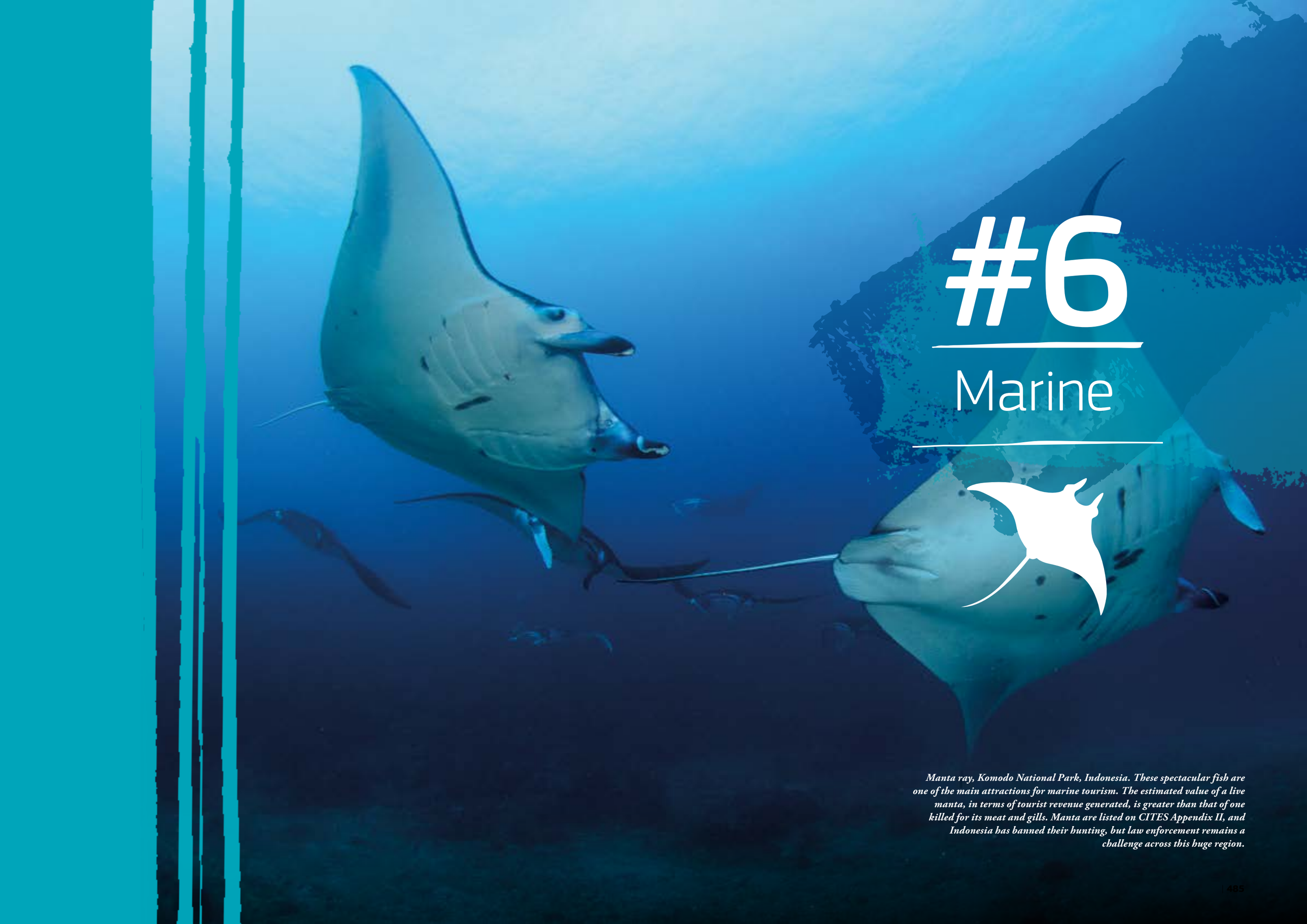
#6

Marine



Manta ray, Komodo National Park, Indonesia. These spectacular fish are one of the main attractions for marine tourism. The estimated value of a live manta, in terms of tourist revenue generated, is greater than that of one killed for its meat and gills. Manta are listed on CITES Appendix II, and Indonesia has banned their hunting, but law enforcement remains a challenge across this huge region.

Contents #6

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List of abbreviations and acronyms

ADB	Asian Development Bank
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of South-East Asian Nations
CBD	Convention on Biological Diversity
CEPF	Critical Ecosystem Partnership Fund
CI	Conservation International
CITES	Convention on International Trade in Endangered Species
CSO	civil society organisation
CT, CT6	Coral Triangle, six countries of the Coral Triangle: Indonesia, Malaysia, Papua New Guinea, Philippines, Timor-Leste, Solomon Islands
CTC	Coral Triangle Center
CTI-CFF	Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security
CTSP	Coral Triangle Support Partnership
DAC	Development Assistance Committee (OECD)
DENR	Department of Environment and Natural Resources (Philippines)
EAFM	Ecosystem Approach to Fisheries Management
EEZ	exclusive economic zone
EU	European Union
EUR	euro
FAO	Food and Agriculture Organisation
FSA	fish spawning aggregation
GDP	gross domestic product
GEF	Global Environment Facility
GIZ	German Technical Development Cooperation Agency
GNI	gross national income
HDI	Human Development Index
IUU	illegal, unreported and unregulated (fishing)
IUCN	International Union for the Conservation of Nature
KSC	key seascape for conservation
LGU	local government unit
LME	large marine ecosystem
LMMA	locally managed marine area
MoU	Memorandum of Understanding
MPA	marine protected area
MPAG	Marine Protected Areas Governance (project)
NGO	non-governmental organisation
ODA	Official Development Assistance
OECD	Organisation for Economic Cooperation and Development
PEMSEA	Partnerships in Environmental Management for the Seas of East Asia
PNG	Papua New Guinea
RPOA	Regional Plan of Action
SDG	Sustainable Development Goal (UN)
TNC	The Nature Conservancy
UN	United Nations
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
WCPFC	Western Central Pacific Fisheries Commission
WCS	Wildlife Conservation Society
WWF	World Wide Fund for Nature

0

Executive summary

A nudibranch, Chromodoris, Indonesia. Nudibranchs eat sponges and hydroids, using toxins from their prey for their own defence. Their bright colours warn potential predators that they are toxic, but also make them popular with marine tourists. Many species are found in the Coral Triangle, and they help to draw attention to the diversity of smaller animals on the reef.

Coral reef, Milne Bay, Papua New Guinea. The Coral Triangle covers the seas of six countries, and is the world's centre of coral reef diversity, with over 500 species of reef-building corals, healthy mangroves, lush seagrass beds and deepwater marine habitats.

Hawksbill turtle, Indonesia. Although widespread throughout the tropics, the species is considered critically endangered because it has suffered a sharp population decline. The main threats are the collection of eggs and nesting females, degradation of breeding beaches and feeding grounds, and hunting of adults.

