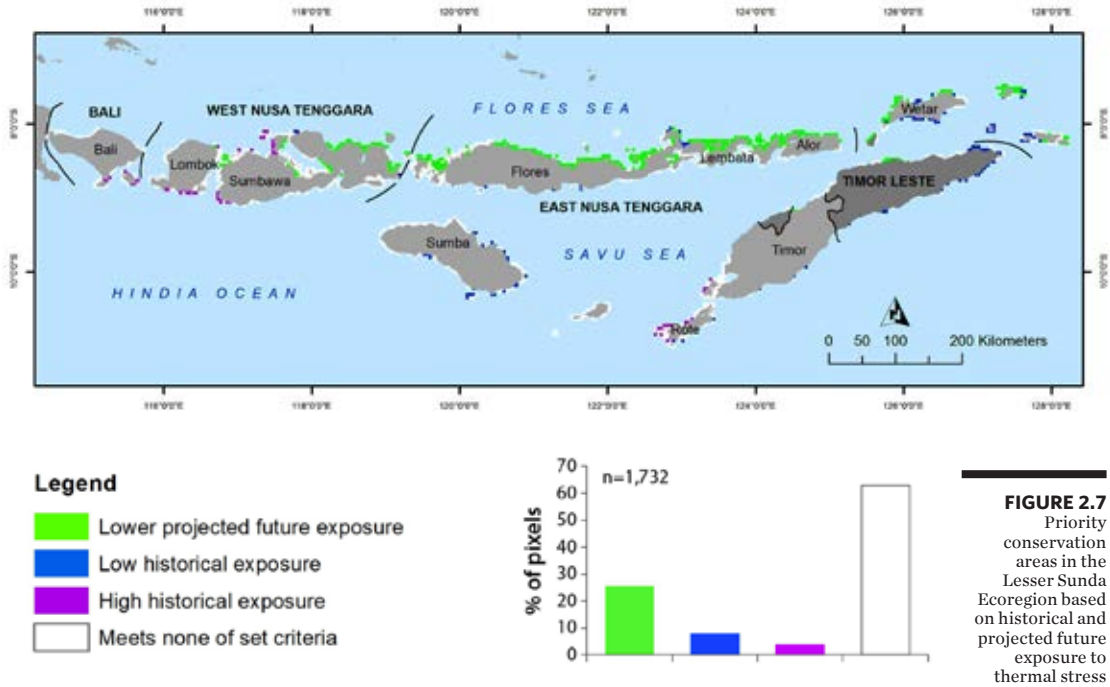


FIGURE 2.7
Priority conservation areas in the Lesser Sunda Ecoregion based on historical and projected future exposure to thermal stress

TABLE 2.6
PERCENTAGE OF THE UPDATED 2017 MPA NETWORK WITHIN THE PRIORITY CONSERVATION AREA BASED ON SURFACE SEA TEMPERATURE STUDY

% OF AREA COVERED	LOWER PROJECTED FUTURE EXPOSURE (GREEN)	LOW HISTORICAL EXPOSURE (BLUE)	HIGH HISTORICAL EXPOSURE (PURPLE)
AOI	1.6	2.8	0.4
Existing MPA	28.5	3.7	5.0
Proposed MPA	4.9	0.9	0.5
Total	35	7.4	5.9

FIGURE 2.8
The flagship species of Nusa Penida, sunfish.

II.2.2 SOUND BASIS FOR MPA DECISION MAKING

Scientific studies can support decision-making. Better scientific information and evidence-based data can lead to better decisions and policies. TNC has supported the government by supplying information for the establishment of MPAs. TNC understands that the sustainability of the MPAs depends on the capacity of managers and stakeholders' sense of ownership and willingness to co-manage.

In Bali province, TNC was a long-time advocate of making the Nusa Penida waters an MPA. TNC has been conducting scientific studies to support this status since 2009. In 2014, the 20,000 hectares area was finally established an MPA after issuance of Decree of MMAF No. 24/KEPMEN-KP/2014 on Marine Conservation Area of Nusa Penida, Klungkung District. This came after years of collaboration between the Coral Triangle Center, the local government and the MMAF. The diverse area is a home for the ocean sunfish or mola mola and two species of turtles (green and hawksbill), dugong, dolphins, manta rays and swathes of healthy seagrass, coral reefs and mangroves. The Fisheries Minister, Sharif C. Sutardjo, mentioned that the establishment of the Nusa Penida MPA was evidence of the local government's commitment to conservation.

In 2014, during the project under BMUB support (2012-2017), there was a change in law regulating district resources. The Law No. 23/2014 on Local Government transferred management authority of Marine, Coasts and Small Islands Conservation Area from the district to the provincial government. TNC along with Wildlife Conservation Society-Indonesia, as the partner of the program in the province of West Nusa Tenggara, and the districts and provincial Marine and Fisheries Offices worked together to ensure West Nusa Tenggara's marine protected areas transitioned smoothly through this legal upheaval. Through a series of consultations and workshops, nine MPAs decreed by the local district heads were adopted and adapted by NTB Province.

These nine MPAs are the Marine Parks of Gili Sulat-Gili Lawang, Gili Tangkong-Nanggu-Sudak, Bumbang Bay, Gili Banta, Liang-Ngali, the turtle nesting site Lunyuk, the Marine Reserve of Cempi Bay, the small island park of Kramat-Bedil-Temudong and Gili Balu small island park-Tatar turtle nesting site. In 2016, all nine of these NTB areas, covering an area of 229 thousand hectares, were designated MPAs by the Decree of Governor No. 523-505. Eight MPAs were designated by Decree of Governor. However, Bumbang Marine Park decreased in size from 22,940 hectares to 6,310 hectares, securing the area of lobster spawning area. In 2016, five of the nine areas were zoned thanks to the Decree of Governor No. 5231-972. The five zoned areas included Gili Sulat-Gili Lawang marine park, Gili Tangkong-Nanggu-Sudak marine park, Gili Balu-Tatar park, Kramat-Bedil-Temudong park, and a nesting site of Lunyuk. Zoning and management plans are required before the establishment of an MPA. The decrees that have been issued by the provincial government show that NTB is committed to conserving its waters, coasts and small islands.

FIGURE 2.9
Coordination meeting on marine resource management of West Nusa Tenggara.

In addition to supporting the central government in the establishment of the Savu Sea MNP in East Nusa Tenggara, TNC has also worked closely with the local and central government (Directorate of Marine Spatial Planning, MMAF) to develop zoning plans (RZWP3K). As the result of our analysis, species migration areas for the RZWP3K was improved by new data on cetacean migratory corridors and the conservation areas for the RZWP3K are improved by our proposals for AOIs. They all feed into the zoning plan for ENT province and act as a model for other provinces to follow. To avoid bycatch of cetaceans, for example, the local government issued a bylaw banning long lines and gillnets in the fishing zones that overlap with cetacean corridors.

Between March and July of 2016, during the process of ENT coastal and small islands zoning plan development, TNC together with the Marine Conservation Council (DKP), local and central government conducted a consultative process to resolve marine spatial use conflicts. The meetings were attended by the head of each institution interested in marine spatial use. This included the institutes of the Marine Transport agency, BKPPN (National Agency for Marine Conservation Areas), BBKSDA ENT (Natural Resources Conservation Agencies) and ENT Province Fisheries Agency. The meetings resolved conflict over the marine boundaries on Savu Sea MNP with Kupang Bay Marine Tourism Park. The overlapping 8,000 hectares were transferred to Savu Sea MNP for management. The core zones of Pantar Strait Nature Reserve and in East Flores Fisheries Nature Reserve were moved because they overlapped with maritime highways. The aquaculture zone of both reserves was also reduced to maintain the size of the MPA area. ■

III.
SAVU SEA

The combination of strong currents and steep underwater cliffs in Savu Sea transports cold water and upwelling to local coral. This creates a consistently cool environment despite periods of increased surface water temperatures. It also creates productive marine habitats that can support large populations of fish, and artisanal and commercial fisheries. The Savu Sea is a resilient tropical marine ecosystem. It is able to adapt to the impacts of climate change. If properly managed, the Savu Sea could become a refuge for coral reefs, large marine life and productive fisheries in the face of emerging threats such as climate change.

With 22 cetacean species recorded (Kahn & Fajariyanto, 2017), the Savu Sea – located in the southern part of Coral Triangle – is recognized as a corridor for migrating cetaceans and turtles. The area has many deep ocean trenches, creating the conditions for highly productive waters suitable as nurseries and feeding grounds for these species. The Savu Sea is also an important resource for the 22 districts of the East Nusa Tenggara region. Sixty five percent of East Nusa Tenggara regional fisheries production comes from the Savu Sea, according to the Ministry of Marine Affairs and Fisheries. ■

III.1
SUPPORT THE ESTABLISHMENT OF SAVU SEA MARINE NATIONAL PARK

Given the importance of regional fisheries and diverse marine habitat and species, the provincial government supported the development of the Savu Sea Marine Protected Area. Formally establishing a Marine Protected Area (MPA) in Indonesia involves various steps. The proposed MPA area must be designated. Then a management and zoning plan is drafted, and boundaries delineated. Following this, there are public consultations. Lastly, a ministerial decree is written recognizing the proposed area as a protected area.

Savu Sea marine national park was launched during the Manado World Ocean Conference in 13 May 2009, through the Indonesia Ministry of Marine Affairs and Fisheries Ministerial Decree No. Kep.38/MEN/2009 on Reservation of Savu Sea National Marine Park and Surrounding water in East Nusa Tenggara. The vision of the Savu Sea MPA is to protect biodiversity to maintain the livelihood and culture of the coastal communities and help local coral resilience in three management areas – Pantar strait Marine Protected Area, Sumba Strait Marine Area and TIROSA-BATEK Marine Area.

The Nature Conservancy (TNC) and partners have supported the Savu Sea Marine Protected Area development since 2009. This climate resilient MPA and its associated district level network of areas are managed for the preservation of biodiversity under threat from climate change. In 2001, the Indonesian Ministry of Marine Affairs and Fisheries carried out a feasibility analysis for a marine national park in the Savu Sea. The analysis led to the decision to develop a network of two interconnected MPAs. The ministry invited The Nature Conservancy to participate in the design and implementation of this MPA network.

Encompassing an area of 3.5 million ha, the network of MPAs in the Savu Sea is part of a lar-ger network of MPAs across the more than 62.5 million ha of the Lesser Sunda seascape. The network includes the 5.7 million ha of Sumba Strait and its surrounding; and the 2.95 million ha Sabu-Timor-Batek. Pantar straits and its surrounding waters, which was originally part of Savu Sea MPA design, was instead preserved by the Alor district government in March 2009 as a 4 million ha district MPA. These interlinked protected areas will hopefully increase the likelihood that local reefs survive catastrophic events, such as bleaching that could destroy entire reef ecosystems.

TNC assisted a working team formalized under East Nusa Tenggara Governor Decree (PPPP KKP Laut Sawu) to assess, design and establish the Savu Sea MPA. Through The Nature Conservancy's 10-step Conservation Action Planning

FIGURE 3.1
Conservation Action Plan introducing zoning to inform the development of Savu Sea MPA (CAP Report, 2010)

(CAP) process, the team found that some local sea turtle and cetacean species require specific management actions to avoid becoming endangered. The CAP exercise also further identified critical threats to the Savu Sea MPA. Multiple threats can impede conservation targets. We ranked the main threats for each conservation target in the Savu Sea: (1) the pervasive threats of sea level rise, heat stress, and plastic disposal; (2) localized threats of fishing practices, loss of habitats, sedimentation and run-off; and (3) threats such as ship strike, noise pollutions, target and by-catch that affect sensitive species.

The CAP processes also provided management strategies for the Savu Sea MPA. Introducing zoning was listed as a main strategy for addressing conservation threats (Figure 3.1). Zoning would help integrate The Nature Conservancy resilience model for coral reefs, as all types of reefs are protected as no-take areas across the MPA. Zoning restricted activities, thereby reducing the majority of threats identified. Zoning also took into consideration management of exceptional cetacean populations. In addition to the zoning scheme, there were management actions such as fishing gear restrictions, seasonal closure (during whale migration), fishing practices (especially tuna fisheries) and codes of conduct. ■

III.1.1 ASSESSMENTS TO INFORM ADAPTIVE MANAGEMENT ACTIONS

Series of scientific surveys were required to establish the Savu Sea national marine park. These surveys looked at key biodiversity features and their threats to inform management actions such as the finalization of the zoning plan, identification of priority areas and seasons for patrolling. The surveys also identified enabling conditions for conservation. These studies, together with the management plan, were used to identify priority conservation actions.

Longline and gillnet fishing often incidentally take non-target species in bycatch. Longlining is done on open oceans. Miles of line are hung with thousands of baited hooks. A single long line can have more than 2,500 hooks. Gillnets are staked to the ocean floor and can trap many animals unintentionally. Longline and gillnet are categorized as a destructive fishing practices (Meryanto et al., 2017) as these practices entangle and kill thousands of non-target organisms. Marine mammals like whales and small cetaceans can get trapped on longlines. Over the past twenty years, an estimated 300,000 marine mammals were lost in bycatch (www.environmentalscience.org). Regulating the use of gillnets and longlines will improve the conservation status of cetaceans and sea turtles. We supported BKKPN Kupang in assessing gillnet and longline fishing practices in Savu Sea. Statistical data shows that the use of longlines and gillnets is considerably high in East Nusa Tenggara, reaching 5% and 20% respectively. Therefore, this assessment was designed to understand the use and socio-ecological impacts of fishing gears within the cetacean migratory corridor. We used descriptive research and participatory mapping to analyze the socio-ecological impacts of longline and gillnet fisheries (Fajariyanto & Darmawan, 2017). Among 50 study sites within Savu Sea MPA, we found that Rote is a favored fishing ground. There are 19 fishing spots around Rote, most of which are located within traditional sustainable fisheries zones (Figure 3.2), in the shallow waters near coasts, coastal shelves, and bays. We found that half of the region's entanglements occurred near East Sumba, Rote and Kupang. This confirmed that entanglement incidents are more likely in fishing zones.

"Over the past twenty years, an estimated 300,000 marine mammals were lost in bycatch." -www.environmentalscience.org

FIGURE 3.2
Fishermen using pole and line to catch mackerel, a friendly fishing gear for the cetacean (Kahn, 2013)

The study found that entanglement incidents affected dolphins, turtles, mantas, dugongs, sharks and whale sharks. Out of a total of 191 incidents reported, there were no instances of whale bycatch. At 80% of total bycatch, shark, manta ray and turtles were found to be the most likely non-target animals caught. The study also identified seasonal trends in bycatch. Dugongs were more likely to be found in nets or on lines between March and December, with a peak season in April. Meanwhile whale sharks were mostly caught between January and March, and between May and November.

Seventy-nine respondents from 45 villages in 29 sub-districts within Savu Sea MPA reported whales and dolphins' sightings. Though the TNC team spotted cetaceans throughout the MPA region, over half of the sightings were from around Rote, Sabu Raijua, East Sumba and Kupang. Whale and dolphin sightings occurred mostly in September and October. Most of the whales we sighted were heading east. A small percentage was found heading south and north also. Each group had two to ten individuals. There were no clear trends in our dolphin sightings.

The study concluded with two regulatory recommendations. Researchers suggest only allowing 10 to 30 gigaton GT boats in fisheries management areas (WPP) 573, which includes East Nusa Tenggara waters. They also suggested that the provincial government be given management authority over shipping lines up to 12 nautical miles from the coast. In 2012, TNC recorded 283 fisheries permits for 10 – 30 GT boats, 71 of which were local. These numbers indicated that boats larger than 30GT were responsible for entanglement incidents in Savu Sea MPA. East Nusa Tenggara provincial government is expected to review permits for boats operating in Savu Sea waters.

We also supported Savu Sea management authority and the Indonesian navy in 949 nautical miles of cetacean monitoring in October of 2013. This was over the course of 169.5 daytime visual assessment hours including 21.3 hours of boat-based behavioral observation. Species identification was obtained and photographed for further analysis to highlight distinctive, colorations, marks or scars. Observers also categorized behavior for each animal sighting, recording whether the animal was feeding, resting, bow riding, avoiding the vessel. Sea surface time and dive duration were also noted whenever possible.

The route was designed to include the maximum habitat diversity within the Savu Sea MPA. The route cut through coastal, oceanic and straits habitats in – the Flores-Sumba, Savu-Rote, and the north and south coasts of Timor. We counted an estimated total of 1,595 individual cetaceans from 10 whales and dolphin species during 39 sightings in the field.

Blue whales, sperm whales and humpback whales, toothed whales and dolphins, baleen whales were sighted. No dugongs were observed during the monitoring. Spinner and spotted dolphins and remarkably blue whales made up 60% of our sightings. We also recorded observed inter-species pods.