0 _ Executive summary

Stretching from the equatorial regions to the far north, Asia's marine environments include a wide variety of habitats and ecosystems, which are home to tremendous biodiversity. The Coral Triangle, defined as the area with over 500 species of reef-building corals, is the most diverse marine area on the planet and covers the seas of six countries, from Indonesia in the west to the Solomon Islands in the east, and north to the Philippines. In addition to its coral diversity the area is of exceptional importance for its mangroves, seagrass beds and deepwater marine habitats. As many as 130 million people live close to the coast and depend to some extent on marine and coastal resources for their livelihoods. Many more millions of people, including those outside the region, enjoy the rich harvest of fish and other marine products. At the same time, the marine habitats support a growing tourism industry.

This valuable diversity is under intense pressure. Virtually all the coral reefs are threatened by a combination of destructive fishing practices and over-fishing, with the pressure somewhat lower only in the sparsely populated coastal regions of Papua New Guinea (PNG) and the Solomon Islands. Some of the most commercially valuable species – tuna, manta ray, shark, sea cucumber, seahorse – have been exploited to extinction in many areas. Sediments, waste and agricultural chemicals washed into the sea as a result of land-based activities pose an additional threat. Undersea mining, offshore oil and gas drilling and dumping of waste pose direct threats to the marine ecosystems. Finally, climate change is adding to the pressure on coral reefs, with damage due to increased storm intensity, rising water temperatures and ocean acidity. The problems are driven by a combination of growing global demand, inadequate capacity to respond and poor policy frameworks.

As awareness of the scale and nature of the threats to marine ecosystems grows, governments, civil society, communities and the private sector are making efforts to improve their management. About 1 972 marine protected areas (MPAs) covering about 200 881 km^2 have been established in the Coral Triangle, and although management remains weak in many cases, this illustrates the level of interest in ensuring that marine resources survive. In addition, some governments in the region have taken action to regulate or ban damaging fisheries (e.g. shark and manta ray), and to protect turtles, cetaceans and other threatened species.

In PNG and the Solomons (and increasingly in the Philippines), regulations encourage the management of marine resources based on community rights and traditional practices, but in the other Coral Triangle countries, government regulation fails to recognise customary claims, creating tensions which are an additional obstacle to conservation action. Nevertheless, large numbers of locally managed marine areas (LMMAs) have been created throughout the Coral Triangle.

The Coral Triangle has attracted considerable donor support, much of it channelled through the regions' governments and international non-governmental organisations (NGOs). The Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF) is one of the biggest conservation initiatives ever undertaken in the marine sector, and has brought together governments, business and civil society to address the challenges of capacity building and sustainable management. The initiative has been supported by a series of donors. Donor support also helped to create the programme for the Bird's-Head Seascape in Indonesian Papua, where participatory planning, community livelihoods, law enforcement and community-based tourism have been integrated to reverse the practices that were threatening the ecosystems and communities of the area.

Strategic approaches to supporting conservation in the Coral Triangle should address six priority areas of action:

- Strengthen and expand the network of marine protected areas in the region, with attention to integration with fishery policies and international cooperation, in addition to stronger management;
- Address the terrestrial threats to the marine environment caused by poor land management and uncontrolled coastal development. Integrate marine and terrestrial issues through ridge-to-reef approaches in sensitive areas, ensuring that planning, control and safeguards do not stop at the tideline. Build capacity and make the economic case for this;
- Capacity for marine conservation in the region: build on the considerable efforts already underway, continue to address the need for greater expertise and experience among decision-makers, MPA managers, community members, researchers and others;
- Address the illegal trade in marine products through enforcement and awareness in destination countries, with effective regional coordination to harmonise policies and approaches, share intelligence and collaborate on enforcement actions;
- Increase the availability of sustainable finance for conservation, including through greater engagement with the private sector in sustainable marine management;
- Improve the data that is essential to plan and monitor the conservation of marine environments, together with the mechanisms to share the knowledge accruing from the many conservation initiatives in the region.

1

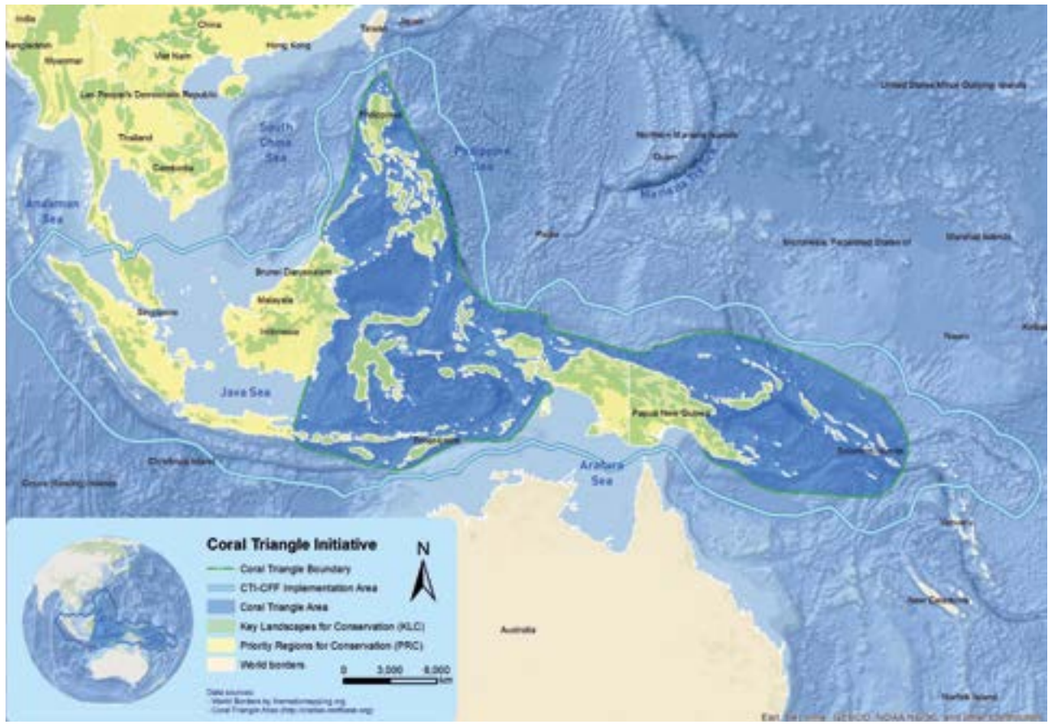
Background

Coral reefs are built by colonies of animals, polyps, which secrete a limestone skeleton. Reef-building corals live symbiotically with algae, and require clear, warm water to thrive. The complex structure they create provides homes for thousands of species of plants, fish and invertebrates. The diversity of the world's richest reefs is greater than that of tropical rainforests.

1 _ Background

Covering only 14 % of the world's land area, Asia contains over half of the world's population, the fastest growing economies and some of the richest biodiversity hotspots. As a result, it is experiencing increasing pressure on its natural resources.[1] Coupled with the effects of climate change, these pressures threaten biodiversity, the quality of ecosystem services and millions of livelihoods across the region.