Spinner dolphins, common bottlenose dolphins, spotted dolphins and pilot whales sometimes swim with larger whales. These associations are not well understood. TNC is curious if associations indicate preferred cetacean habitat. Of interest was the sighting of blue whales (Figure 3.3). These baleen whales are rarely encountered on surveys in East Indonesia (Kahn & Fajariyanto, 2017). Yet the TNC team recorded five separate blue whale sightings between the Savu Islands and northwest Timor. In fact, blue whales ranked as the third most sighted cetacean in this highly diverse area. Such abundance is confirmation of the Savu Sea's critical role as a migratory corridor for earth's largest and endangered creature (Kahn & Fajariyanto, 2017).

Visual surveys were complimented by data from acoustic

"We counted an estimated total of 1,595 individual cetaceans from 10 whales and dolphin species during 39 sightings in the field."

FIGURE 3.3
Sighting of Blue Whales – one of important findings from the cetacean monitoring (Kahn, 2013)

listening stations. The listening stations helped to locate large cetaceans including sperm whales, pilot whales and other deep-diving oceanic cetaceans (Figure 3.4). We calculated a total acoustic coverage of 455 square kilometers for sperm whales and 97 square kilometers for small odontocetes. Cetacean sounds were recorded at 20% of all listening stations. Sperm whales were heard at 12.5 % of the stations. The highly distinctive vocalizations of sperm whale bulls were heard at one listening station.

FIGURE 3.4
Listening Station with Hydrophone to help locate large cetaceans.

They were detected together with the regular clicks from nursery schools of adult females and immature whales of both genders. Visual contact with sperm whale in low latitudes strongly indicate that the deep waters of Savu Sea are a tropical breeding ground for this species (Kahn & Fajariyanto, 2017).

During this cetacean monitoring, all sightings of seabird flocks encountered during daylight hours were recorded. This activity was integrated with the cetacean sighting efforts. A total of 15 seabird species were observed, including several rare, migrant species. Overall, 142 separate seabird flocks were recorded with an estimated count of 3,346 individual seabirds. These observations revealed that there was a high level of both seabird species diversity and overall abundance. For each encounter, sighting conditions, distance between the bird and the boat, the sea birds' behavior and whether the flocks were mixed species were recorded. (Kahn & Fajariyanto, 2017) noted this was one of the first combined cetacean and the significant biodiversity seabird monitoring expeditions in South East Asia.

The ecological results of the cetacean monitoring trips formed the basis for at least six high priority conservation areas (Figure 3.5). The identification of these six high priority areas later provided the premise for establishing the Savu Sea National Marine Park (Table3.1). The scientific observations were also useful for the development of zoning and management plans, particularly the development of the MPAs'core zones. ■

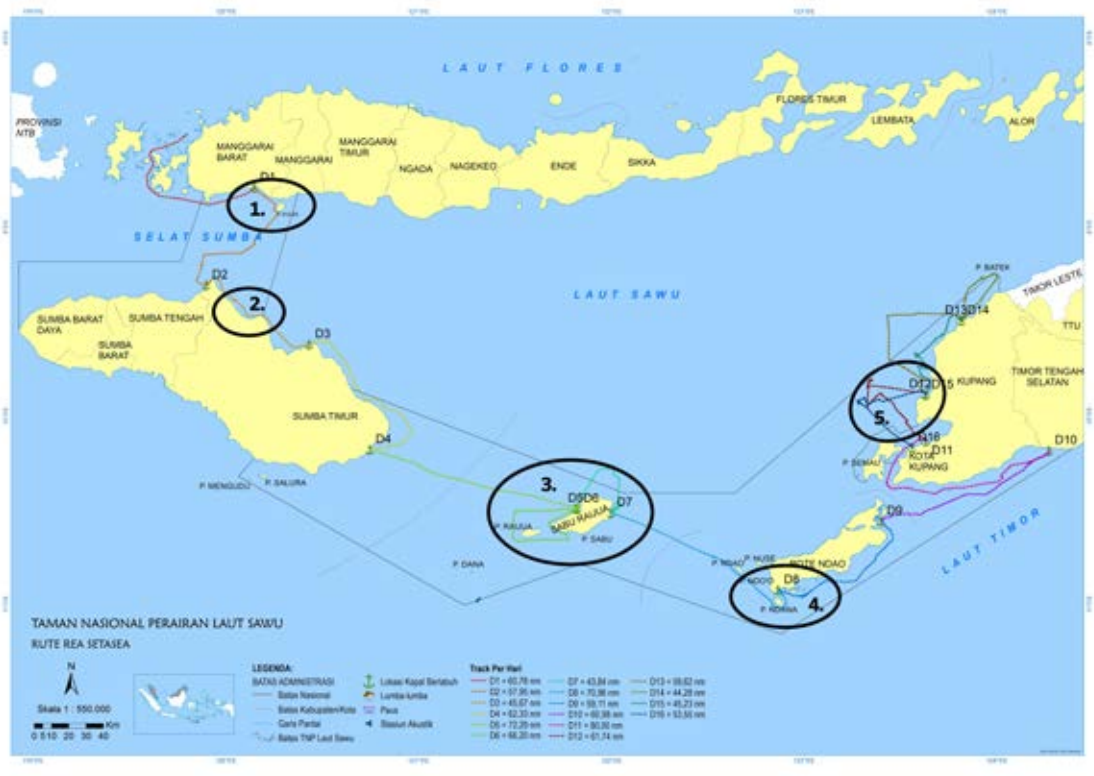


FIGURE 3.5
High priority areas for conservation to inform Savu Sea Zoning Plan Design (Kahn, 2013)

TABLE 3.1
HIGH PRIORITY AREAS FOR CONSERVATION TO INFORM SAVU SEA ZONING AND MANAGEMENT PLAN DESIGN (KAHN, 2013)

AREA	DESCRIPTION	CONSERVATION FOCUS
① **Nanglele Bay, South West Flores**	High abundance of seabirds, productive waters, exceptionally scenic landscapes (rice terraces, rainforest mountains along the coast with white sandy beaches, Pulau Mules or Toren Island).	Seabirds, high tourism potential, wwcoastal productivity (baitfish).
② **Tanjung Batu Ata, E Sumba**	High abundance of seabirds, multiple tern species resting on sand spits, extensive mangroves and white beaches, productive waters, exceptionally scenic landscapes incl. traditional houses and coastal villages.	Seabirds, high tourism potential.
③ **Savu and Rai Juwa**	High cetacean diversity and abundance, incl. blue and humpback whales, oceanic dolphins and billfish relatively abundant, local traditional coastal communities with marine mammal usage (dugong).	Cetaceans, including blue and humpback whales, highly productive coastal waters (baitfish fishery).
④ **South West Rote**	High cetacean diversity, high diversity and abundance of seabirds, including foraging areas for multiple tern, booby and frigate bird species, productive waters, relatively abundant bill fish, sea snakes and sea turtles, scenic complex of coastal bays and rocky islands, white sandy beaches.	Cetaceans, seabirds, high tourism potential, coastal productivity (baitfish).
⑤ **North Semau – South West Timor (Kupang Corridor)**	Offshore area with high abundance of blue and sperm whales (including highy migratory bulls and residential female groups), high diversity and abundance of sea birds, coastal and oceanic dolphins and scenic bays of Barate and Naiklui.	Cetaceans, seabirds, high tourism potential.

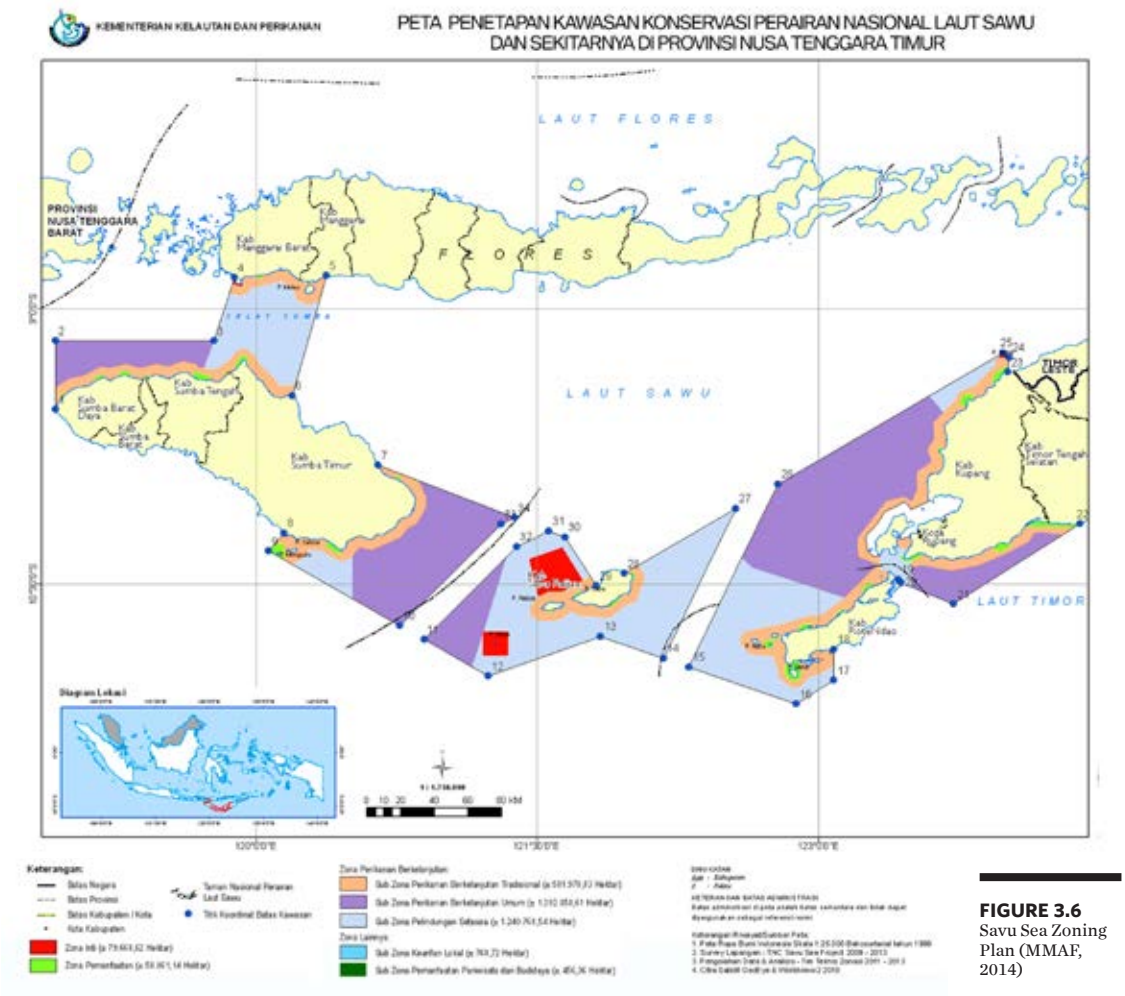


FIGURE 3.6
Savu Sea Zoning Plan (MMAF, 2014)

III.1.2 SUPPORTING THE DEVELOPMENT OF SAVU SEA MANAGEMENT AND ZONING PLAN

Following the Ministerial Decree of Ministry of Marine Affairs and Fisheries No.30/2010 on MPA management and zoning plan, we supported the Savu Sea Marine National Park authority in the development of their management and zoning plan. Fifty layers of data on biophysical, socio-economic, and resilience conditions were analyzed in the Savu Sea zoning design. We applied MARXAN – a decision support tool that suggests zoning options for biodiversity conservation – to minimize costs. We set coastal areas less than 200 meters with 500 square meters for each planning unit as the main target for this analysis and produced 14,815 planning units for the whole Savu Sea marine national park. For the unit hierarchy analysis, we divided Savu Sea into 7 units, namely South Flores, North Sumba,

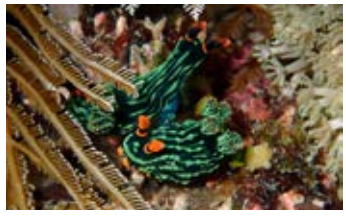
East Sumba, Sabu Raijua, Rote Ndao, Timor Tengah Selatan, and North Kupang.

Socio-economic data played a major part in setting the cost layer. We set 3 (low); 6 (medium) and 9 (high) respectively in scoring negative impacts to conservation from cost layer themes – aquaculture, coral mining, marine transportation, former blast fishing areas, sand mining, mangrove logging, fishing with poison, and angling. For the percentage number in conservation, we set 10% for shallow habitat; 33% for nesting areas; 20% for crocodile habitat; 25% for spawning and dugong habitat; 5% for highly pelagic areas, satellite islands and straits; 5% cetacean distribution and corridors; and 5% for sharks and manta rays. Enabling conditions for conservation were also inputted: local wisdom area, navy/police/DKP/enforcer post, mystic area, champions of local conservation, no-take tourism area, and a pearl farm. We selected no take areas and protected areas for lock in areas. The Marxan analysis resulted in three management scenarios and identified 63 areas with high conservation values, in 7 stratifications, based on geographical factors and ecosystem connectivity.

The finalized Savu Sea plan consists of four types of zoning: namely a core zone, a sustainable fisheries zone, a marine tourism zone; and others zone. The others zone is further divided into areas for traditional use, cetaceans and cultural/tourism (Figure 3.6). Core zone can only be used for research and education. These zones were envisioned for the full protection of habitat and fish population, as well as unique or vulnerable coastal ecosystems. Normally, MPA core zones have fairly intact ecosystem conditions ('good' ecological conditions) and few human visitors ('low utilization'). The core zone that includes Dana island, Batek island, Tanjung Keritamese, Tanambas, and North Raijua island's water makes up 2.34% of total area Savu Sea marine national park or 79.679.04 hectares.

If there is not a large enough area of healthy habitat (ideally two percent of the entire MPA), no-take zones – a marine tourism zone – are designated instead. The no-take zones are limited to tourism activities, with restrictions on the number of visitors. No fishing activity is allowed in this zone, unless catch and release sport fishing. This zone is also design for ecosystem restoration and rehabilitation activities. There are 79.7 thousand hectares of no-take zone between the Sabu-Timor-Batek and Rote island MPAs covering 61 villages that makes up 1.81% of the entire MPA.

One interesting element of Savu Sea zoning process was the creation of others zones. Customary *adat* practices such as the once a year community collection of coral for lime used in betel nut consumption can occur in the 'others' zone. The other customary practice protected in this zone is 'Lilifuk' in Kupang. Lilifuk is a large tide pool area managed



by Baineo community. It is only open for fishing once every six months. Penalties are applied who violate this rule. The sub traditional use zone covers 4 villages and makes up 0.02% of the entire MPA. The sub-cetacean zone and part of others zones cover the western part of Rote and Sabu Raijua waters; southern part of East Sumba; strait between Rote and West Kupang; northern part of Kupang; and Sumba strait. The sub-cetacean zones make up 1.3 million hectares or 37.61% of the entire MPA. The sub-cetacean zone marks a bold regional commitment to protecting the Savu Sea flagship species. Apart from the zoning system designed, the Savu Sea management plan also regulates cetacean conservation in all zones and subzones. For example, boats must maintain a minimum distance of 100 meters from whales, and 50 meters for dolphins.

In the sustainable fisheries zone, fish can be caught using environmentally friendly methods and tools. The sustainable fisheries zone was intended to maintain the habitat of local fish. Small and artisanal scale fishermen are allowed to fish commercially without permits. As are fisher groups equipped with modest structures or businesses. Mariculture and seaweed cultivation is also allowed in this zone without permits. Meanwhile, 30 GT boats in the 'sub-general' are allowed in part of this zone. As are traditional 5GT boats. The management authority is mandatory to do monitoring and coaching to ensure its sustainability and effective management of the park. The total area for sub-general and traditional sustainable fisheries zones are 1,333,659.76 hectares (39% of the entire MPA) and 650,980.31 hectares (19% of the entire MPA). ■

III.1.3 CONSULTATIVE PROCESS FOR DEVELOPMENT OF SAVU SEA MANAGEMENT AND ZONING PLAN

District, province, and national-level government offices were consulted about the Savu Sea management plan and zoning plan. A series of consultations were hosted in 10 districts within Savu Sea MPA from 28 March – 5 April 2012. Ten district governments announced their support for the Savu Sea MPA during these consultations. The consultations also provided an opportunity to discuss the capture fisheries permitting system shared between local and central governments. All parties - the local government, park management authority, the Ministry of Marine Affairs and Fisheries - agreed that permitting should be managed by the provincial government.