Figure 1.1 The scientific and political boundaries of the Coral Triangle



(1) Squires D. (2013). Biodiversity Conservation in Asia. Asia & the Pacific Policy Studies (1), pp. 144-159. See http://onlinelibrary.wiley.com/doi/10.1002/app5.13/full

Young mangrove trees, Indonesia. Healthy mangroves protect shorelines, provide habitat for endemic and migratory birds, provide shelter for juvenile reef sharks, act as nurseries for fish, and are home to mangrove clams, mud crabs and many other invertebrates.

The European Union (EU) is an important donor and trading partner with the countries of the region, and views a shift towards more sustainable, equitable growth as important for both Europe and the countries of the region. This study aims to help the coordination and harmonisation of support provided by the EU, other development partners and governments in the region, as well as to inform strategic dialogue with partner countries. It is intended to provide information for funding that has the conservation of biodiversity as an explicit objective, but also other types of funding where biodiversity concerns could be mainstreamed.

Spanning from equatorial regions to the far north, Asia's marine environments include a wide variety of habitats and ecosystems, which are home to tremendous biodiversity, from tropical coral reefs to uninhabited islands in the Sea of Okhotsk that are breeding grounds for seal, sea lion and seabirds. Eleven large marine ecosystems (LMEs) have been defined for Asia's oceans: the Sea of Okhotsk, Sea of Japan, Yellow Sea, East China Sea, Oyashio Current, Kuroshiro Current, South China Sea, Sulu-Celebes Sea, Indonesian Sea, Gulf of Thailand and Bay of Bengal. Relatively recent work to identify the world's epicentre for marine biodiversity has led to the delineation of the 'Coral Triangle', a biogeographic region defined by >500 species of zooxanthellate corals: those that have symbiotic algae and can therefore build reefs.[2] Other taxa follow similar patterns.[3] The Coral Triangle encompasses the Sulu-Celebes and Indonesian Sea LMEs, as well as the waters surrounding Papua New Guinea (PNG) and the Solomon Islands, which are further east and not included in the LME system (Figure 1.1). This chapter focuses on the Coral Triangle, while other important marine areas in Asia are dealt with briefly in the synthesis report.

(2) Veron J.E.N., L.M. Devantier, E. Turak, A.L. Green, S. Kininmonth, M. Stafford-Smith and N. Peterson (2009). Delineating the Coral Triangle. Galaxea, the Journal of Coral Reef Studies 11, pp. 91-100.

(3) Ibid; see also Allen G.R. (2007). Conservation hotspots of biodiversity and endemism for Indo-Pacific coral reef fishes. Aquatic Conserv: Mar. Freshw. Ecosyst. DOI:10.1002/aqc.880

Children commuting to school, Solomon Islands. Many Solomon Islander communities depend heavily on the sea for food, trade and transport.

Bamboo fish trap, Alor, Indonesia. Healthy marine ecosystems are vital for the livelihoods of coastal communities. Indonesia, the Philippines and PNG have the largest populations of reef fishers in the world, and fish provides over 40 % of the animal protein intake of the Coral Triangle's population.

1.1 Socio-economic setting

1.1.1 Political and administrative context

The 'political boundary' of the Coral Triangle encompasses the exclusive economic zones (EEZs) of the countries that have signed up to the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF): Indonesia, Malaysia, the Philippines, PNG, Solomon Islands and Timor-Leste. (Brunei Darussalam has recently been admitted as a member, but is not covered in this chapter[4]). The first three are members of the **Association of South-East Asian Nations** (ASEAN), an economic and political union that moved closer towards economic integration in 2015 with the launching of the ASEAN economic community. Timor-Leste and Papua New Guinea are both potential future members of the community. Environmental sustainability is addressed as a major theme in ASEAN's socio-cultural community blueprint.[5] PNG and the Solomon Islands are members of the **Pacific Islands Forum**, a trade and cooperation agreement between Pacific states, including Australia and New Zealand.

Malaysia is a constitutional monarchy and the only federation within South-East Asia. It is divided into 13 states and 3 federal territories, with 11 of the states in Peninsula Malaysia, and the 2 large states of Sarawak and Sabah on the island of Borneo. **Indonesia** is a secular, multi-party democracy, independent from colonial authority since 1945 but ruled by a single president, Soeharto, from 1965 until 1998, and since then by directly elected presidents. **Timor-Leste** achieved independence from Indonesia in 2002, after 24 years of occupation that was preceded by 450 years of Portuguese colonial rule; it is now a parliamentary democracy. The **Philippines** is a multi-party democracy and has played an important role in regional politics, being a founder member of the United Nations and ASEAN. **Papua New Guinea** is a multi-party democracy, which became independent from Australia in 1975, and remains a member of the British Commonwealth. The Solomon Islands is a constitutional monarchy with a democratically elected parliament, and is also a member of the British Commonwealth.

1.1.2 Population and livelihoods

The majority of the Coral Triangle's population (90 %) resides within Indonesia and the Philippines. The Philippines is the most densely populated country in the region, PNG the least (Table 1.1). Indonesia has the largest population, and the largest annual increase in population, although the fastest growing populations in percentage terms are in PNG and the Solomon Islands.

Roughly one-third of the region's 390 million people reside within 10 km of the coast and depend on the region's marine

Table 1.1 Human population trends in the Coral Triangle

Country	Population in 2015 (millions)	Annual growth rate (%, 2010-2015)	Population density (people/km²)	GNI per capita (EUR)	HDI (2015)	GDP (2015), EUR billion
Indonesia	257	1.2	132	7 529	0.689	663
Malaysia	30	1.6	91	17 509	0.789	227
PNG	7	2.1	16	1 894	0.516	13
Philippines	100	1.7	333	6 088	0.682	224
Solomon Islands	0.6	2.1	21	1 184	0.515	0.92
Timor-Leste	1.2	1.7	78	4 125	0.606	1.0