Another result of the consultation was the decision to carry out further analysis on suitable fishing fleets capacity currently plying the sub-general sustainable fisheries zones, traditional sustainable fisheries zones and cetacean protection zones. This recommendation laid the foundation for longline and gillnet assessments outlined in the previous section. Ministry of Marine Affairs and Fisheries Decree No. 30/2010 offers general guidance on capture fisheries activities. The consultative process also highlighted the need for village-level dialog before the marine park was mapped. Districts that needed particular attention were included West Manggarai (South Lembor sub-district); Rote Ndao (West Rote sub district); Sabu Raijua (Raijua sub district); as well as East Sumba covering Wulla Waijelu, Pahunga Lodu, and Karera sub district. The plans were reviewed through public meetings in 94 villages involving over 1,000 participants between 15 June and 10 October of 2012 and 2013. Notable recommendation during the consultative process was the support from local community on the initiative to establish Savu Sea MPA. However, the community wished that fishers outside the area be required to obtain permits from the village government in order to fish in traditional sustainable fisheries zones.

There was also a unique recommendation from the community in Sabu Raijua. They asked to continue harvest coral once every year for 'Keruga,' or lime for the local betel nut delicacy. This request was later integrated into the management plan. The once-a-year collection of coral lime stone was deemed possible for subsistence, not commercial purposes. Also recorded during the consultations was the communities' desire to develop village ordinances and/or *adat* regulations for utilization zones. In Rote Ndao, local regulations kept the community active in protecting the utilization zones. In Raijua, the village ordinances were prioritized for the areas of Panadahi, Watu Ari, Peluru Ruju, and Habbi Pikka Enyu. These marine conservation agreements are more elaborated in Chapter 4.

The Ministry of Marine Affairs and Fisheries was also consulted in 2013. We recorded there are at least five versions of the zoning plan due to the presence of national shipping lanes within the marine protected areas around Sabu Raijua and Rote Ndao. The Indonesian Archipelagic Sea Lane (ALKI) determines the placement–Indonesia shipping lanes is axis lines that function as lines to provide guidance for shipping transiting archipelagic waters. Thus, ALKI has no dimension (length or width) and cannot be addressed specifically as zone. Based on International Maritime Organization (IMO) SN/Circ. 200 in 1998 and Indonesian regulation, ALKI has 40,2336 km buffers on the outer limits of axis lines and where an island borders the sea lane, ships in ALKI Passage may not navigate closer to the coast than 10% of the distance between the nearest point on the island and the axis line of the sea lane.

The Indonesian navy supported this statement following meetings in 2012. Representatives from the navy considered the Savu Sea MPA shipping corridors strategic. The Ministry of Marine Affairs and Fisheries decided to remove the corridors from the zoning design. The ministry did not want overlapping zoning plans, which might lead to conflict between user groups. The discussion also happened for Rote Ndao and Sabu Raijua districts. The original design referred to whole districts within the Savu Sea MPA. Ministry of Marine Affairs and Fisheries decided to remove partially coverage of Rote and Raijua islands in Savu Sea MPA.

The consultative meetings were very dynamic. There were no winners or losers in the process. We learnt how to listen, accept and deal with other interests. Adjustments made to the Savu Sea zoning plan based on suggestions are as follows:

1. The Pantar straits Marine Protected Area, with a total area of 9,9 million acres, was delisted from Savu Sea Marine Protected Areas after consulting communities on Alor Island.
2. Northern Sabu Raijua and Southern Rote Ndao were removed from the original design based on consultative processes and decision from Ministry of Marine Affairs and Fisheries in 2014.
3. High conservation value areas were adjusted from 63 areas to 19 areas.
4. Shipping lanes (ALKI) were removed from the original design, on the advice of Ministry of Marine Affairs and Fisheries in 2014.
5. The cumulative adjustments reduced the coverage of Savu Sea MPA network from 3,5 million ha to 3.35 million ha. ■

III.2
PROMOTING EFFECTIVE AND EQUITABLE GOVERNANCE OF SAVU SEA MARINE NATIONAL PARK

Savu Sea Marine National Park is the largest marine protected area in the Coral Triangle. Spanning over 3.35 million ha, the Savu Sea MNP encompasses 10 districts and 195 villages. If properly managed, the Savu Sea could become a refuge for coral reefs, large marine life and economically important fisheries from emerging threats such as climate change. However, managing such large protected areas can be very challenging. There are a number of interests and government offices to navigate. Plus, a balance must be struck between conserving natural resources and equitable economic development. It was crucial to have a collaborative mechanism among various stakeholders as the Savu Sea conservation work spans many districts, government agencies and other stakeholders.

East Nusa Tenggara Governor formalized a special task force composing multiple stakeholders from national and local governments, coastal communities, the private sector and the scientific community in June 2009. The taskforce, known locally as PPPP KKP Laut Sawu, designed and established the Savu Sea marine protected areas. PPPP KKP Laut Sawu will continue in its task to ensure effective and equitable governance of Savu Sea marine national park from a field management unit (Kantor Balai Kawasan

Konservasi Perairan Nasional) established in Kupang by the Ministry of Marine Affairs and Fisheries.

TNC facilitated the formation of P4KKP (Team for Assessment, Establishment and Management of Savu Sea National Marine Park) – a multi-stakeholder team for the preparation and establishment of the Savu Sea national marine park. This team was formally recognized by the provincial government in 2013 as a Marine Conservation Council (DKPP) with 35 representatives from various agencies. The DKPP manages the national marine park and coordinates marine conservation development programs for the province (Figure 3.7). The establishment of the East Nusa Tenggara Marine Conservation Council (DKPP) also created an opportunity for wider engagement of the key national and sub-national stakeholders prior to park development. DKPP brought together over 1,000 people to discuss the development of Savu Sea management plan and zoning. This was perhaps Indonesia's largest and most varied involvement of stakeholders in a single decision-making process concerning natural resource

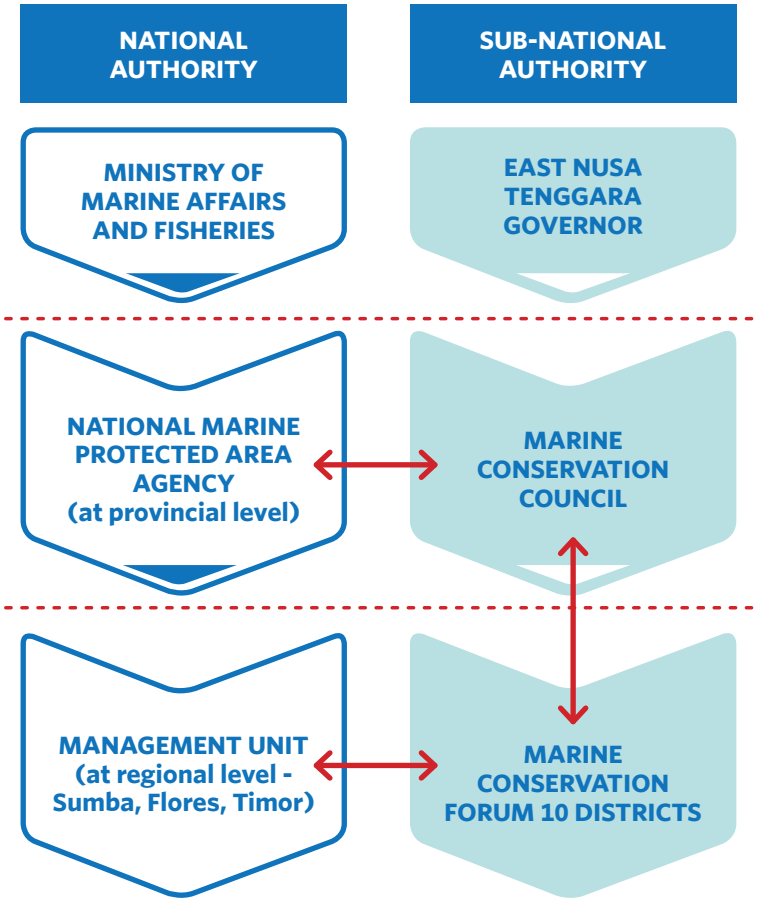


FIGURE 3.7
Sharing Governance towards effective management of Savu Sea Marine National Park (Ninef and Tanody, 2009)

"TNC facilitated the formation of P4KKP – a multi-stakeholder team for the preparation and establishment of the Savu Sea national marine park."

management. It marked East Nusa Tenggara Marine Conservation Council as a force for a more inclusive, transparent and accountable decision-making.

DKPP continued a series of consultative processes even after the park was established. Government agencies in East Nusa Tenggara, local universities and park management were conferred before management decisions were made. This consultative process helped DKPP identify activities and budget in government or organization working units that could be put towards research, patrolling, law enforcement, conservation actions and community development in the Savu Sea NMP. The capacity of DKPP has continued to improve as indicated by the establishment of marine conservation forums in 10 districts within Savu Sea, representing various stake-holders including community leaders, civil society organizations and government agencies. These forums will improve the flow of communication and coordination between agencies and stakeholders. Technical support was also provided to facilitate high-level discussion at the national level that promoted the collaborative mechanism efforts in the park. Village-level consultations were conducted in 10 districts following the establishment of conservation forums. The consultations, which ran in 20 villages in designated no-take areas, produced key management recommendations. As a result of these consultations, patrolling posts were set up in no-take areas. Village regulations were developed to ensure the compliance of management and zoning plan. Community surveillance groups were set up. The consultations also provided opportunities to conduct awareness and livelihood programs for the community. These recommendations were passed on to BKKPN Kupang, the management authority for Savu Sea.

DKPP made sure there was no conflict between the Savu Sea zoning plan and provincial land-use planning or coastal zoning. We provided technical assistance with a zoning analysis that refined the East Nusa Tenggara provincial zoning plan and the zoning for five districts, namely Sumba Tengah, Sumba Timur, Sikka and Rote Ndao. The provision identified and resolved the conflict of boundaries between Savu Sea NMP and Teluk Kupang nature tourism park. Furthermore, the work resolved conflict of uses between provincial shipping lines and the core zones of two recently established MPAs in Alor and Flores Timur.

Promoting effective and equitable governance of Savu Sea Marine National Park takes at least one lifetime. The collaborative mechanism began in 2006, long before the marine national park was established. The commitment and support of political leaders is necessary to ensure the collaborative mechanism continues. Political leaders can play a major role in accessing bureaucracies and ensuring sustainable financing. Collaborative mechanism results in a continuous problem-solving process. Collaborative mechanism invites debate, joint learning and problem-solving networks. ■

IV. COMMUNITY ENGAGEMENT

To establish an MPA is one thing, and to manage the MPA is another. TNC believes that collaboration is the core of effective MPA management. Government Regulation No. 60 of 2007 on the Conservation of Fisheries Resource mandates a partnership approach in the management of MPAs. Article 18, paragraph I of the regulation states that national or local government agencies must involve communities in the management of MPAs through partnerships between organizational unit managers and community groups and/or indigenous peoples, non-governmental organizations, corporations, research institutions or universities. In 2014, this regulation was amended to say indigenous people can determine the utilization of local coastal and small islands' resources on their own (Government Regulation No. 1 of 2014 on the Management of Coasts and Small Islands, Article 21, paragraph 1).

During the establishment of Savu Sea MNP, TNC in collaboration with Marine Conservation Council (DKPP) and the National Agency for Marine Protected Areas (BKKPN) Kupang hosted public consultations in 94 villages on Sumba, Rote and Timor islands. Communities are vital stakeholders in MPA management. This is why TNC engaged and invested in communities during its work in Lesser Sunda. Consultations and socialization activities with key-stakeholders were conducted at the district and community level to foster wider acceptance in management and zoning plans. The public was consulted before TNC finalized its management plan. Such engagement ensures long-term viability of the marine national park, and guarantees that the management and zoning plan benefits local people, local government and other stakeholders. Public consultation also makes decision-making more inclusive, transparent and accountable. TNC undertook similar steps on a smaller scale for the establishment of the Pantar and Nusa Penida MPAs.

A frequent concern voiced by local people is that they will lose access to an area once it is proclaimed a protected area. The result of perception monitoring

carried out by DKPP and TNC between October to December of 2015 showed that 69 percent of respondents did not understand new zoning plans and therefore were unclear that fishing was allowed in certain parts of the newly designated protected areas. The respondents who lived in 36 coastal villages within the Savu Sea MNP cited the importance of both coral reef and mang-rove ecosystems. The people interviewed were also aware of how healthy ecosystems resulted in fish abundance and protection from coastal erosion. About 81% of the respondents agreed that law enforcement and fishing regulations protected ecosystems. The result of the survey showed a good social capital for the sustainable management of Savu Sea MNP and the importance of routine socialization on zoning (DKPP, 2016b). ■

"Communities are vital stakeholders in MPA management. This is why TNC engaged and invested in communities during its work in Lesser Sunda."

IV.1 WORKING THROUGH PARTNERS

After the establishment of Savu Sea MNP, TNC, in collaboration with East Nusa Tenggara Marine Conservation Council (DKPP), conducted a 3-month-long survey to evaluate stakeholders' perceptions on the natural resource management in ten districts within the MNP. The survey, involving 1,138 respondents, showed that: [1] 84% of respondents were well informed about the MPA although many still did not understand the MPA's zoning; [2] 56% of respondents agreed to comply with a zoning plan that protected marine and coastal resources; and [3] 80% of respondents understood the need for forbidding

a better understanding of the homegrown context and how to convey conservation messages to locals. The partnership also provided an opportunity to train local NGOs in financial management and project cycle management. Some of the local NGOs are unfamiliar with environmental conservation. So engaging them provided an opportunity to improve their understanding of MPAs, management and conservation values. Eleven villages and three nusak (ex-local kingdom areas) were chosen as pilot sites. The villages were selected based on a set of indicators, which included proximity to the park's core zone, and whether the village threatened the MNP's conservation targets or would be impacted by management and zoning.

destructive fishing gears and practices within the MPA. The practices banned include trawling; the harvesting of turtles, coral and clams; reef gleaning (Makameting) which destroys coral; the use of tubes, compressors, cyanide and explosives; sand mining and chopping mangroves (DKPP, 2016a; Meryanto et al., 2015).

To engange the people and explore the economic benefits of the Marine National Park, TNC partnered with ten local NGOs in the ten districts within the Savu Sea MNP (see Table 4.1). The NGOS were selected because they are local and therefore have

TABLE 4.1
THE WORK OF COMMUNITY AND LOCAL NGOs TO SUPPORT MPA MANAGEMENT

LOCAL NGO	SITE	DIMENSION OF THE WORK		
		POLICY AND GOVERNANCE	ECONOMIC	SOCIAL AND GOVERNANCE
Yakines	Nanga Bere, Flores ENT	The enactment of local wisdom "Nempung Cama Riang Tacik" by the Vice Head of District of West Manggarai on Aug 2016 to manage marine resources.	The formation of Saving and Loan Group Initiation of organic coastal farming as alternative livelihood.	The establishment of Coastal Monitoring Adat Group "Ponggawa Riang Tacik" who also planted mangrove and ketapang tree along the coasts.
Yayasan Tunas Jaya	Sataruwuk, Flores ENT	The enactment of village regulation no 04/ 2016 based on local wisdom "Lontoleok" on Oct 2016 to manage the village as tourism site and coastal conservation.	Initiation of alternative livelihood from processed sea food into snacks and tourism activities, including handwoven clothes. The formation of Saving and Loan Group with a capital of 100 million rupiah per 2016.	The establishment of Marine Conservation Group "Lonto Tacik"
Yayasan Pengembangan Swadaya Masyarakat Ie Hari Sabu Raijua	Eilogo and Waduwalla, Sabu Raijua, ENT	Declaration of Adat Agreement based on local wisdom "Kapue Murimada Dapeloro " on the Conservation of Coastals and Marine Resources in Adat Region of Liae, Sabu Raijua District on Aug 2016	Processing of seaweed into snacks and jam by women group. Tourism business. Development of craft for souvenirs and tourism potential map.	The establishment of Tourism Group "Jaga Dahi". The establishment of woman coastal microbusiness group Jagga Hari.
Yayasan Tananua	Napu, Sumba ENT	The enactment of village regulation No. 3 of 2016 based on local wisdom to manage coastal and marine	The formation of Saving and Loan Group of Larawali Coastal People	The establishment of Marine Conservation Adat Group "Pengawas Adat Pantai Napu".
Yayasan Wahana Komunikasi Wanita	Tanambanas, Wendewa Utara, Sumba ENT	Adat agreement of Tanambanas to protect mangrove and turtle and to set up a closure zone. Village Regulation No. 5 of 2016 on Sustainable Marine Utilization in Wendewa Utara.	The development of ecotourism village of Tanambanas Barat through seaweed and souvenir business The development of shredded fish business (Wendewa)	The establishment of Marine Conservation Group "Nelayan Bijak Wendewa" and coastal women group. And marine tourism group in Tanambanas
Yayasan Bahtera	Lokory, Sumba ENT	The enactment of village regulation No. 3 of 2016 based on local wisdom "Weri" to manage coastal and marine	The development of local food and souvenir business	The establishment of Lokory Marine Conservation Group

LOCAL NGO	SITE	DIMENSION OF THE WORK		
		POLICY AND GOVERNANCE	ECONOMIC	SOCIAL AND GOVERNANCE
Yayasan Kasimo	Karoso, Sumba ENT	The enactment of village regulation No 5/2016 to manage coastal and marine – village ordinance.	The development of local food and souvenir business by the coastal women group	The establishment of Karoso Coastal Conservation Group.
Yayasan Sanggar Suara Perempuan	Tuafanu TTS - ENT	Multi-party agreement of stakeholders and government in three villages (Tuafanu,Kiufatu and Toineke) to manage coastal and protect turtle as conservation, ecotourism object.	The development of souvenir business by the coastal women group.	The establishment of Turtle Conservation Group.
Bengkel Advokasi Pemberdayaan dan Pengembangan Kampung NTT	Lifuleo, Kupang-ENT	The development of a working group to review the medium-term development plan of the village (RPJMDes) towards a tourism village. The enactment of village regulation No 4/2016 on eco, conservation tourism and no. 3/2017 on retribution of the tourist area. The letter of designation to manage a plot of land as tourism site from the village government.	The development of local food and souvenir business to support ecotourism village.	The establishment of tourism group and a Board of tourism and it is inaugurated by the Provincial Government through a Decree.
ForKom Tokoh Adat Peduli Budaya Rote Ndao	Nusak Termanu, Rote, NTT Nusak Dengka, Rote, NTT Nusak Landu, Rote, NTT	The development of customary regulation "Hoholok/Papadak to manage and protect coastal and marine to 3 Nusak (ex-Local Kingdom) level.		The establishment of Marine Watch Group of Manaholo.