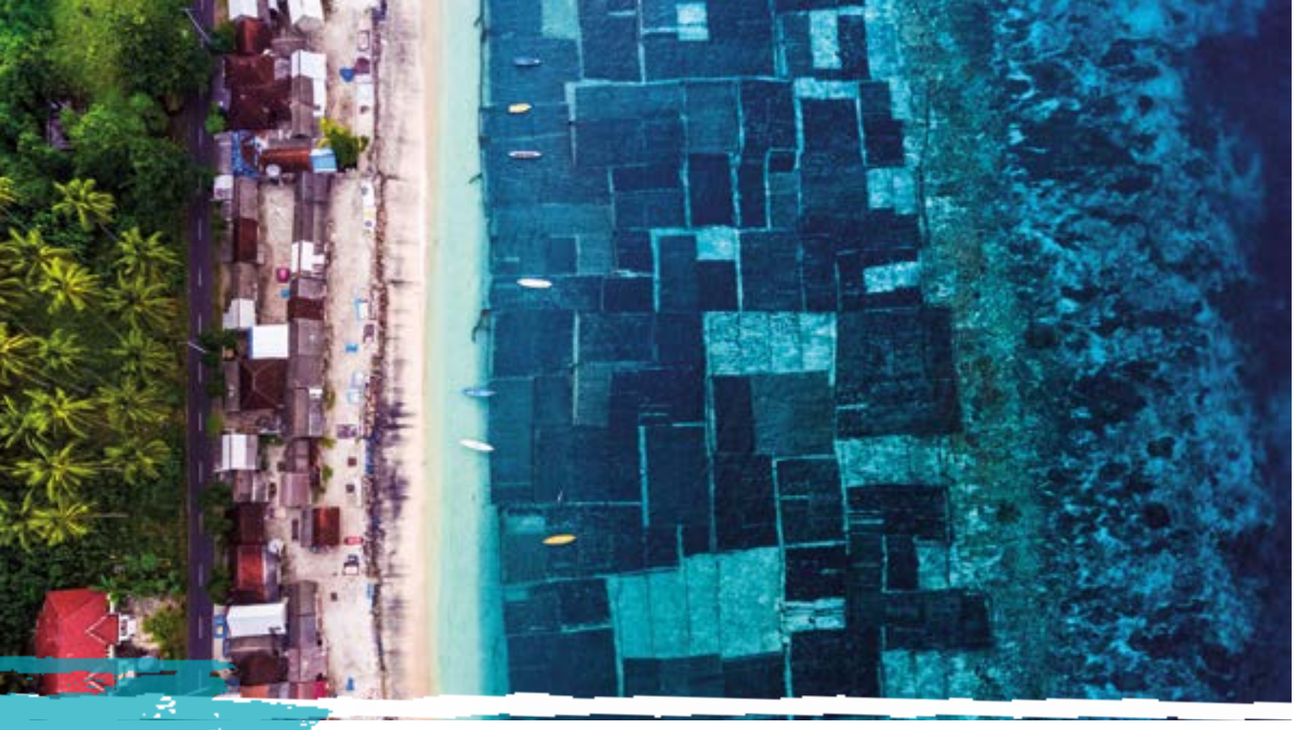
Sources: Population, gross national income (GNI) and Human Development Index (HDI) data from the 2016 Human Development Report[6]; gross domestic product (GDP) data from the World Bank[7].

(4) CTI-CFF (2015). CTI-CFF Senior Officials Endorse 2016 Programs of Work, Admit Brunei Darussalam. CTI-CFF Press Release: Available from http://nr.iisd.org/news/cti-cff-senior-officials-endorse-2016-programs-of-work-admit-brunei-darussalam/

(5) ASEAN Secretariat (2009). ASEAN Socio-Cultural Community Blueprint. Jakarta: ASEAN Secretariat. Available at http://www.asean.org/wp-content/uploads/images/archive/5187-19.pdf, accessed 20 September 2016.

(6) UNDP (2016). Human development Report 2016. New York: UNDP. Available at: http://hdr.undp.org/sites/default/files/hdr_2015_statistical_annex.pdf

(7) http://data.worldbank.org/indicator/NY.GDP.MKTP.CD



Seaweed gardens, Nusa Pendida, Indonesia. Seaweed production for food and other products is a major global industry, and tens of thousands of people farm seaweed throughout the Coral Triangle. The income from seaweed farming can provide an attractive alternative to subsistence fishing, and has been widely promoted as an alternative to destructive fishing and farming practices.

Tuna auction, Japan. Fisheries make an important contribution to the GDP of the Coral Triangle countries. High value fish such as tuna are especially important, but managing their stocks has proved difficult and some species have been fished close to economic extinction.

and coastal resources for income and food[8,9], with dependence highest in the Solomon Islands, where over 80 % of households are involved in fishing, both pre- and post-harvest sectors[10]. Indonesia, the Philippines and Papua New Guinea have the first, second and third largest populations of reef-fishers in the world.[11]

Fish is the dominant source of animal protein for 30 % of the population in the Coral Triangle, and makes up more than 50 % of the population's main animal protein in Indonesia and the Solomon Islands (Table 1.2)[12]. With a high dependence on natural resources and an increasing population, plus a large proportion of catch exported, it is likely that Coral Triangle countries will put increasing pressure on fishery resources[13].

1.1.3 Economy

The national economies of the Coral Triangle countries are highly dependent on natural resources, especially extractive industries, agriculture, fisheries and tourism[14]. Capture fisheries and aquaculture contribute between 1.2 % (Malaysia) and 6.8 % (Solomon Islands) of national GDP in the region, and make up over 10 % of the exports of PNG and the Solomons. The contribution of agriculture (which includes capture fisheries) to the GDP of Indonesia, Malaysia and the Philippines has decreased over the last half of the 20th century to between 10 % and 15 % as these countries become more industrialised, while in PNG and Solomon Islands agriculture still contributes 35 % to 40 % of GDP. Indonesia has embarked on a policy to greatly increase fisheries and aquaculture over the coming years as part of the 'Maritime Doctrine' of President Joko Widodo[15]. The Solomon Islands, where a subsistence economy still predominates, has the least developed economy of the six countries of the Coral Triangle (CT6)[16]. The economic importance of fisheries is summarised in Table 1.3.

The region welcomed 263 million tourists in 2014, earning EUR 290 billion. This is expected to increase, with the United Nations World Trade Organisation estimating that nature-based and adventure tourism are growing annually by between 10 % and 30 %, and currently account for up to 25 % of the world's tourist market. It also estimates that the revenue generated by nature-based tourism in the Coral Triangle was worth EUR 19 billion for the 2013-2014 period.

Table 1.2 Fish consumption in the Coral Triangle

Country	Fish supply, 2007 (million tonnes)	Per capita fish supply, 2007 (kg/person/year)	Fish protein as % of total animal protein	Fish protein as % of total protein
Indonesia	5.5	24	52	14
Malaysia	1.5	56	44	22
PNG	0.1	16	13	7
Philippines	3.1	35	45	19
Solomon Islands	0.02	34	76	22
Timor-Leste	0.004[i]	4.4	n/a	n/a

Source: ADB (2014).[17]
(i) 2004 data.

(8) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.
(9) Burke L., K. Reytar, M. Spalding and A. Perry (2012). Reefs at Risk Revisited in the Coral Triangle. World Resources Institute.
(10) Brewer T D., J.E. Cinner, A. Green and J.M. Pandolfi (2009). Thresholds and Multiple Scale Interaction of Environment, Resource Use, and Market Proximity on Reef Fishery Resources in the Solomon Islands. Biological Conservation 142, pp. 1797-1807; See also: Bell J.D., M. Kronen, A. Vunisea, W.J. Nash, G. Keeble, A. Demmke, S. Pontifex and S. Andrefouet (2009). Planning the use of fish for food security in the Pacific. Marine Policy 33, pp. 64-76.
(11) Asian Development Bank (2014). Op. cit.
(12) ASEAN Secretariat (2009). Op. Cit. and Burke L. et al. (2012). Op. cit.
(13) ibid
(14) Burke L. et al. (2012). Op. cit.
(15) S. Ferse pers. comm. and http://thediplomat.com/2014/11/jokowis-maritime-doctrine-and-what-it-means/
(16) Cohen P. J. and D. J. Steenbergen (2015). Social dimensions of local fisheries co-management in the Coral Triangle. Environmental Conservation 42 (3) pp. 278-288.
(17) Asian Development Bank (2014). Op. cit.

Table 1.3 Economic importance of fisheries in the Coral Triangle

Country	Contribution of fisheries to GDP (2007, %)	Export value of fishery products to all exports (%)	Employment (thousand people)	
			Fisheries	Aquaculture
Indonesia	2.4	1.9	2 169	749
Malaysia	1.2	0.4	99	n/a
PNG	3.4	10.0	5	n/a
Philippines	2.2	0.9	1 388	226
Solomon Islands	6.8	12.0	30	n/a
Timor-Leste	n/a	n/a	6	n/a

Source: ADB (2014).[18]

Tourism is an important economic activity in the region, contributing around 9 % to the GDP of Malaysia, the Philippines and the Solomon Islands.[19] Malaysia receives the fourth highest number of tourists per year globally, with an average of 17 million visitors. The contribution of tourism to the GDP of Timor-Leste is roughly 2 %, for Indonesia just over 1 %, and for PNG less than 1 %[20]. Indonesia's tourism sector is developing rapidly, with a 40 % increase in the number of tourists visiting per year between 2006 and 2010.[21]

Tourism based on coastal and marine environments is a major component of this market, and brings substantial economic benefits to the Coral Triangle, although this varies by country. Divers, snorkelers, beachgoers, kayakers and recreational fishermen support a multitude of local businesses, including dive shops, hotels, restaurants and transportation.[22] Furthermore, the tourists' use of coral reefs and corresponding ecosystems (mangroves, beaches, etc.) in some areas contributes directly to the management costs of marine parks and other forms of marine protected areas.

With an expanding middle class and the corresponding increase in disposable income, the number of visitors is projected to reach 535 million by 2030, and revenue to hit EUR 157.2 billion by 2035[23]. The income is not distributed equally however, and in PNG and the Solomon Islands tourism has so far failed to produce significant economic gain for local people[24] as they lack the capacity and funds to provide services for tourists or to invest in facilities (see section 4).

1.2 Key biodiversity features

1.2.1 Geography and climate

The Coral Triangle is a biogeographic region located along the equator, where the Java and Banda Seas mark the convergence of the Pacific and Indian Oceans, and the Indonesian throughflow provides a pathway for higher temperature, lower salinity water to move from the Pacific to the Indian Ocean. The Coral Triangle is subdivided into 16 ecoregions.[25]

(18) Asian Development Bank (2014). Op. cit.
(19) Plumpton R. (2015). Nature-based Marine Tourism in the Coral Triangle. Prepared by 2iis Consulting on behalf of WWF-Pacific.
(20) Ibid.
(21) Ibid.
(22) Ibid.
(23) Ibid.
(24) Hviding E. and T. Bayliss Smith (2000). Islands of rainforest: agroforestry, logging and eco-tourism in Solomon Islands. Ashgate, London, and S. Jupiter, pers. comm.
(25) Veron J.E.N. et al. (2009). Op. cit.

Reefs and seagrass beds off the coast of Siargao Island, Philippines. The Coral Triangle straddles the equator and is on the convergence of the Indian and Pacific Oceans. It has over 25 000 islands, 132 000 km of coastline, seamounts, deep-sea trenches and shallow seas. All of these features contribute to the region's exceptional biological and cultural diversity.

Much of the region is tropical in climate, with most coastal areas ranging in air temperature from 21 °C to 32 °C and humidity from 60 % to 80 %.[26] There are typically two monsoon seasons, the north-east (dry) and the south-west (wet) The duration and timing of these seasons varies across and within the countries. The Pacific Decadal Oscillation as well as inter-annual variations in monsoon seasons create considerable variability across the region, with total annual rainfall ranging from 997 mm to 9 000 mm[27,28]. Typhoons in northern PNG and the Philippines can cause significant damage to shallow corals, as can events such as the 2004 Indian Ocean tsunami in Indonesia.

1.2.2 Habitats and ecosystems

The Coral Triangle is characterised by a wide array of habitats and ecosystems. Coral reefs, mangroves and seagrass bed habitats have been referred to as 'an enchanted braid' since they are important, interlinked ecosystems[29]. These three ecosystems fringe the 132 800 km of coastline in the Coral Triangle[30,31] (Table 1.4). Coral reefs act as barriers to coastal erosion and can protect the coastline during storm surges. Mangroves and seagrass beds mostly grow in the calm, shallow waters inshore from the reefs, where they trap material carried by rivers, protecting the reef from excessive sedimentation, and protecting the coastline from erosion and storm damage. They also absorb excess nutrients, and serve as nurseries and habitat for fish and other reef species.

Other types of coastal and marine ecosystems not dealt with in more detail here are important for biodiversity. Coastal regions include tidal mudflats and estuaries, while marine ecosystems include seamounts, pinnacles and deep reef areas, which are hotspots of biodiversity and productivity. Upwelling areas and offshore waters are important to migratory species, such as tuna, billfish, cetaceans and sea turtle.

Coral reefs

Estimates of the area covered by coral reefs vary depending on the methodology used, but there may be 86 500 km² of coral reefs in the Coral Triangle (35 % of the global total[32]), the bulk of it in Indonesia (estimates range from ~20 000 to 51 000 km²),

(26) Asian Development Bank (2014). Op. Cit.
(27) Allen, G. R. (2007). Op. cit.
(28) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.
(29) Davidson O.G. (1998). The Enchanted Braid: Coming to Terms with Nature on the Coral Reef. Wiley. 296 pp.
(30) Green A.L. and P.J. Mous (2008). Delineating the Coral Triangle, its Ecoregions and Functional Seascapes. Version 5.0. TNC Coral Triangle Program Report 1/08. 44 pp.
(31) Asian Development Bank (2014) State of the Coral Triangle: Indonesia. Mandaluyong City, Philippines. Burke L. et al. (2012). Op. cit.
(32) Burke L. et al. (2012). Op. cit. Other estimates are up to 100 000 km² of coral reef in the Coral Triangle - see Table 1.4.

Shallow fringing reef, Solomon Islands. The Coral Triangle has between 85 000 and 100 000 km² of coral reef, just over a third of the global total. More than half of it is at risk or degraded.

Seagrass beds, Omadal Island, Malaysia. Seagrasses are flowering plants which grow in shallow seas where there is a suitable substrate. They are highly productive, and provide food to turtles, dugongs and many fish, as well as shelter for numerous species. Seagrass beds sequester large amounts of carbon.

followed by the Philippines, Papua New Guinea, Malaysia, the Solomon Islands and Timor-Leste (Table 1.4).[33] More than 85 % of reef ecosystems in the Coral Triangle are threatened with degradation or possible extinction from a multitude of factors, both terrestrial and marine, and 45 % are at high or very high risk[34].