SOURCE
(Final Report of NGO Monitoring & Evaluation, TNC, 2016)

Communities were engaged during rural appraisals. The information gathered became the basis for a two-year program (2015-2016) for community empowerment and sustainable livelihood. Most of the economic initiatives were in collaboration with village women groups. Local women were coached in food processing, weaving, community-based tourism (Figure 4.1 A, B). A series of awareness-building activities were conducted at the village level to promote conservation agreements (Figure 4.2). All ten local partners assisted in the establishment of local groups and helped formalize local wisdom into regulations (Table 4.1). ■

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FIGURE 4.1
Ⓐ Women groups producing snacks and Ⓑ weaving for additional income.

FIGURE 4.2
The people in Lonto Leok attending the awareness-raising activities.

FIGURE 4.3
The representative of mone ama (adat figures) reading the adat agreement of "Kapue Murimada Dapeloro " in Liae, Sabu Raijua District on August 2016.

IV.2 CUSTOMARY PRACTICES

Local taboos or customary regulations sometimes regulate the management of natural resources for the conservation of the species and habitat, and the welfare of the people. TNC found some traditional resource management systems in Lesser Sunda when working with the DKPP. In the Maluku islands, there is *sasi* (closure system). In Bali and West Nusa Tenggara, there is *awig-awig*. In Kupang and Rote Ndao districts, *Lilifuk* (large tide pools in Baineo dialect) is managed with a closure time. People can only harvest in *Lilifuk* using traditional fishing tools one to two times a year between the months of June and December. In Flores, there is *Nempung Cama Riang Tacik*. In *Sabu*, *Pana Dahi* and *Hole*, people make an annual offering to honor their harvest from the land and the sea. Here, the harvest of coral used for chewing betel (*menyirih*) is only allowed once a year. During *menyirih* openings, locals are only allowed to approach reefs with motor-less two-man boats. There is a local prohibition on using chemicals to fish. There is also a sacred area that locals are not allowed in, which effectively acts as a fish bank.

People of Central Sumba also have annual rites (*Luat*) when they make offering to the ancestor and spirits who have preserve the ocean and provide for the people. In Rote, *Papadak* and *Hoholok*, such 'local wisdom' guides the sustainable use of marine resources (DKPP, 2016a; Meryanto et al., 2015). These customary (adat) agreements and sanctions are not present in national laws. Nevertheless, local people use adat rituals to determine when and where to fish, who can fish, closure periods and areas. Therefore, these rules are good tools for regulating common resources.

Adat management is actively practiced in some areas and has all but vanished in other areas where modern, easy-profit fishing practices are now common. The decline in use of adat law relates to the lack of regeneration of adat leaders. Until recently, little attempt was made to evaluate whether locally practiced customary marine tenure and management systems could be integrated into the national legal marine resource management framework. This is changing however. Several areas issued regulations that reinstate customary concepts of land/sea management and boundaries. Following this trend, the Nature Conservancy is working with local NGO partners in 10 districts to incorporate local wisdom into MPA management. The hope is that this will result in more easily adopted conservation practices.

In Flores, the practice of *Nempung Cama Riang Tacik* was used to manage spring areas. It has been adapted to coastal area management.

In Rote, TNC encouraged the community to adapt local *Papadak* and *Hoholok* wisdom for the management of marine spaces. *Hoholok* or *Papadak* are a set of ethics and solidarity values concerning springs, water distribution and natural resource management. *Hoholok* is practiced in the western part of Rote while *Papadak* is used in the eastern part. Traditionally *Papadak* is enforced for activities in paddy fields and perennial plantations as historically locals depended on the land. Papadak adat regulations reduced conflict between paddy farmers, and between paddy and livestock farmers. In the western region, *Hoholok* was also used to manage mangrove area.

The process took place in mid-2015. It involved the BKKPN-Kupang, Forum Komunikasi Tokoh Adat Peduli Budaya (FKTA-PB, a communication forum for adat leaders concern for their local culture), East Nusa Tenggara Marine Conservation Council, the community and the district government of Rote Ndao. Three out of 19 *nusak* were chosen as pilot projects in the East and the South West of Rote. These were Landu, Temanu and Dengka Nusak. Two villages represent each *nusak*, so the pilot took place in a total of six villages, namely Sotimori, Bolatena, Nggodimeda, Siomeda, Netenaen and Oelua. TNC and FKTA-PB formulated an agreement about how to manage the resources through a series of meetings and group discussions (Figure 4.4). TNC also helped FKTA-PB choose community representatives for a monitoring group, known locally as Manaholo (Usmi, 2015).

FIGURE 4.4
People in Nusak Dengka are discussing the adaptation of *Papadak* in marine space.

FIGURE 4.5
Ⓐ The declaration of *Hoholok* mark in Dengka Nusak, attended by adat leaders, Manaholo and officials from district government.
Ⓑ The *Papadak* in Landu Nusak.

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The *Papadak/Hoholok* regulations of each *nusak* delineated: (1) zones for fishing and cetacean protection and demarcated boundaries between villages, (2) the use of environmentally friendly fishing gear, (3) resources that can be harvested (with prohibitions on cutting mang-rove trees, capturing monkeys, smoking out bees from hives, using poison to catch turtles and lobsters, destroying coral reefs, quarrying sand with heavy equipment), (4) waste management for tourism and industrial activities, (5) sanctions (6) management and (7) governance (Figure 5A). The draft regulations were distributed to communities for feedback, and finalized for each *nusak*. Afterwards, the Head of Rote Ndao District, who also holds the title of Maneleo Inahuk (Main Adat Chairperson) declared the regulations official and inaugurated the *Manaholo* in a ritual (Figure 5B). ■

PAPADAK & HOHOLOK

1 Even though Rote is an island, most locals have land-based livelihoods such as agriculture and plantation work. People look to the sea as a supplementary source of food. Therefore, it is no surprise that there are no coastside sacred places on Rote, or any *adat* laws pertaining to marine resources. However, as the population grows, so does the need for marine resource management. FKTA PB (a communication forum for *adat* leaders concern for their local culture) opted to use their land-based Rote Ndao local wisdom as a premise for marine resource management. The organization, founded in 2010, consists of 20 *adat* leaders. This council uses the principles of *Hoholok* and *Papadak* to manage their mangrove and terrestrial resources in 19 *nusak*.

3 *There were a number of push and pull factors that set the stage for the adoption of* Hoholok *and* Papadak *principles into regional law. It was challenging to zone for different purposes. Overharvesting resulted in a marked decrease in local fish catch. There was an increasing threat of unfriendly fishing practices by outside fishermen. Thus, FKTA PB was enthusiastic about adapting and adopting their local wisdom in the management of marine resources.*

4 There were nine bans stipulated in the law. Violators could be fined 1 million to 100 million IDR. To help enforce the law, the local administration established a monitoring structure with officers known as *Manaholo* in each village. John Ndolu as the chairman of the FKTA-PB expected to establish *Manaholo* in 52 villages in 8 districts where each village would have eight *Manaholo*. Ndolu also said that 'the adoption and implementation of *Papadak/Hoholok* along the coast and sea is necessary. The *adat* approach is relatively effective. People obey *adat*. These rules have protected forests and plantations for hundreds of years."

5 **The head of district of Rote Ndao, Drs. Leonard Haning, MM,** said "*Hoholok/Papadak* is an indigenous regulation. This structure will later aid the government in resolving coastal problems." Haning thought it's important to disseminate the regulation to inform all visitors to because it applies to all people coming to Rote. Meanwhile, Andi Rusandi,the Maritime Affairs and Fisheries Ministry's marine biodiversity conservation director who attended the declaration of the *Papadak/Hoholok* regulation, also perceived this initiative in a very positive manner. "We welcome the declaration because the enforcement of the customary law will support the government's task of preserving the natural resources," he said. Ferdy. J Kapitan, a representative from the provincial government, also shared the same sentiment by appreciating the initiative of district government and the Indigenous People's contribution to marine conservation.

2 TODAY, more people from outside Rote have started to come and harvest local resources. This has implications for local people. Latief Kawali from Manuluean sub-village mentioned, "nowadays, we only get 3 kg per fishing trip. Sometimes we don't get anything because we only use fishing rods and nets." Dahun Lahamu from another subvillage of Pantai Batutua said fishermen from the neighboring island of Bima had destructive fishing practices. He said that, "besides bombs and [the use of] potassium [cyanide], he often finds them harvesting shrimp using compressors." Mukhtar, a fisherman from Manuluean added, "the ropes of cultured seaweed culture are also annoying because we put our fish net in at the same place."

6 **It was a historical moment when the District Government of Rote Ndao declared *Hoholok/Papadak* and inaugurated 48 adat monitoring officers (*Manaholo*) in Central Rote during September of 2016. The declaration means that other *nusak* acknowledge and submit to *Hoholok/Papadak* rules. People are more likely to obey the customary regulations for fears of social expulsion and *adat* punishment.**

FIGURE 4.6
Recovering Acropora coral surrounded by rubles due to destructive fishing practice.

IV.3 SUSTAINABLE FISHERIES

As mentioned earlier, one of the objectives in the establishment of an MPA is to bring economic benefit to the region through the sustainable use of marine resources. The marine resource most utilized by local people is fisheries. Resource boundaries are discussed in the context of Regional Fisheries Management Districts (WPP) under national Law 31 of 2014 on Fisheries article 5. The law explains that fisheries are managed in the territorial waters of Indonesia, waters in Indonesia's Exclusive Economic Zone and other bodies of water such as lakes, marshes and other standing water with the potential for fish farming.

TNC hopes to show resource users that sustainable fisheries will support marine conservation and biodiversity and provide livelihoods. However, challenges

such as overfishing and destructive fishing are still rampant in LSE (Figure 4.6). One underlying cause is that the ocean is considered an open access resource. When there is no ownership, no one feels the urge to conserve and everyone assumes their right to utilize the resources. This leads to a tragedy of common resources. Fisheries and marine resources management have been introduced to hinder overuse. ICZM (Integrated Coastal Zone Management) and LMMA (Locally Managed Marine Area) are examples. Generally, these two models engage communities but they are not as well accepted by local and national government entities.

Currently, RBFM (Rights Based Fisheries Management)/ TURF (Territorial Use Right of Fisheries) model is in vogue. Twenty-two out of 119 developing countries with coastal areas have introduced RBFM (Barner et al., 2015 in Anggraini, 2015). This model acknowledges community rights in accessing, utilizing and conserving their resources. RBFM is defined as an area where a certain group of fishermen has exclusive access. The Government of Indonesia hasn't adopted this model much. It is used in the coastal areas with traditional management systems such as *sasi* and *awig-awig*. The RBFM size reccommended for demersal fishes is 10-100 km^2 (Mous 2014 in Anggraini, 2015).

The criteria for establishing RBFM/TURFs for demersal fisheries are (1) designating and ensuring the continued monitoring of an area; (2) exclusive access for certain groups; (3) the groups given the access shares responsibility for the management of the TURF area with local government (4) TURF area is enough in terms of size and has the population of targeted fish. TURFs require a protected area, commonly referred to as a TURF-reserve. The ultimate goal of this model is to have sustainable fisheries, where the total capture approaches the Maximum Sustainable Yield (MSY) or Maximum Economic Yield (MEY) (Mous, 2014 in Anggraini, 2015). Usually artisanal fishermen with simple fishing gear who are involved in TURF-reserves. Sometimes management varies for particular species. Fish move more and therefore have a different management system from more sedantary species of echinoderms, molluscs, crustaceans or algae. Some management systems, such as in closed reserves, only allow certain fishing gear.

There are two types of TURF-reserve (Afflerbach et al., 2014 in Anggraini, 2015). One, practised in Fiji, Samoa and Vanuatu, is based on traditional knowledge and land and sea ownership values. The other TURF-reserve system is based on government mandate. It usually targets the conservation of certain high economic value biota. TNC is implementing both. The first is launched in project in Rote. The other is being tested in Sumbawa, where traditional marine management knowledge is lacking but there is local government support.

RBFM is best practised where people have access marine resources and already fish in a sustainable manner. Under RBFM, local people maintain sovereign rights over their resources. Especially with the acknowledgement by the provincial government by aligning RBFM area in their zoning plan or by enacting the adat rules in local regulation. Under a RBFM system, government agencies are more likely to closely monitor fishing permit given to big companies. RBFM systems also require outsider fishermen to request permission before fishing. Such local control can prevent illegal fishing, overfishing and destructive fishing. However there are challenges in drafting and implementing RBFM systems. If the management plan is not structured properly or is set up without the involvement of the right stakeholders, it can lead to conflict among social groups. ■

FIGURE 4.7
Fisheries area of Saleh Bay, WNT Province

IV.3.1 MPA APPROACH AS A MODEL FOR RIGHTS-BASED FISHERIES MANAGEMENT (RBFM)

The revised Fisheries Law No. 31/2004 supports pre-existing fisheries management systems. Access and withdrawal rights of the small-scale fishers are addressed in Article 61. The sub-clause states that "small-scale fishers are free to fish in all fisheries management areas of the Republic of Indonesia". "Small-scale fishers" are defined as "traditional fishers who engage in fishing using traditional fishing technology and for whom an enterprise certificate and tax are not imposed". These fishermen "are free to fish in all fisheries management areas of the Republic of Indonesia". This means that small-scale fishers can access and draw marine resources anywhere in national waters.

Many fishing communities develop property rights based on local adat rules. These adat rules regulate which fishermen can fish a certain area and how outsiders are excluded. Fishermen have limited communication, which can exacerbate conflict. The second issue is that there is no article in the revised Fisheries Law No. 31/2004 that addresses management rights, despite the fact that some local adat systems have existed for centuries. This leaves fishermen to resolve matters according to central or

local government regulations. If regulations are considered 'unfair,' this is another source of potential conflict. When there is so much emotion but little understanding about local regulations, the rules are weakly enforced, and result in poor fisheries management.

TNC is piloting to establish RBFM using the approach of MPA establishment. Under Indonesian Fisheries Law, habitat and fish populations in an MPA's core zone get complete protection. Humans can only use the space for research and education purposes. Normally, the ecological condition in this core zone is under the 'good' category with low human use. The core zone fits the definition of TURF-Reserve concept. The core zone makes up 2 percent or more of total MPA area. This requirement is hard to achieve in some reserves. In such cases, no-take zones can be designated. No-take zones are intended for the protection and preservation of habitat and fish population. However, tourism and leisure activities are allowed in these zones. In the marine reserves system, there are also rehabilitation zones for areas under severe threat. Then there is the sustainable fisheries zone, where fishermen can harvest with environmentally friendly methods. Commercial fishing is allowed in this zone but only artisanal fishermen or fishermen groups with modest tools are allowed to participate. The criterion under reserve zoning is suitable in introducing the rights for fisheries and might be potential to exercise TURF-reserve model.