Mangroves

Mangrove forests used to be extensive across the Coral Triangle but their cover has been reduced significantly in some countries (see section 2.1). Much of the Coral Triangle has over 35 species of mangroves.[35] Indonesia has the most extensive mangrove forest cover, at 35 337 km².

Seagrass

Most of the Coral Triangle has 12 to 15 species of seagrass. Seagrass beds reach their largest extent in shallow seas, and serve as feeding grounds for various species of fish, turtle and dugong, many of which are endangered.[36] They support economically important fisheries, such as the Solomon Islands' rabbitfish fishery.[37] They are also potential carbon sinks, and a number of 'blue carbon' programmes focus on the Coral Triangle[38]. To date, few assessments have been conducted on seagrass in the Coral Triangle, although a recent study in the Lesser Sunda ecoregion demonstrates the effective use of Landsat imagery and remote sensing techniques to derive eco-regional-scale seagrass maps in support of MPA network design[39].

1.2.3 Species diversity and endemicity

The complex coastlines of island archipelagos in the Coral Triangle provide a tremendous diversity of habitats, resulting in a diversity of fauna and flora[40]. While there is a greater focus on corals and coral reef-associated fish, the general biodiversity trends hold for other taxa as well (e.g. marine mammals, sharks and rays, mangrove and seagrass species, etc.).

Reef building corals (Zooxanthellate)

The Coral Triangle contains 76 % of the world's known coral species (605 out of a total of 798)[41], making it the region of highest coral diversity globally[42,43]. As a comparison, the Caribbean contains roughly 8 % of the world's coral species.[44]

(33) Asian Development Bank (2014). State of the Coral Triangle: Indonesia. Mandaluyong City, Philippines.
(34) Burke L. et al. (2012). Op. cit.
(35) http://ctatlas.reefbase.org/pdf/CT_Number_Mangrove_Species.pdf
(36) Asian Development Bank (2014). State of the Coral Triangle: Indonesia. Mandaluyong City, Philippines.
(37) Asian Development Bank (2014). State of the Coral Triangle: Solomon Islands. Mandaluyong City, Philippines.
(38) For example, http://www.grida.no/activities/193 and http://thebluecarboninitiative.org
(39) Torres-Pulliza D., J.R. Wilson, A. Darmawan, S.J. Campbell and S. Andréfouët (2013). Ecoregional scale seagrass mapping: A tool to support resilient MPA network design in the Coral Triangle. Ocean & Coastal Management 80, pp. 55-64.
(40) Burke L. et al. (2012). Op. cit.
(41) http://ctatlas.reefbase.org/coraltriangle.aspx
(42) Green A., N. Peterson, A. Cros and E. McLeod (2008). Coral Triangle Facts, Figures and Calculations: Patterns of Biodiversity and Endemism. The Nature Conservancy.
(43) Burke L. et al. (2012). Op. cit.
(44) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.

Table 1.4 Area of key physical features and ecosystems

Country	Total sea area (thousand km²)	Total coastline (thousand km)	Coral reef area (thousand km²)	Mangrove area (thousand km²)	Seagrass area (thousand km²)
Indonesia	5 800	109	51	35	30
Malaysia	614	5	4	6	n/a
PNG	3 120	17	14	4	n/a
Philippines	2 000	37	26	2	1
Solomon Islands	1 340	4	4	0.6	0.1
Timor-Leste	n/a	0.7	0.1	0.02	0.02

Source: ADB (2014).[45] n/a: data not available.

Individual reefs contain up to 280 species per hectare, over four times the total coral diversity of the entire Atlantic Ocean[46]. The Bird's Head Peninsula of Indonesia, which includes the Raja Ampat Islands, contains the highest known coral diversity in the region, hosting 574 species.[47] The Coral Triangle region has 15 endemic coral species and shares 41 regional endemic species with the rest of Asia[48]. Centres of endemism include the Sulu Sea and North Lesser Sunda Islands/ Savu Sea in Indonesia, and Milne Bay in Papua New Guinea.[49]

(45) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.
(46) Turak E. and L. DeVantier (in press). Biodiversity and conservation priorities of reef-building corals in the Papuan Bird's Head Seascape. In Katz L.S., A. Firman and M.V. Erdmann (Eds.). A Rapid Marine Biodiversity Assessment of Teluk Cendrawasih and the FakFak-Kaimana Coastline of the Papuan Bird's Head Seascape Indonesia. RAP Bulletin of Biological Assessment. Conservation International, Washington, DC.
(47) Veron J.E.N. et al. (2009). Op. cit.
(48) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.
(49) Ibid.

Dolphins in the Philippines. The Coral Triangle has important populations of many marine mammals, including blue and sperm whales and dugong.

Coral reef and other fish

The Coral Triangle contains the highest diversity of coral reef fish in the world – roughly 2 200 species, which is 55 % of Indo-Pacific reef fish[50] or 37 % of the global total. Of these, 235 species (8 %) of coral reef fish are endemic to the Coral Triangle or are locally restricted. Although this is a large number of endemic species, the proportion of endemics in the Coral Triangle is lower than in some other coral regions due to the high total number of species present. Indonesia (especially the Lesser Sunda islands and the Bird's Head Peninsula), the central Philippines and Papua New Guinea through to the Solomon Islands have some of the highest numbers of endemic reef fish species in the world.[51] Pelagic and non-reef inshore fish species have a lower overall diversity, but play a particularly important role for local people, who rely on small pelagic fish and those caught by bagan (lift net) fisheries for food or income. The Coral Triangle is a highly productive area for the breeding of many tuna species as well.

Invertebrates

Most invertebrates are not known at the species level[52], but molluscs, crustaceans and other phyla exhibit high diversity, although this is not necessarily directly linked with reef diversity within the Coral Triangle but rather with habitat diversity[53]. Many invertebrate taxa live in shallow, near-shore habitats such as mangroves and seagrass, which have high diversity in the Coral Triangle[54]; many are also threatened, such as the sea cucumber species, which are a staple in diets across Asia and thus heavily fished.

Marine mammals

Cetaceans (including blue and sperm whales), the endangered dugong and other large marine fauna have significant populations in the Coral Triangle, but they face threats from shipping, fishing and illegal hunting[55]. They are critical to many cultures in the region, have huge tourism potential, and are important ecologically as top predators or as large lower order predators.

Chondrichthyans (sharks, rays, skates)

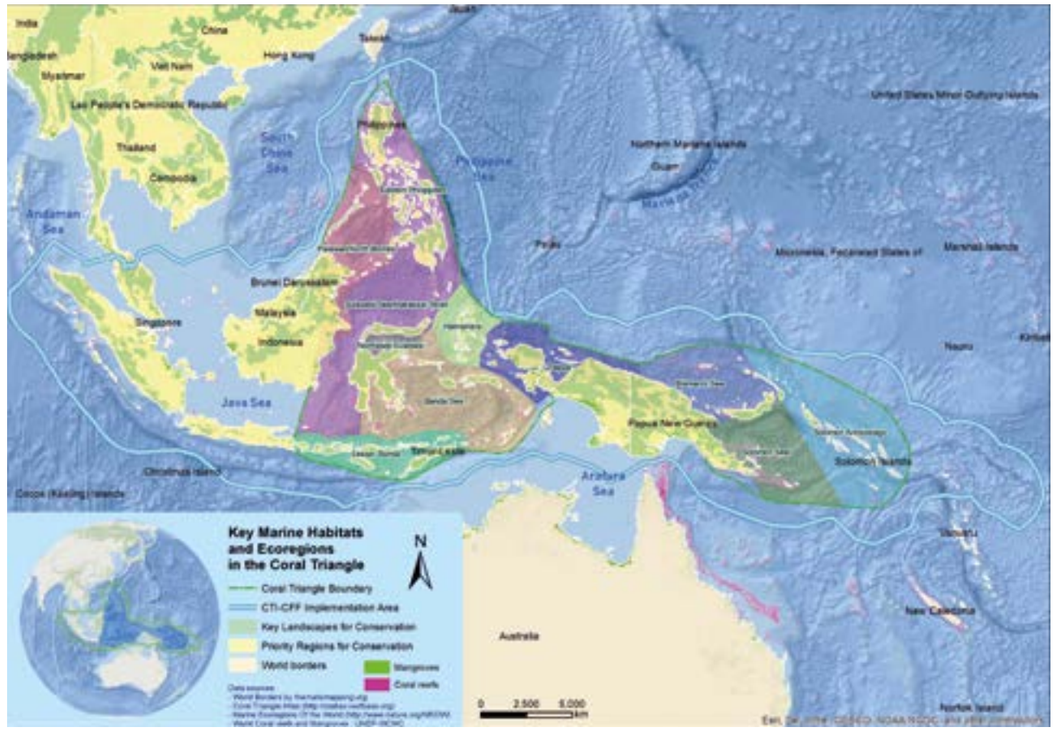
Asia, particularly East Asia, South-East Asia and South Asia, encompassing five distinct large marine ecosystems[56], is very important for chondrichthyan conservation, from the standpoint of biodiversity, fisheries and trade, as well as for consumer and market demand from many countries, such as China, Indonesia, Korea, Malaysia and Singapore. A new 10-year global conservation strategy for these fish, compiled by conservation and chondrichthyan experts[57], identifies a range of needs and priorities for reversing the decline of these species in Asia.

Marine turtles

Six of the world's seven marine turtle species are found in the region, including the critically endangered hawksbill and leatherback turtles.

(50) Allen G.R. (2007). Op. cit.
(51) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.
(52) Meyer C., J.B. Geller and G. Paulay (2005). Fine scale endemism on coral reefs: archipelagic differentiation in turbinid gastro-pods. Evolution 59, pp. 113-125.
(53) Briggs J. (2005). Coral reefs: conserving the evolutionary sources. Biological Conservation 126, pp. 297-305.
(54) Spalding M., M.L. Taylor, C. Ravilious and E.P. Green (2003). Global overview. The distribution and status of seagrasses. In Green E.P. and F.T. Short (Eds.). World atlas of seagrasses. University of California Press, Berkeley, California, pp. 5-26.
(55) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.
(56) Five large marine ecosystems (LMEs) have been delineated in the tropical-subtropical Asian Seas: Bay of Bengal, Gulf of Thailand, South China Sea, Sulu-Sulawesi Sea and Indonesia Sea.

Figure 1.2 Key marine habitats and ecoregions of the Coral Triangle.



conservation strategy for these fish, compiled by conservation and chondrichthyan experts[57], identifies a range of needs and priorities for reversing the decline of these species in Asia.

Marine turtles

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1.2.4 Geographic priorities for conservation

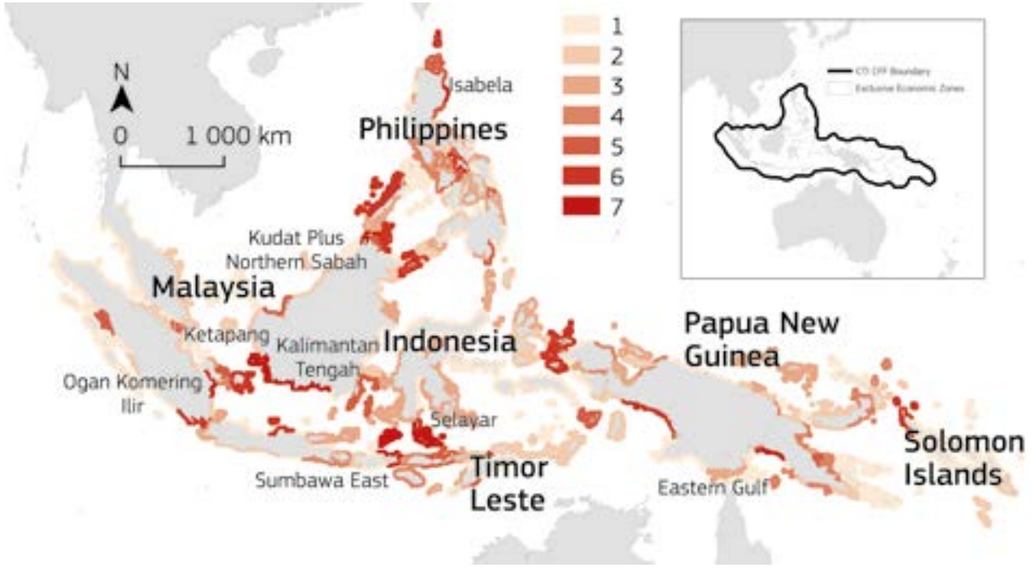
Multiple thematic and geographic priorities for conservation activities have been identified in the region, relating to MPAs, ecosystem approaches to fisheries management and climate change adaptation[58]. 'Seascapes' or 'Ecoregions' are used to integrate fisheries and MPA management, recognising that ecological connectivity often transcends political boundaries.[59] Three approaches to identifying and prioritising these areas are described in the following sections.

One exercise[60] identified and delineated 11 ecoregions across the Coral Triangle, defined as "large areas containing geographically distinct assemblages of species, natural communities and environmental conditions" (Figure 1.2). This analysis could be the basis for conducting ecoregional conservation assessments to identify priority areas for conservation. Note that the analysis excludes western Indonesia, which is within the Coral Triangle implementation area but outside the Coral Triangle scientific boundary.