In 2013, TNC together with DKP representatives, initiated an initial feasibility study for a TURF project in West Nusa Tenggara Province. Then in 2015, TNC along with WCS, had an opportunity to continue the initiative at two pilot sites for sustainable fisheries practices: Cempi Bay, in Dompu, and Saleh Bay in West Sumbawa. Both places are major fish sources for WNT. Their demersal fisheries make up a fifth of total fisheries production. Seven percent of national grouper and snapper landings come from Cempi and Saleh Bay alone. Cempi Bay is also a lobster fishing area and is a source of various types of shrimp, mud crab, crab, tuna and other species of fish with important economic values. About 639 boats with 5 GT scale operate here. One hundred and ten of these boats are engine-less. Saleh Bay (Figure 4.7) is a source of livelihood for approximately 3.800 local fishermen, and additional 2,000 outsider fishermen. It produces about 18% coral fishes of WNT fisheries production (WCS, 2017). Snapper (Figure 4.8) and grouper are the dominant species locally. The seascape at these two sites is characterized by small islands, and habitats important for fisheries, including coral reefs, seagrass and mangroves.

FIGURE 4.8
Dominant fish catch of grouper & snapper of Saleh Bay, WNT Province.

"TNC helped develop the management and zoning plans for Cempi and Saleh Bays."

Saleh Bay was designated as a marine tourism park under Head of Sumbawa Decree No. 1441/2015, with a total area of 33,461 hectares. Meanwhile Cempi Bay special fisheries area was established under Head of Dompu District Decree No. 23/2013 as special fisheries areas with a total area of 25,804 hectares. These provincial assignments conflicted with a national government designation of the areas as marine reserves under Law No. 23 of 2014. Each area requires a Governor Decree to be established as MPA (either in marine tourism park status or special fisheries area). TNC and WCS's facilitations resulted in the designation of 9 MPAs in the WNT province. They were all are established as MPA by Governor Decree No. 523-505/2016. The total area of 229,555.36 hectares, includes Teluk Cempi Marine Reserve with a new area allocation of 39,000 hectares, and West Sumbawa's 33,461 hectare-wide Liang and Ngali Marine Tourism Parks. TNC helped develop the management and zoning plans for Cempi and Saleh Bays. TNC's facilitation resulted in Governor Decree 532.1-972/2016, on the management and zoning plans for individual MPAs in West Nusa Tenggara (Aminollah, et al., 2016).

Having a status of MPA with its TURF-reserve is only the first step towards establishing a RBFM. The status ensures that fishing permits are not given to big, fishing companies. It also ensures that mariculture is only allowed in certain areas. MPAs are still not a widely adopted management model for RBFM in West Nusa Tenggara. This is because: 1) Regional autonomy is restricted to the provincial level (the drafting of RZWP3K, or Zoning Plan for Coastal Areas and Small Islands, is under Provincial Fisheries Office authority); 2) The RBFM under MPA scenario only cover the first criteria of its establishment, to have fisheries management area. However, the setting of group to have the exclusive access, the management of sustainable fisheries are not present yet. The management authority should consider the input control/ number of fishing allowed for each fisherman and the output control/ number of fishes allowed to be caught by each fisherman. ■

FIGURE 4.9
The people actively participated in gathering information on spatial map, marine resource potential, and proposal of *Papadak* rules for Rainggo Nusak.

IV.3.2 *PAPADAK* AND *HOHOLOK* AS RIGHTS-BASED FISHERIES MANAGEMENT (RBFM) MANAGEMENT MODELS

Coastal and Small Island Management Law No. 27/2007, article 62 honors pre-existing *adat* arrangements. It states that both communities and companies may participate in the planning and development of coastal and small islands. Article 9 affirms that (1) the Government admits, respects and protects the rights of customary communities and traditional communities and local regulations of coastal areas and small islands that have been in operation for generations, and (2) states that the rights of customary and traditional communities and local regulations is a reference for coastal and small island management (Satria and Adhuri, 2010).

Adat-based fisheries management is being practiced in Rainggo Nusak, East Rote. Here a RBFM/TURF Reserve based on traditional knowledge values or type 1 TURF Reserve is being piloted. Rote's waters are rich in pelagic and demersal fishes, shrimp and sea cucumber. Rainggo Nusak in particular has potential as a tourism destination. The *nusak* also has the highest number of fishermen of all Rote. Thus, management is necessary for the longterm viability of local fisheries. The people in Rainggo Nusak are launching *adat*-based management by revitalizing and adapting *Papadak*, their land-based *adat* rules. When local *adat* rules

FIGURE 4.10
The surveyor team of TNC, FKTAPB and representatives of fishermen and adat is arranging survey plan in Rainggo waters.

are transformed into formal fisheries management regulations, there is less chance that jurisdictions will overlap or there will be inter-*nusak* or local-provincial scale conflict (Adrianto, et al., 2013).

The process of adapting *Papadak* began with a series of consultations between the FKTA-PB, TNC and the people in Rainggo. Marine resources and the MPA area were mapped with the help of fishermen and local people including the women (Figure 4.9). Discussions were conducted in all three villages within the *Nusak* (Papela, Serubeba and Londalusi). Participatory mapping exercises followed. A group of people, accompanied by a TNC GIS officer, surveyed the area to verify the collected information (Figure 4.10). The people agreed to zone the area of Nusalai cape as a fish bank. Two areas were zoned for *makameting*.

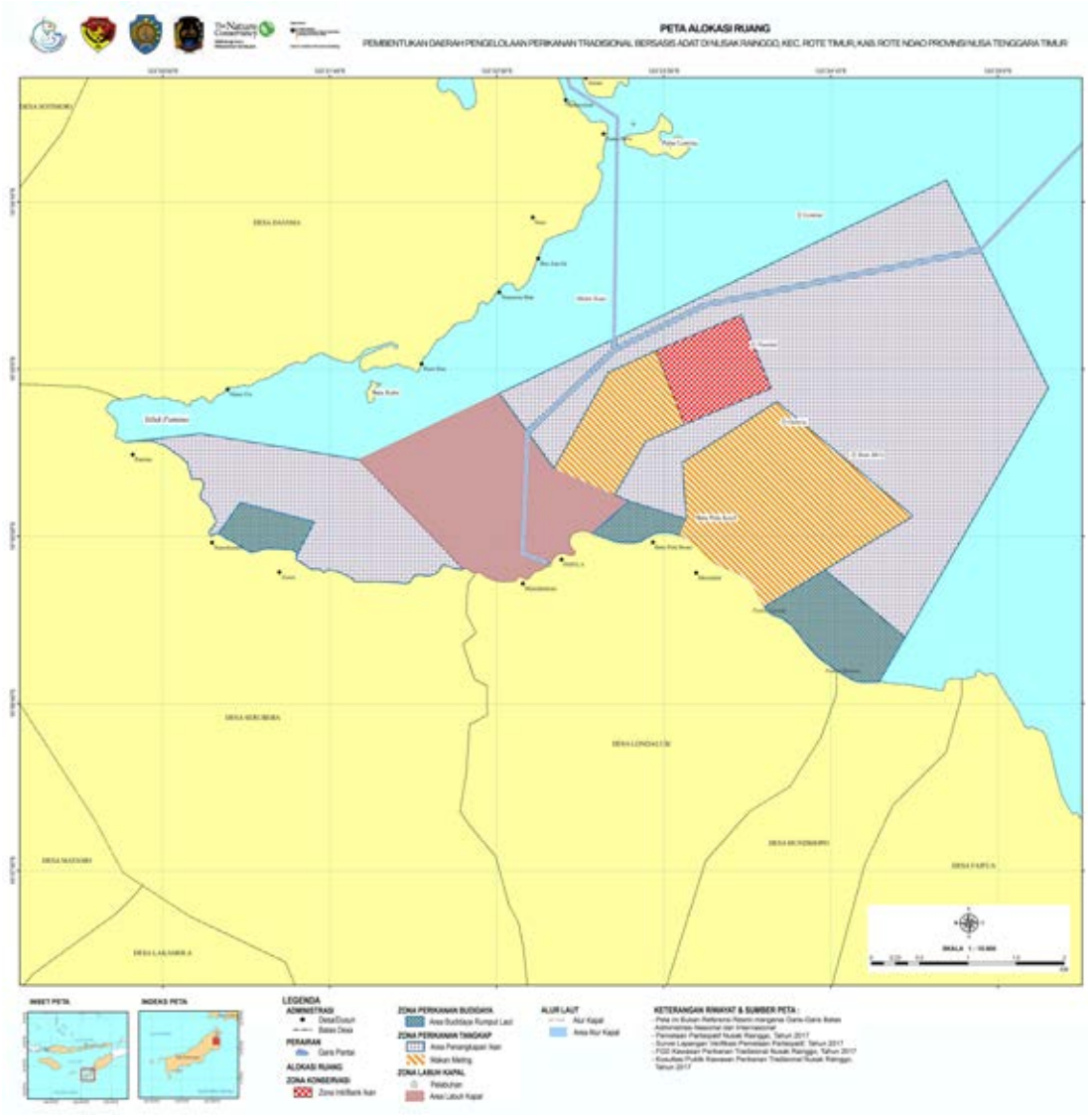


FIGURE 4.11
The design of marine spatial use of Rainggo *Nusak*.

In Rainggo Nusak, the zoning of the 1,623.2 ha RBFM pilot was divided into 7 zones as laid out in Figure 4.11. These include zones for cultivation, tourism, mooring, *makameting*, fish bank/TURF reserve, fishing and transportation. The cultivation zones (around 7% of total RBFM size) are located in Namohenda and Luwule beach as well as in the coastal areas of Batu Pulu Besar and Batu Pulu Kecil. Here people are allowed to culture seaweed and sea cucumber. The size of the whole area is in the range of an ideal RBFM area (1 – 10 thousand ha). Around 58% of the RBFM area is designated for fishing. Three percent of the area is the TURF-reserve. Following the previous process, the people then draft the *Papadak* rules. It lays out what can and can't be done in each zone, resources that can be harvest-

> "As with other *Papadak*, people living in the neighboring *nusak* and people from outside of Rote must respect local rules."

ed and the allowed gear types. As with other *Papadak*, people living in the neighboring *nusak* and people from outside of Rote must respect local rules. Manaholo are responsible for the monitoring, surveillance and compliance and the delineation of coastal management areas. The indirect benefit of such rules is the reduction of social conflict and a theoretical improvement of the traditional fishers' income. This system not only improves the economics and life quality of local communities, it fosters marine cultural identity for local fishermen (Satria and Adhuri, 2010).

RBFM should consider three things (Pomeroy 2004 in Kiki, 2015b): ways to close the access to the marine resources; ways to control the number of fishermen; and ways to control the number of fish each fishermen is allowed to catch. The RBFM pilot in Rote considers two of these three aspects. Consultations and a ground survey revealed ways to close the access to fish resources. *Papadak* regulation prohibits certain fishing practices and gears, therefore controlling fishermen's access to the fishing grounds (FKTA-PB, 2017). However, there are no catch limits either given to a group or to individuals. Another achievement is that the government and community outside of the Rote RBFM acknowledge *Papadak*. The next goal is to ensure equal rights among fishermen and rules concerning total allowable catch and the number of fishermen allowed in the RBFM zone.

The draft of *Papadak* regulation will be put into effect June of 2017. TNC believes that the regulation will be successful. *Papadak* regulations were developed through a participatory process. Papadak is a form of pre-existing local knowledge, it will likely be widely accepted and considered legitimate by all stakeholders (Satria and Adhuri, 2010). The implementation of Papadak will showcase how co-management by government and resource users is possible in Indonesia.

Through working with partners and riding the force of existing social capital, TNC has brought all stakeholders – central and district officials, community members and local NGOs to develop initiatives. This approach fits well with the Indonesian tradition of making consensus decision (*musyawarah*). It has made a model for a participatory marine conservation agreement in Lesser Sunda that benefit the people and nature. ■

V. MARINE SPATIAL PLANNING

The Coral Triangle Initiative (CTI) Plan of Action manifests the bold and ambitious commitments made by six countries in Manado in May of 2009. Representatives at the meeting pledged to sustainably manage marine resources in the Coral Triangle (CT) region. As mandated in the CTI Plan of Action, member countries must identify priority seascapes for investment and the demonstration of best practices. The CTI Seascape Working Group meeting held in Bali, April 2013, identified Lesser Sunda as Indonesia's top conservation priority.

Marine spatial planning has been recognized widely as an effective tool for managing resource use in large marine areas. Mapping allows stakeholders and decision

makers to place their area of interest in a broader context, thus preempting conflict in the use of the space by different sectors (Douvere, 2009). More importantly, marine spatial planning is an essential step towards achieving ecosystem-based management. Marine spatial planning takes into consideration the heterogeneity of marine ecosystems and their conservation values, and estimates current and future human use. Marine spatial planning is a continuous, iterative, and adaptive process. It makes conflicts and compatibilities more visible, therefore comprehensible (Douvere 2009, Douvere & Ehler, 2009).

The Nature Conservancy works with the government to protect and promote development that allows Indonesia's people and nature to prosper. Our work in Lesser Sunda demonstrates that ecosystem-based marine management can be done at a large scale. Marine spatial planning tools are key to this objective, as it establishes and clarifies institutional roles and thus improves the management of shared resources both at an administrative and ecosystem scale. ■

V.1 POLICY SETTING FOR ECOREGION MARINE SPATIAL PLANNING

The Nature Conservancy and Institut Teknologi Bandung have led the effort of engaging the Indonesian government in marine spatial planning. This initiative is inspired by the experiences of other countries that have successfully implemented marine spatial planning frameworks (Douvere et al., 2007). One fruitful path for TNC to engage the government has been to cast the planning process as important to the current administration's ambition to build a 'maritime highway,' and turn Indonesia into a global maritime axis.

The maritime highway, which is also known as short-sea shipping, offers an alternative to land-based freight transportation. Short-sea shipping moves cargo between ports that are a short distance apart. The maritime highway concept is perhaps inspired by Europe's success in short-sea shipping freight. A maritime highway is a reasonable concept given the 18,307 islands of the Indonesian archipelago (922 of which are permanently inhabited). By extension, given its strategic position in the middle of the biggest oceans and flanked by the Asian and Australian continents, Indonesia could really turn into a world maritime axis if it successfully created a short-sea shipping system.

The maritime highway concept is also a positive step forward for Indonesia's aging marine transportation infrastructure. The first step towards a short-sea shipping system would be the construction of more public ports. The current administration's nine-point 'Nawacita' national development program serves as a policy guideline for all Cabinet ministers. Eleven major and feeder ports are currently being modernized to ease passenger traffic between the western and eastern parts of the country. Another 13 ports are planned to facilitate cargo handling. Aside from seaports, Indonesia would also need more ships. Maritime infrastructure development, agriculture, tourism, fisheries and livestock are key economic sectors in this region. Data indicates that there is a lot more potential for development in the sectors of fisheries, tourism, and mining.

TNC's groundwork views the Lesser Sunda ecoregion holistically. Yet economic activities currently taking place in Indonesian seas are regulated with a sector-based approach. Government agencies are charged with the management of individual economic sectors. These agencies have jurisdiction over the regulations and marine planning for a given sector regardless of where in the country the activity is happening.

The increased development pressures on the marine environment and the potential for multiple use conflicts has not yet been considered in Lesser Sunda ecoregion planning. However,

considering the ocean in development planning would enable adaptive decision-making. This would in turn preempt conflicts over the safety of maritime transport and the protection of fisheries, sustainable fisheries and important natural areas. It is important to get the government interested in marine spatial planning so as to ensure their active engagement in the process. We realize that ultimately the government will be the authority to ensure that a marine spatial management plan is enforced. So, the first step toward selecting goals and objectives for marine spatial planning should be aligning with the government's goals (Douvere, 2009).

In line with other successful marine spatial planning initiatives, TNC's first step in the Lesser Sunda was to identify appropriate authorities for the planning process. We conducted an analysis of four government ministries involved in marine spatial planning: namely the National Board Planning Agency; Ministry of Marine Affairs and Fisheries; the new Ministry of Agrarian and Spatial Plan; and the new Coordinating Ministry of Marine Affairs. Marine planning in Lesser Sunda ecoregion allocates space and marine resources for the welfare of the community. Exercising a conservation approach, the eventual zoning will balance conservation with the economic interests of the fisheries, tourism, and mining sectors. With political, institutional, and technical support, it is expected that Lesser Sunda marine planning can be a national showcase for effective management of marine space and resources.

> "Maritime infrastructure development, agriculture, tourism, fisheries and livestock are key economic sectors in this region. Data indicates that there is a lot more potential for development in the sectors of fisheries, tourism, and mining."

We concluded that existing regulations could lay the foundation for marine spatial planning practices. Marine spatial planning at an ecoregional scale must include management of land, coastal and marine uses. However, when an ecoregion spans multiple provinces, planning authority resides with the national government while management authority is done in coordination through a number of ministries. The Lesser Sunda ecoregion includes provincial boundaries up to continental shelf so a minimum scale of 1:500.000 is required. Indonesian law acknowledges the hierarchy of planning and authority between national, regional and local governments. Moreover, we found that the ongoing national marine planning initiatives may address the absence of sea-use management of Indonesia (Kombaitan et al., 2015b). ■

V.2 APPLICATION OF PERFORMANCE ZONING

During the Lesser Sunda marine planning exercise, we reviewed various techniques and found that performance zoning was an appropriate conservation tool for the Lesser Sunda ecoregion. The decision was built on the sense that we understand so little about the character of marine spaces. Even though nature is always changing, conservation zoning is often a static, one time affair. Data goes out of date or becomes incomplete. A wide range of potential activities are prohibited in certain zones. Meanwhile the intensification of the same activity is encouraged in another, more limited space. Land-use planning inform marine spatial planning even though some elements are not relevant in this context.

Performance zoning seeks to address potential impacts ari-sing from a certain use or activity, rather than restricting the activity in a specific zone. Performance zoning allows for comprehensive zoning arrangement at a larger scale since activities are not limited if they meet a standard or specific target. Performance zoning provides an alternative conservation tool to ecosystem-based management. Performance zoning overlaps with ecosystem-based management in the sense that both frameworks emphasize reducing conflict between

TABLE 5.1
CLUSTERING SYSTEM APPLIED IN LESSER SUNDA ECOREGION

CLUSTER	CHARACTERS			
	SENSITIVITY	EXEPTIONALITY	EXISTING CONDITION	ENVIRONMENTAL VALUES
I (Bali Waters)	Medium	Medium	Disturbance from medium to high (anthropogenic)	High ecosystem services (4-5 are considered important)
II (Lombok Waters)	Medium to high	Medium to high	Potential disturbances	High ecosystem services (5-8 are considered important)
III (Sumbawa and East Nusa Tenggara waters)	High to very high (threatened endemic species and habitat with low resilient and resistant).	High to very high	Relatively low disturbance	High ecosystem services (8 are considered important)
IV (High Sea)	High (highly susceptibility to disaster with unique species from other areas)	High	Relatively low disturbance	High ecosystem services (8 are considered important)

resource use and ecosystem function. By striking a balance between the two, performance zoning and ecosystem-based management encourage resilience in the marine environment.

We set explicit performance standards for each zone in the Lesser Sunda ecoregion MPAs, thereby limiting resource use and emphasizing potential impacts. By incorporating standards that simultaneously promote the economic growth and allows for the protection of local resources, performance zoning management targets transcend physical boundaries. Moreover, we must improve management capacity of central and regional government to implement performance monitoring.

Guided by the above principles, under the performance zoning framework we divided the region into four areas based on key characteristics of the ecosystem, including existing conditions, levels of endemism, ecosystem sensitivity, and environmental services offered to local communities. The clustering approach is crucial for identifying how specific areas may be affected by disturbances. How an area reacts and recovers will impact the management and concentration of activities allowed there. The four areas as further elaborated in Table 5.1 were namely: Bali (medium level of sensitivity or uniqueness and high level of human use); Lombok (medium to high level in sensitivity or uniqueness and potential disturbance from anthropogenic causes); Sumbawa and East Nusa Tenggara (high level of sensitivity or uniqueness and considerably low disturbance); and high seas (highest level of sensitivity or uniqueness). In total, we have 20 sub clusters in Lesser Sunda ecoregion as laid out in Figure 5.1. Sub-clusters represent similar geography, strategic function and environmental services provided. The sub-clustering is based on ecological boundaries. ■

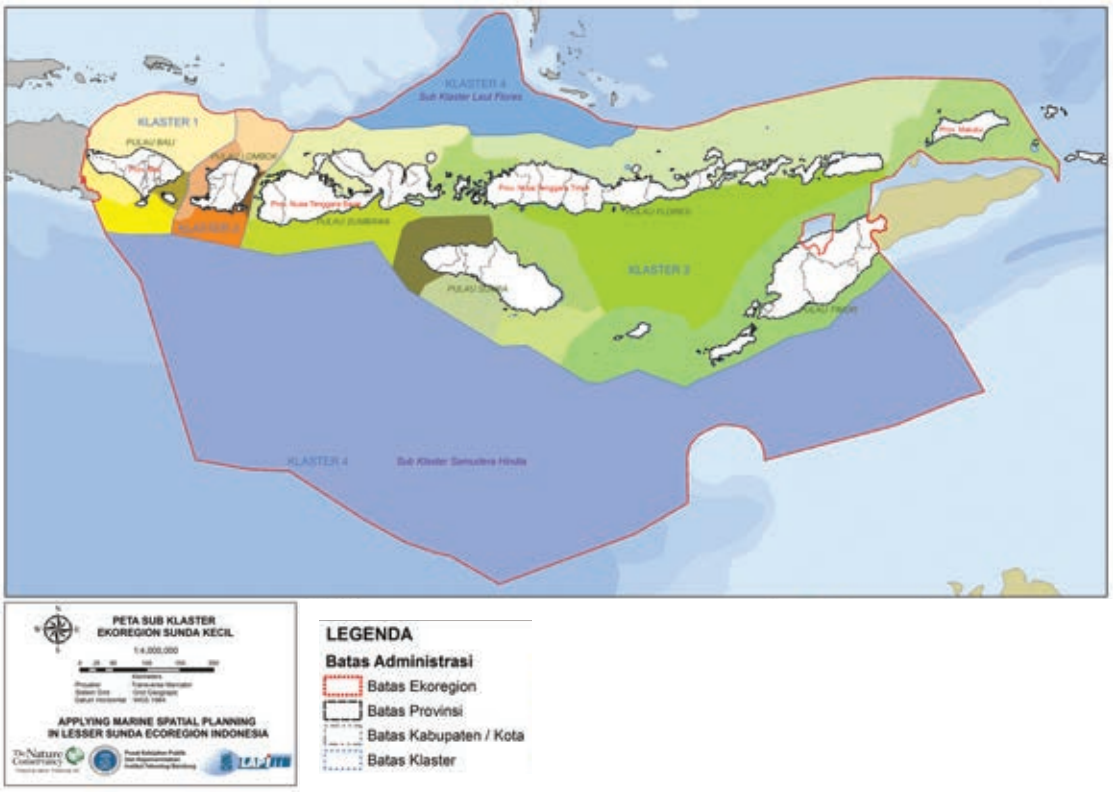


FIGURE 5.1
Twenty sub-clusters in Lesser Sunda ecoregion marine planning

Under the performance-zoning framework, marine spaces development requires ecosystem limits. For example, limits on mangrove ecosystems may include the maintenance of substrate and water canals, the protection of the ecosystem from erosion or sedimentation, harvest limits, emergency plan of action in case of an oil spill. Under the performance zoning principles, single location can be designed for multiple uses based on integration of marine dimension – surface, water column and sea bed. However, definite zoning boundaries can only be performed in protected areas, aiming species and ecosystem protection.

Designs must also consider environmental services. For instance, in western Bali, 90% of the marine area is identified as nursery grounds for marine biota in East Java and Bali's fisheries. So, local marine spatial plans must address potential disturbance caused by coastal development. Eastern Bali is considered a

highly sensitive region with medium levels of ecological uniqueness. Other examples are West and East Lombok. Both regions provide ecological services, including acting as migratory corridors for dolphins and sharks. There are 12 dolphin species recorded locally. East Lombok is exposed to destructive fishing practices targeting sharks while the ecosystems in West Lombok are disturbed by large-scale tourism development. From an economic perspective, both areas provide high valuable target captured species including skipjack, tuna and blue swimming crab. So, it is important to set criterions for space utilization for regional development that weighs economic, social and environmental sustainability.

When setting up a zoning system, developers or planners should consider observe and monitor physical elements to understand how they affect the ecosystem. This will inform planners and enable them to set limits for especially area for general utilization. For example, in an upwelling zone, inorganic matter determines nutrient availability and species abundance. Temperature is also an important ecosystem element. A change in water temperature can upset ecological balance. This happened when excess hot water was introduced into the coastal ecosystem from sardine processing plants was disposed from a processing activities in Pengambengan (Bali Bay). The influx of hot water caused a decrease in local fish populations. Temperature as limits in this example is the development limit to determine whether certain activity is allowed or not allowed in certain area.

Limitations should be based on negative impacts. Utilization here means use with little impact on the environment. If a sub-cluster has pelagic habitat or acts as a cetacean corridor, then prey abundance, nutrient levels, surface water temperature and dissolved oxygen are important elements to consider. If a sub-cluster is noted for its carbon storage capacity, the levels of inorganic phosphorus and carbon dioxide should be measured.

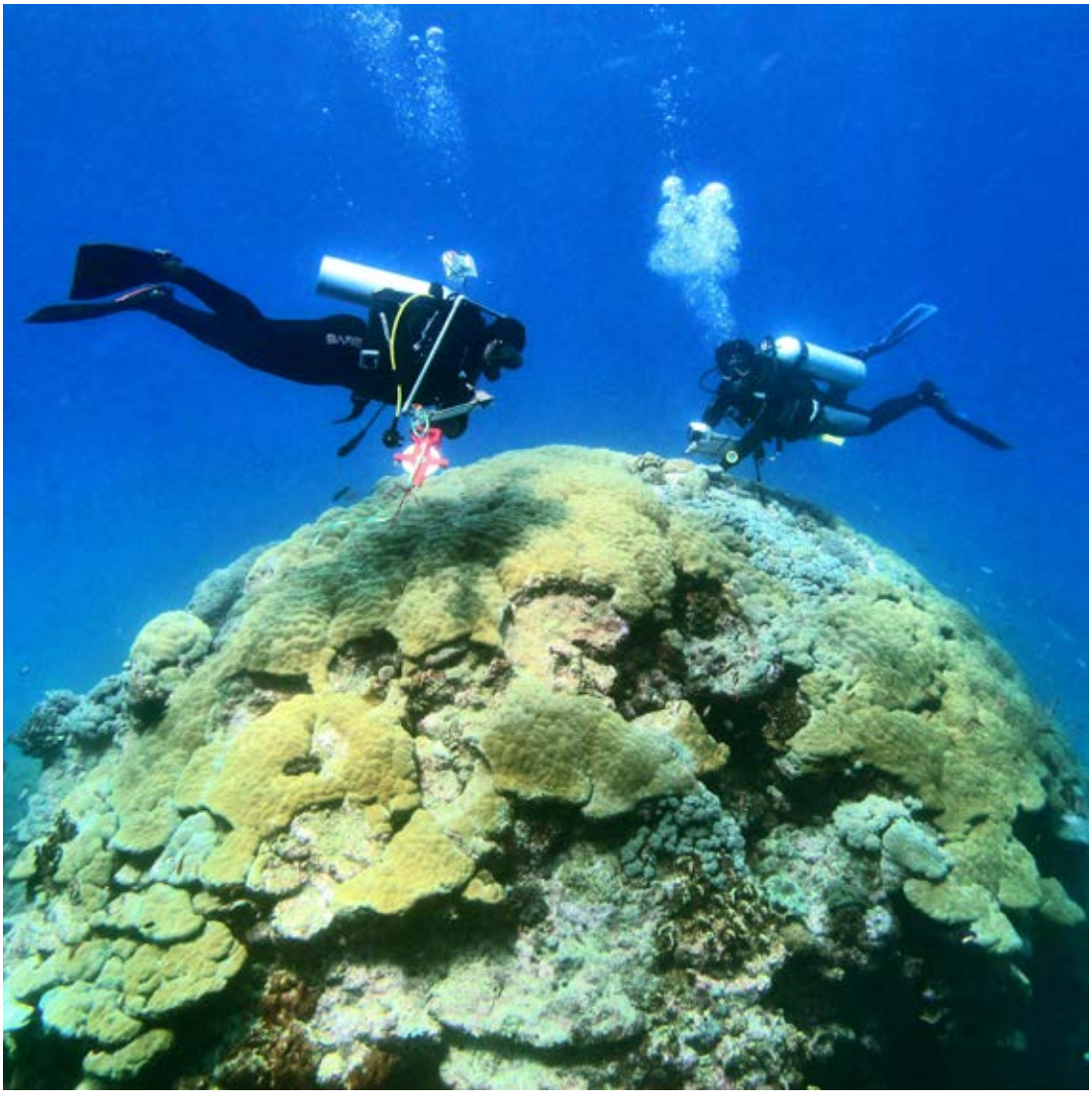
Limiting factors for managing coastal and high seas ecosystems are necessarily different. In a coastal setting, seagrass and coral reef ecosystems depend on physical factors such as acidity, temperature, salinity, light intensity, and turbidity. In high sea ecosystem management, development limits should consider keystone species. Keystone species plays a unique and critical role in the way an ecosystem functions. In addition to biotic factor, physical-chemical factor is later defined by type of ecosystem services provided (Table 5.2).

“It is important to set criterions for space utilization for regional development that weighs economic, social and environmental sustainability”

TABLE 5.2
EXAMPLES OF LIMITING FACTORS APPLIED IN VARIOUS SUB-CLUSTERS OF WEST BALI, NORTH LOMBOK AND TIMOR

SUB-CLUSTER	TYPE OF ECOSYSTEM	LIMITING FACTOR	MINIMUM THRESHOLD	OPTIMUM CONDITION	MAXIMUM THRESHOLD
West Bali	Coral Reef, Seagrass, mangrove	Temperature (northern part)	–	30-36	36
		Temperature (central to southern part)	–	25-30	–
		Salinity (northern part)	–	30-37	–
		Salinity (central to southern part)	32	34.62 ± 1.04	37
		pH	7-8	–	–
		Tidal Inundation	0-70		
		Sea Level Rise	1 to 9 mm/ year (IPCC, 2001) in (Grimsditch & Salm, 2006)		
		Light intensity (maximum depth)	100 m for hermatypic coral (Anonim 1, 2016)		
		Light	10% (Greve dan Binzer)-11% (Ralph et. al., 2007)	400 to 700 (known as photosynthetically active radiation)	–
		Sedimentation	0	0	0
		Chlorophyll A	–	–	–
		Phosphate	0.0028	0.0230 ± 0.0202	0.6420
North Lombok	Seagrass, Mangrove, Coral reef, Small Island, Deep sea	Temperature	28-34		
		Salinity	30-35	–	–
		pH	**7-8**	**–**	**–**
		Tidal Inundation	**0-70**	**–**	**–**
		Light Intensity (maximum depth)	100 m for hermatypic coral	–	–
Timor	Captured fisheries and cetacean corridors	Dissolved oxygen	2-4 ppm (ITB-TNC, 2016)	–	–
		Light	10%(Greve dan Binzer)-11% (Ralph et. al., 2007)	–	–
		Substrate (seagrass)	–	–	–
		Key stone species (abundance)	DD	DD	DD

TNC ran 20-year projections for development scenarios for the Lesser Sundas Ecoregion ahead of regional planning workshops. In each scenario, various parameters were measured such as gross domestic product, infestation, connectivity, pollution and damage, biodiversity and disaster risk. The first five-year scenario focuses on stakeholder relations towards the implementation of ecosystem based management in Lesser Sunda. The second five-year scenario emphasizes sustainable development. The third scenario emphasizes productive conservation . In the final scenario, the Lesser Sunda is developed sustainably with improvements in local social welfare. ■



V.3 CONSULTATIVE PROCESS TO UNDERSTAND DEVELOPMENT TREND

We carried out a series of focus group discussions with relevant marine sectors. We aimed to collect data and information on the current and future uses of Lesser Sunda. To date, we have completed 5 focus group discussions, including with members of the mining and energy; fisheries, conservation, marine infrastructure and tourism sectors. Experts, policy makers, private sectors and civil societies were involved in this process.

The discussions produced constructive inputs to inform our marine spatial planning design process. For example, we learned that the Lesser Sunda's mineral resources were not as vast as we thought. There is actually little current mining activity in this region. Mineral reserves have been identified within the region but mining company operations are currently more focused on improving waste management practices. There is manganese mining in East Nusa Tenggara. However, experts who attended the focus group discussions noted that only half of mining companies in East Nusa Tenggara met environmental standards and remained operational. Mining sector representations at the meeting also shared that local communities have few other income generating activities.

TABLE 5.3
SERIES OF FOCUS GROUP DISCUSSIONS TO INFORM MARINE SPATIAL PLANNING DESIGN

LOCATION & DATE	SECTOR	KEY PARTICIPANT	KEY ISSUE
Bandung 25 June 2016	Energy and Mining	Indonesian NAVY, Ministry of Energy and Mineral, subject on experts	Energy and mining development and policy: Renewable energy; Oil and gas
Bandung 3 December 2016	Fisheries	Research & Development of Ministry of Marine Affairs and Fisheries; Seaweed Association; Fisheries Office Bali, subject on experts	Sustainable fisheries: aquaculture technology development; socio-economic context in sustainable fisheries; seaweed farming development
Bandung 12 December 2016	Tourism	Ministry of Tourism and Creative Economy, Indonesia Tourism Development Cooperation; Swiss contact, Komodo Park, subject on experts	Tourism Planning and Control; criterion for tourism areas; Mandalika Economic Area Development; Promotion and Marketing
Bandung 17 December 2016	Marine Infrastructure	Maritime expert; PELNI; Marine Transportation Office of Bali and East Nusa Tenggara, subject on expert	Marine infrastructure development; Shipping lines development; Green marine infrastructure development; Cold storage development; Bali and East Nusa Tenggara Marine Transportation Offices

Meanwhile, our focus group discussion with representatives from the fisheries sector highlighted how development should focus on promoting community practices, ecosystem based management, improvement on infrastructure, upgrading production chains, ecolabeling, integrating farming with other activities, and collaborative management. Of interest to marine spatial planning were recommendations on how to minimize conflict of uses between fisheries and tourism in the region.

The focus group discussion on tourism brought up the subject of whether there should be limits on when visitors can enter the national park, of whether tourism is allowed throughout the MPAs network. If it is, conservation should be main consideration. This means that the carrying capacity of local ecosystems should be monitored to ensure that the area is not negatively affected by tourism.

The focus group discussion on marine infrastructures addressed the role of new infrastructure. The new shipping lanes and ports aid national defense and security and give access to isolated areas. Despite the fact that planning is done at the macro level, management should be applied at the micro-scale in order to be strategic. Moreover, infrastructure development network should emphasize on utilization. Port development for instance is required to provide clear criterion for crossing fleets. ■

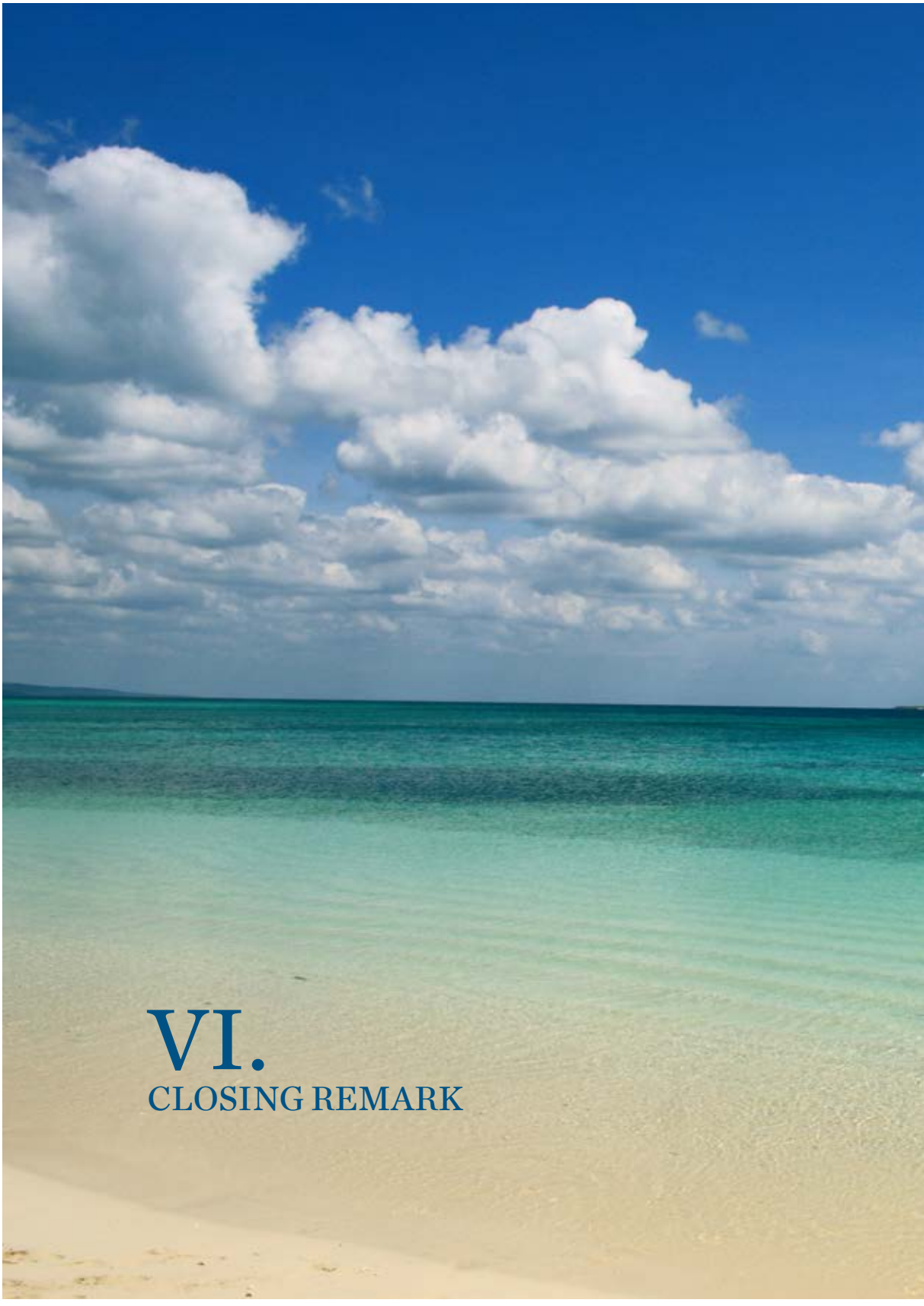
V.4 BUY-IN PROCESS FROM GOVERNMENT IS UNDERWAY

The initial phase of marine spatial planning practices for the Lesser Sunda Ecoregion provided several challenges, some of which were overcome through innovative strategy and initial research. However, it is expected that others may be better addressed through more intensive surveys and consultation at all levels. The major challenge during the initial phase was the government engagement.

A 2-year marine spatial planning program plan for Lesser Sunda has been developed together with Spatial Planning Directorate of Indonesia's MMAF laying out timeline, funding needs and the activities to be carried out. However, after a year of implementation, this plan hasn't progressed much. Lack of supports from other sectors in the process was simply because Fisheries is just single sectors among other sectors that regulate the use of marine space. The establishment of new Coordinating Ministry of Marine Affairs at the end of September 2014 holds higher responsibility to coordinate development planning in the context of marine uses. It is a way to enable adaptive decision-making in the context of marine spatial planning.

During marine spatial planning exercise in Indonesia, we see the missing pieces of the bigger government planning. The increased development pressures on the marine environment and the potential for multiple use conflicts, arising because of the current expansion of marine infrastructure has not been considered in the planning yet. Nevertheless, it creates opportunity for more comprehensive development planning towards integrated ocean management. However most importantly, this gets the government interest of the marine spatial planning as well as ensure their active engagement in the process. We realize that at the end, the government will be the authority to ensure that a marine spatial management plan as will be enforceable. Moreover, we as a private entity outside the government structure needs support and buy in the process. Engaging the leading university is not just improved the initial research but also open network to the government which define the marine spatial planning practices at the end. ■


SAFET FIRST



VI.
CLOSING REMARK

VI.1 LESSON LEARNT

The Lesser Sunda encompasses 62.5 million ha and spans four Indonesian provinces. It was a challenge to compile ecological, economic and social data over such a large geographic area. Limited access and infrastructure to the relatively remote and undeveloped area meant a lot of time was lost in travel. The Lesser Sundas are graced with a number of ethnic groups (13-17 ethnic groups in each province, Ananta et al., 2015, Suryadinata et al., 2003), so creativity was required in program communication and implementation. Cultural sensitivity and respect were essential.

Engaging and coordinating four government bureaucracies in four separate provinces proved challenging. Representatives had to be identified in each local administration. Representatives, and local community stakeholders had varying levels of technical capacity, understanding and

support for conservation. Funding had to be generated to run consultations with representatives from multiple agencies in each province. Given the resources and time frame for this program, it was hard to consult with all district-level representatives.

The results of the 2014 Indonesian national election also affected program implementation. 2014 was the second year of TNC's Savu Sea program. The newly elected President, Joko Widodo, established a new cabinet structure. He merged the ministries of environment and forestry. Under the Law no. 23/2014, regional authority moved from the district to provincial level. These rearrangements meant follow up of MPAs designation to establishment needs to be reconsulted in provincial level, capacity and number of staff in the districts that have already built need to be re-arranged to be based in the province for example. MMAF also issued amendment to the coastal and small islands management, Law no. 27/2007 junto 1/14 and set of law and regulations already present to make MPA establishment to be easier. All this reshuffling taught TNC program staff lessons: to be flexible; to focus on the goal.

Considering the vast area and complexity of the program, TNC has applied one of the new Direction and Approach to work with and through partners to obtain program goals – either the Government and the NGOs (international and local). Program staff working in government partnerships should keep in mind that government staff can be promoted or demoted. Similarly, there is turnover in NGO offices. Other risks when working with NGOs include the chronic lack of funding and the high likelihood of complex office politics. Choosing NGO partners is a delicate exercise tied to timely deliverables and smooth program implementation. It is important to coordinate closely with partners to ensure that they share the vision for introduced programs.

The relationship with media needs to be strengthened. Connecting local journalists with SIEJ (The Society of Indonesian Environmental Journalists) has built local capacity in writing on conservation. However, media coverage of conservation is needed, especially in Bali and West Nusa Tenggara. ■

VI.1.1 GOVERNANCE

Marine areas are common resources, which means that they serve multiple uses. Marine areas are important for fisheries, transport, energy development but also conservation. This can result in conflict between local and central government offices. Public meetings and consultations can preempt conflict.

The exercise of developing marine spatial planning (MSP) in Indonesia could improve national and local government planning in general. It helps local government in developing their Provincial Coastal Areas and Small Islands Zoning Plan (RZWP3K) in East Nusa Tenggara. Thus, zoning plan can act as a tool to accommodate environmental protection and economic development. Through zoning, protected areas are secured and conflicting multi-uses on a horizontal and vertical space of water space can be resolved. It is also essential to engage the government in MSP, as they have the ultimate authority on whether a marine spatial management plan is enforced.

The process of zoning involves time and money. But it pays off in conflicts avoided and the ease of future management. The goal of the Savu Sea MNP zoning plan is not only to protect reef habitat and cetacean corridors, but also to bring welfare to the people living close to the MNP. Given these parallel goals, the

"The goal of the Savu Sea MNP zoning plan is not only to protect reef habitat and cetacean corridors, but also to bring welfare to the people living close to the MNP."

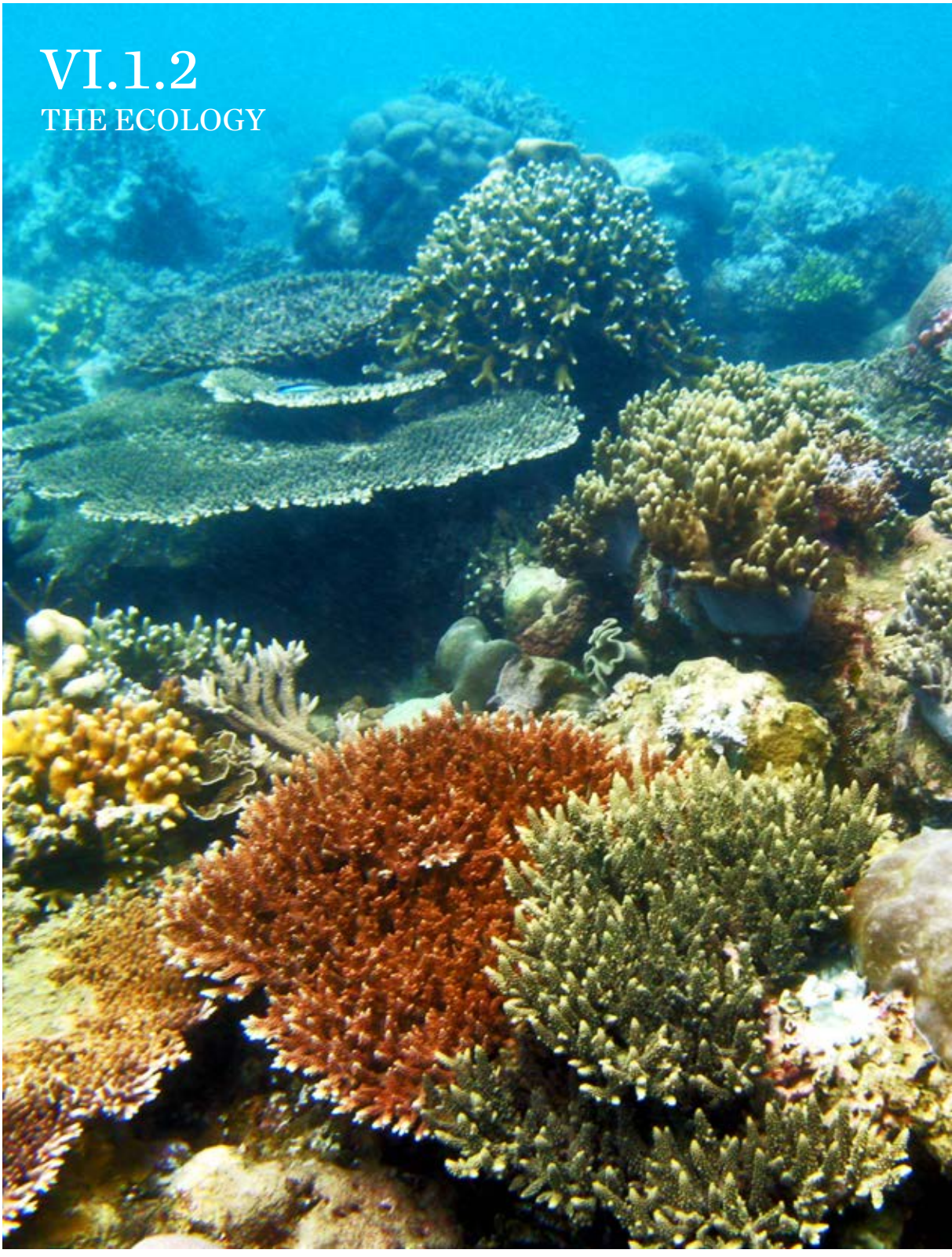
local government must balance development pressure and environment health. Zoning protects ecosystems. Engaging leading universities improved initial research on MSP and introduced TNC to key partners.

MPA network enable managers to create comprehensive conservation strategies. Networks connect ecosystems between small islands, small and big islands, as well as ridges and reefs. MPA networks also require coordination between MoEF and MMAF.

Managing MPA networks into practical level is challenging.

TNC perceives government, local NGOs and community as equal partners in program implementation. TNC understands that trust is vital in building productive partnerships. It supports the Government's agenda and sees it as aligned with TNC strategic directions. The establishment of the East Nusa Tenggara marine conservation council (DKPP) demonstrates the province's commitment to biodiversity conservation and sustainable development. Moreover, the establishment of the council was a showcase for sharing power and responsibility. Constant communication and coordination among stakeholders are essential for building a common understanding of conservation and the success of the council. The council is now in the final stages of establishing as a legal entity so it can tap resources. It can maintain its role as management's partner for BKKPN. ■

VI.1.2
THE ECOLOGY



The process of Savu Sea MNP establishment was also a lesson in the importance of science in informing conservation. In retrospect, we realize that the premise that an established and effectively managed MPA network will lead to healthier reefs is not entirely true. Anthropogenic factors such as destructive fishing practices and heavy tourist traffic were not the only influences on reef health that can be intervened. Invisible, natural phenomena, such as an increase of sea surface temperature leading to coral bleaching, was also a factor. Therefore, coral cover can't be used as a measurement of program outcome. Coral cover is beyond the scope of our program's intervention, especially given the limited timeframe of program. Extensive areas of single coral species do not indicate great reef health either. Diversity is more important to reef health than abundance.

Working with partners enables the spread of successful MPA monitoring methods. The seagrass, reef health, resource use and turtle nesting beach protocol implemented in Savu Sea alongside BKKPN Kupang is now replicated in the seven other MPAs in eastern Indonesia. The protocol is now used in WNT, Papua, South Sulawesi and Maluku. Routine refresher courses about the protocol, data processing and analysis to improve MPA are encouraged to be to upgrade the management capacity. TNC uses Conservation Action Plan (CAP) tools as a basis of conservation. CAP details TNC's strategic planning, implementation and success measurement for conservation programs. It is the basis for TNC program in LSE. TNC uses CAP to support the national Indonesian government and other partners in planning. The tool is going to be replicated by BKKPN Kupang.

The ecology of a marine system and its local human residents are intimately connected. Therefore, it is important for a program to work both on community and ecology. Projects should be managed with precautionary principles in mind. There should be a compromise so that local peoples' needs are met without bringing any detriments to the ecology.

Science team is required and its technical capacity building is needed. More ecologists with writing capacity should be added to the team to improve the quality of scientific reports. ■

VI.1.3 THE COMMUNITY, TOGETHER WITH THE PEOPLE

Collaboration with international and local-level NGOs proved fruitful to the program. These other organizations contributed expertise and resources to the program. These organizations also shared insights on conservation and program implementation. Collaboration was also important because TNC will not keep a permanent presence in the Savu Sea. Ten local NGOs pledged to continue working on the programs. They intend to mobilize their own resources to continue TNC's efforts at their respective sites. Collaboration with the ten local NGOs also revealed that the use of local languages and visual communication are key for conservation awareness. It is also important to collaboration with multiple NGOs since capacity is not

uniform at all organizations in LSE. Some NGOs lost focus during the program, fixating on their own internal office politics instead.

Adat (customary) law is still relatively strong in eastern Indonesia. Adat leaders and local wisdom can be drawn into management of common resources. However, it is important to be sensitive to cultural differences. Also, local respect for adat law does not automatically translate into universal acceptance of TNC's programs that incorporate indigenous conservation principles. TNC found success in adat-based TURFs in Rote.

When a community does not all belong to a single ethnicity or subscribe to the same adat laws, village-level regulations can institutionalize conservation program objectives. Enshrining these values in local law also ensures that local NGOs have a framework in which to keep striving on the environmental issues raised during the program's lifetime. ■

VI.1.4 CONSERVATION CAN BRING ABOUT ECONOMIC WELFARE

TNC introduced a variety of micro-business possibilities for communities within the Savu Sea MNP. However, we have yet to aid locals in accessing the markets for the resulting products, which include chips, syrups, souvenirs. TNC also need to train locals in hospitality, basic sanitation and hygiene and eco-friendly diving to promote villages in the region as eco-tourism destinations.

There is still room for improvement in showcasing how conservation benefits communities. Given the short timeframe of the program, it is also difficult to prove to locals that the suggested microbusinesses are viable. The whale watching tours, sustainable fisheries and seaweed initiatives are all in early stages. TNC staff are not trained business developers. And the bulk of TNC's Savu Sea program funding and time allocation were dedicated to establishing the Savu Sea MNP.

It was also not easy to prove to communities the importance of ecosystem services. Stressed ecosystems need time to recover to a state where they can provide services. Even then, there is always the looming threat of anthropogenic impacts. Conservation laws must be enforced. Local environmental awareness must be built up.

In Rote, communities are much more convinced of the importance of the established Savu Sea MNP. Two thirds of their marine area are included in the MNP. Areas where once outside fishermen practiced destructive fishing are now protected by adat law.

RBFMs or TURFs are still new concepts but they can encourage sustainable fishery management for an area. However, there must be resources to support the establishment of the RBFM or TURF. It is more practical and natural to set up a RBFM or TURF fishery where there are already long-standing 'adat' rules, rather than demarcating and introducing an MPA artificially with government backing. It is not always possible to find a situation such perfect conditions though. In addition to the presence of adat rules, those rules must be fair. There must be a respected adat leader and social cohesion in the area. ■

VI.2
THE NEXT HOMEWORK

VI.2.1 EXPANDING WHALE SANCTUARY IN INDONESIA'S WATER

Long before the conservation works in the Lesser Sunda ecoregion started 9 years ago, TNC put the idea back in proposing the entire marine zone of Indonesia as a whale sanctuary to adjoin the Indian Ocean sanctuary in 2002. TNC took what was left from the third World Park Congress Bali in 1982 acceptance from the Government of Indonesia upon the proposal from Rod Salm; former IUCN Marine and Coastal Conservation Program (Hoyt, 2005).

Upon request from the Indonesian Ministry of Marine Affairs and Fisheries, TNC expanded marine mammal proposal with APEX Environment. The idea was to protect important migratory corridors for cetacean between Indian Ocean and Pacific Ocean. Protecting these corridors would also safeguard critical habitats for Indonesia's marine mammals and extend the Indian Ocean Sanctuary where there have been reports of whaling. Indonesia is the only equatorial archipelagic state where inter-oceanic exchange of marine flora and fauna occurs (Kahn, 2002).

At that time, the Savu Sea was a vast, unknown area. Thus, TNC ran a rapid ecological assessment between 2013 and 2015. The study was not designed to address species or habitat-specific conservation but it laid the groundwork for future steps. There were 22 cetacean species recorded during the assessment. The study also revealed that cetaceans in the Savu and Banda Seas, Raja Ampat and Timor Leste may be genetically related to cetaceans in Papua New Guinea and Solomon Islands. This finding suggests that the area is important for both migratory and resident whales in the Coral Triangle region.

This corridor network is a remote and spectacular mosaic of inter-island passages that are part of the world's largest archipelagos. Residential whale and dolphin populations, as well as migratory species in their long-range movements, may be increasingly vulnerable to numerous regional and local environmental impacts. Seismic surveys for seabed oil and gas exploration, potential strikes from increasing ship traffic, entanglement in fishing nets, increasing discharge of plastic pollution from urban areas and targeted catches by traditional whale hunters are the potential emerging threats to cetacean. The research also showed that cetaceans in this region are increasingly exposed to threats such as subsurface noise disturbances, net entanglement, marine pollution and overfishing of marine resources. However, understanding about these threats is so little.

Studying marine mammals is challenging. Research takes a long time given the migratory nature of these animals and the vast distances they travel. There are many gaps such as relative

abundances, population sizes, and stock identities in whale research, particularly in data-deficient regions like the Lesser Sunda Seascape. These gaps can be filled through structured and periodic surveys. TNC hopes to develop a conservation strategy for the Savu Sea's resident and migratory dolphin and whale species. TNC hopes to compile a comprehensive species list for this region, replete with spatial and temporal distribution of cetaceans in the Indo-Pacific. The plan is to learn what emerging threats there are for cetaceans along the understudied Savu Sea trans-boundary corridor.

TNC is building strategic alliances with various international and local organizations in the fields of maritime transportation and seismic industries to ensure that industrial activities in this region do not affect local cetaceans. TNC hopes to use zoning to resolve conflict between conservation efforts and industrial activity such as marine transportation, mining and oil exploration. Field data through scientific surveys of these key migratory species will also be compiled. This will provide strong justification of decision-making processes. ■

VI.2.2 HOW FAR WE ARE FROM RESILIENT MPA NETWORK

It is critically to recognize that the single MPA will not be able to protect large marine ecosystem, MPA network will improve level of protection and prevent from indirect threats such as climate changes impacts. 'Do not put all of your eggs in one basket' by not concentrating all resources in one place or you could possibly lose everything is perhaps the proper idiom to simply describe how MPAs network works. Should one or more MPAs experienced with disturbances, the rest will allow an ecosystem to recover. Therefore, Lesser Sunda MPA was designed to improve the resilience of its ecosystem to climate change impacts and to minimize the stress caused by anthropogenic threats. Wilson et. al (2011) noted that the design also provides a starting point for support of site-based planning, which includes the design and implementation of individual MPAs.

Lesser Sunda MPA network design emphasizes that Savu Sea MPA will contribute significantly to maintain the resilience of this network if managed properly. The assumption was made based on the large size of the area – over half of this network and the fact that Savu Sea national marine park itself is a network. Nevertheless, we have been asking how is our MPA doing – its effective management of Savu Sea MPA. A healthy Savu Sea MPA will perhaps determine the health of others individual and affect the network.

TNC has carried out ecosystem health status monitoring in a representative sample of at 16 sites of Savu Sea. The monitoring informed that hard coral cover in Savu Sea is below 50 percent; under the category of medium and bad. The 2015 baseline coral cover is reported to decline in 2016 monitoring. Coral bleaching event in early 2016 is assumed to be the culprit to the loss of several corals species. Coral bleaching also impacted soft coral cover – 2016 monitoring result is reported to be lower compare to 2015. However, statistical analysis confirmed that the decline of coral cover percentage is not significant and can be considered as relatively stable. Moreover, health stress monitoring recorded that within the short period – only 8 months, the majority of coral cover returned to the original state. Upwelling is assumed to play major roles to maintain the sea temperature to allow coral recovery.

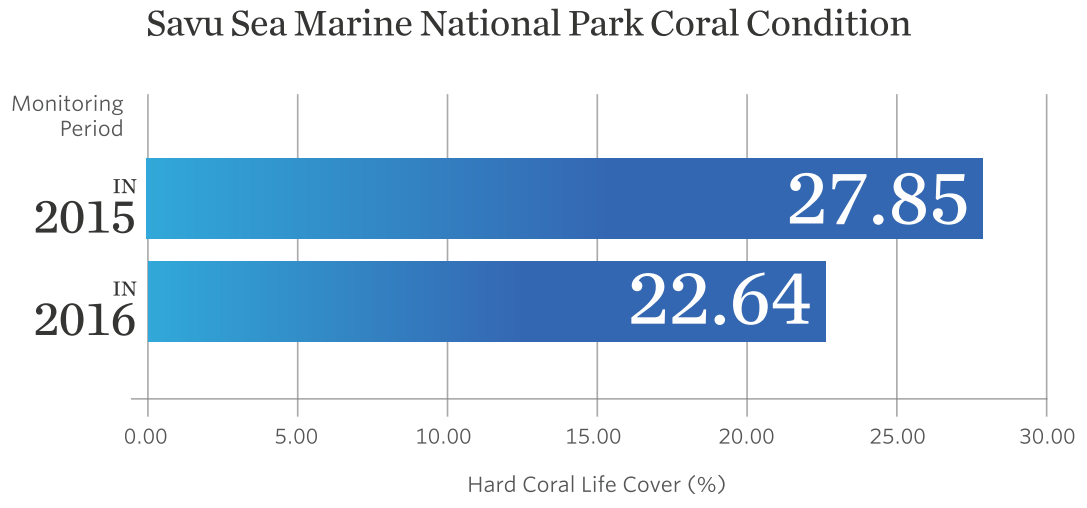


FIGURE 6.1
Comparison of hard live coral cover of Savu Sea MNP during 2015 and 2016 ecosystem health monitoring.

TNC's analysis in identifying priority areas for conservation using historical and future projection of sea surface temperature in 2015 informed that Lesser Sunda, in majority has lower projected future exposure. Relatively Savu Sea MPA is categorized as low (Sumba Island) and high historical exposure (Rote Island) in response to sea surface temperature. Therefore, establishment of Savu Sea MPA and its management turned out to be strategic in building resilient to climate change.

The establishment of MPA and its management will ensure stock of coral seeds for other areas. In the long run, effective MPA and network management will help to improve resilient to climate changes.

TNC learnt that effective management is more than just improved ecosystem health, and ecosystem health is far more complex than just healthy reefs. Sea turtle abundance offers another barometer of ecosystem health and the effectiveness of

management efforts. The previous participatory mapping study (in 2011) and turtle nesting beach vulnerability assessment (in 2014) revealed that the Savu Sea's sea turtle nesting sites are threatened the development of coastal infrastructure, sand mining, seaweed farms, and sea level rise. Additionally, the turtle themselves are threatened by poachers, dogs, wild pigs, and reptiles.

In coordination with the Savu Sea management authority and fisheries offices, TNC has developed a sea turtle monitoring program since April of 2016. The first sea turtle database in Savu Sea is also established. The database has information on the current state of sea turtle nesting activities in Savu Sea, existing threats to sea turtles in the region and changes in threats level with the establishment of Savu Sea MNP. Also recorded are community perceptions about sea turtles and sea turtle protection. This database will help to determine conservation priority areas in the region. Ultimately, this database will be used to develop an effective and accurate sea turtle conservation program that will further support the management of Savu Sea MNP.

TNC carried out multiple training courses on sea turtle biology and conservation to counter the preconceived ideas of residents in the region. A community-based monitoring program in 9 villages, on 19 beaches within the national park area is developed. TNC strategy was to collaborate with local university students and communities to conduct monitoring activities. Simple monitoring guidelines and protocols that could easily be applied by people from a variety of backgrounds are developed. TNC have also developed an Android-based cloud-based database that allows instant input from the field. To date, this project has involved ten undergraduate students and four community members.

When TNC started its sea turtle initiative, many people in the village still consumed sea turtle eggs and were unaware that sea turtles are protected species in Indonesia. Most of them had been indirectly informed about the law but did not realize the serious implications of violating these laws. They also did not understand the concept of sustainable resource use and the fact that sea turtle populations are threatened globally. So the first mitigation step was to install information boards in villages and on local beaches to raise awareness and understanding about sea turtle conservation. TNC also plan to install nest protection to prevent predators from excavating sea turtle nests on the beach. Another major threat is that many nesting beaches are sites for unregulated sand mining. This means that TNC must collaborate with miners and the coordinating national ministry to stem this trend. The local government is actively engaged on all these initiatives. TNC aims to expand sea turtle monitoring activities so as to identify other crucial sea turtle habitats beyond known nesting beaches. TNC would like to pinpoint habitats through in-water surveys. Better science and knowledge of sea turtle crucial habitats and behaviors helps to support long-term survival of the species.

The Nature Conservancy had completed and updated a scientific design of a resilient MPA network for the Lesser Sunda Ecoregion. Resilient principles also had been applied into this scientific design which is very important for each of conservation area to take this into account in facing threats such as destructive fishing, overfishing, pollution, climate change and others threats. Although there were significant ecological gaps that still exist in the current status but a process on how to filling these gaps are ongoing. TNC recognized that the scientific design has provided very comprehensive well-planned MPAs network. However, this planning design needs to be well implement on the ground and manageable by the support from the government and local community. In the long-term process, TNC recommends that MPAs network in Lesser Sunda Ecoregion should be managed through integrated ocean management plan that can balance the ecological, socio-economic and governance for the sustainable uses of marine environment. ■

"TNC recognized scientific design provides comprehensive, well-planned MPAs network. By the support from the government and local community, it is well implemented."

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(in alphabetical order)

ABM: Area-based management

ALKI: Alur Laut Kepulauan Indonesia (Indonesian Archipelagic Sea Lane)

AOIs: Areas of Interests

BBKSDA: Balai Besar Konservasi Sumber Daya Alam (Natural Resources Conservation Agencies)

BKKPN: Balai Kawasan Konservasi Perairan Nasional (National Agency for Marine Protected Areas)

BMUB: Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

BPS: Badan Pusat Statistik (Central Statistics Bureau)

CAP: Conservation Action Planning

CITES: Convention of International Trade in Endangered Species of Wild Fauna and Flora

CTI – CFF: Coral Triangle Initiative on Coral Reefs, Fisheries and Food

CTI: Coral Triangle Initiative

DKP: Dinas Kelautan dan Perikanan (Marine and Fisheries Agency)

DKPP: Dewan Konservasi Perairan Propinsi (Marine Conservation Council)

EBM: Ecosystem-based Management

ENT UNICONSUFISH: A Consortium of Six East Nusa Tenggara's Universities for Sustainable Fisheries initiated by TNC

ENT: East Nusa Tenggara

FKTA – PB: A Communication forum for adat leaders concern for their local culture

GIS: Geographic Information System

GT: Gross Tonnage

ICZM: Integrated Coastal Zone Management

IMO: International Maritime Organization

IUCN : International Union for Conservation of Nature

KJA: Keramba Jaring Apung (floating net cages)

LAPI ITB: Lembaga Afiliasi Penelitian Indonesia Institut Teknologi Bandung

LMMA: Locally Managed Marine Area

LSE: Lesser Sunda Ecoregion

MCA: Marine Conservation Agreements

MEY: Maximum Economic Yield

MMAF: Ministry of Marine Affairs and Fisheries

MNP: Marine National Park

MoEF: Ministry of Environment and Forestry (Menhut/Menteri Kehutanan)

MPAs: Marine Protected Areas

MSP: Marine Spatial Planning

MSY: Maximum Sustainable Yield

NGO: Non-Government Organization

P4KKP: Pengkajian,Penetapan dan Perancangan Pengelolaan Kawasan Konservasi Perairan Laut Sawu (Team for Assessment, Establishment and Management of Savu Sea National Marine Park)

RBFM: Right Based Fisheries Management

RPJMDes: Rencana Pembangunan Jangka Menengah Desa (Village Mid Term Development Plan)

RZWP3K: Rencana Zonasi Wilayah Pesisir dan Pulau-Pulau Kecil (zoning plan for coastal and small islands)

SIEJ: The Society of Indonesian Environmental Journalists

SK: Surat Keputusan (Decree)

TNC: The Nature Conservancy

TURF: Territorial Use Right Right of Fisheries

WCS: Wildlife Conservation Society

WNT: West Nusa Tenggara

WPP: Wilayah Pengelolaan Perikanan (Fisheries Management Zone)