A second study[61] identified broad-scale priority areas for achieving a set of six objectives, which were drawn from existing

(57) Bräutigam A., M. Callow, I.R. Campbell, M.D. Camhi, A.S. Cornish, N.K. Dulvy, S.V. Fordham, S.L. Fowler, A.R. Hood, C. McClennen, E.L. Reuter, G. Sant, C.A. Simpfendorfer and D.J. Welch (2015). Global Priorities for Conserving Sharks and Rays: A 2015-2025 Strategy.
(58) Coral Triangle Support Partnership (CTSP) (2013). Year 5 Semi-Annual Report. Prepared for the United States Agency for International Development (USAID).
(59) CTI (2014). Summary Activity Report: 1st Regional Exchange on Seascapes. Manila, Philippines.
(60) Green A.L. and P.J. Mous (2008). Op. cit.
(61) Beger M., J. McGowan, E.A. Treml, A.L. Green, A. White, N.H. Wolff, C.J. Klein, P.J. Mumby and H.P. Possingham (2015). Integrating regional conservation priorities for multiple objectives into national policy. Nature communications, DOI: 10.1038/ncomms9208

Figure 1.3 Multi-objective priorities in the Coral Triangle. Locations where multiple conservation objectives were met (e.g. ecosystem representation, threatened fauna, connectivity and climate change); the darker red indicates more objectives were met.



regional goals: represent marine habitats; protect reefs likely to experience less mortality from predicted climate change impacts; preserve critical fish spawning in aggregation sites (based on existing data for groupers); preserve habitats and migration corridors for threatened sea turtles; maximise larval dispersal among reefs for coral trout; and maximise larval dispersal among reefs for sea cucumbers. The prioritisation used two approaches: identification of **multi-objective hotspots**, areas that are reasonably good for achieving benefits for a number of objectives (Figure 1.3), and **complementary priority areas** that achieve the highest possible benefits for a single or few objectives. The second analysis is adopted as the basis for key seascapes for conservation areas (section 5.1).

Results suggest that areas of significant priority include parts of the Sulu-Sulawesi seascape (e.g. northern Visayas in the central Philippines, northern Borneo/ southern Palawan), southern Borneo, the Bird's Head Seascape in West Papua Province, the Bismarck Sea around Manus and the Lesser Sundas/ Selayar and Banda Islands.

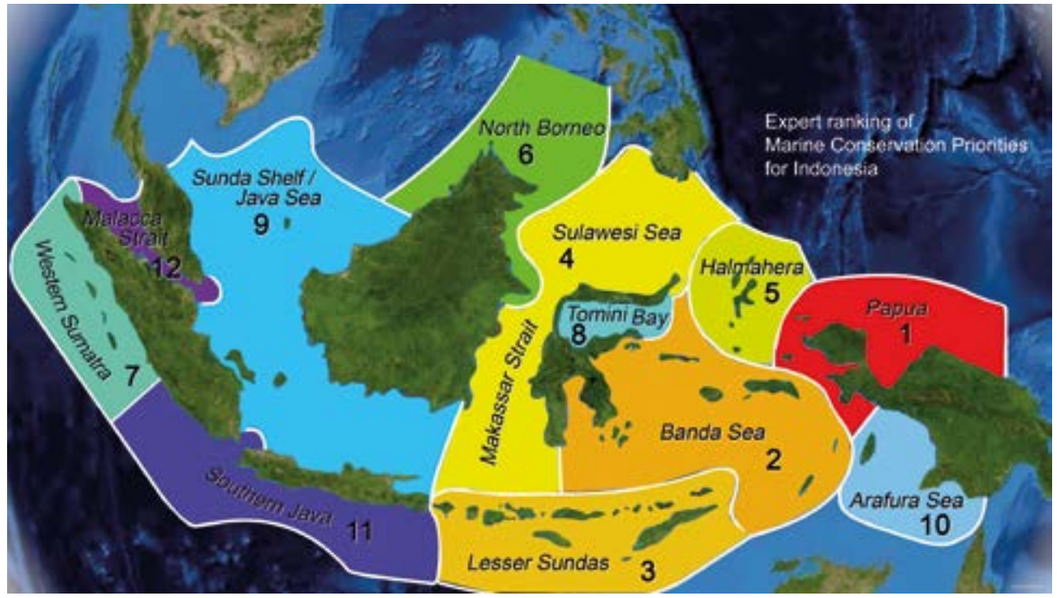
The next steps for this geographic prioritisation would be to update these regional priorities with better data and updated management information, because a lack of data for the peripheral areas of the Coral Triangle has possibly resulted in disproportionate concentrations of conservation priorities in the central parts of the area[62].

Thirdly, a separate Indonesian prioritisation exercise used quantitative data on the patterns of species richness and endemism compiled via an electronic expert opinion questionnaire[63]. Twenty-one experts on Indonesian marine biodiversity provided information on their respective taxonomic area of expertise for each of Indonesia's 12 marine ecoregions and then ranked Indonesia's ecosystems for marine biodiversity conservation investment (Figure 1.4). These results represent hundreds of cumulative years of biodiversity fieldwork across the archipelago, but do not include other elements used in conservation prioritisation such as productivity, costs and other social aspects. Ranking approaches to prioritisations also ignore inter-dependency among ecosystem components and species, and they neglect areas that might be less diverse but harbour unique or rare species.

([62]) Asian Development Bank (2014). State of the Coral Triangle: Indonesia. Mandaluyong City, Philippines.
([63]) Huffard C.L., M.V. Erdmann and T.R.P. Gunawan (Eds.) (2012). Geographic Priorities for Marine Biodiversity Conservation in Indonesia. Ministry of Marine Affairs and Fisheries and Marine Protected Areas Governance Program. Jakarta, Indonesia. 105 pp.

Mangrove prop roots, Raja Ampat, Indonesia. Mangroves grow in shallow inshore waters, forming a barrier between land and ocean. They protect reefs from sedimentation, and the coastline from erosion and storm damage. They also absorb excess nutrients, and serve as nurseries and habitat for fish and other reef species. There are nearly 50 000 km² of mangroves in the Coral Triangle.

Figure 1.4 Expert ranking of marine conservation priorities for Indonesia



Note: numbers in each ecoregion denote their overall ranking, 1 = highest priority for conservation investment. Source: Huffard et al (2012): Op. cit.

2

Conservation challenges

The pygmy seahorse, Hippocampus bargibanti, *measures less than 2 cm and only lives on a specific type of gorgonian (sea fan), which it closely resembles. The species was first described in 1970. Since then, a handful of other species of pygmy seahorse have been found, but knowledge of their distribution and taxonomy is very incomplete, as it is for many marine animals and plants.*

2 _ Conservation challenges

Overfishing, coastal development, land-based pollution (primarily caused by agriculture or logging), marine-based pollution and climate change threaten the future of marine and coastal resources in the region.[64]

Sea cucumber (Bohadscia sp.), Indonesia. Many species of sea cucumbers are exploited for food and medicinal properties, with a large market across Asia. The commercial trade has resulted in over-exploitation and local extinction of sea cucumbers in some areas.

Plastic waste on a remote island in the Coral Triangle. Eight million tonnes of plastic enters the world's oceans every year, harming reefs, marine life and the tourism sector. The problem is caused by poor waste management in growing coastal towns and tourist centres, and changing consumer habits. Indonesia and the Philippines have been identified as two of the biggest polluters.

2.1 Key direct threats

2.1.1 Overfishing, destructive fishing, and illegal, unreported and unregulated fishing

Overfishing is a ubiquitous threat throughout the region, and may be the single most important cause of poverty. Destructive fishing, defined as fishing with the use of explosives or cyanide, threatens 60 % of reefs in the region. When overfishing is considered in addition to destructive fishing, nearly 85 % of reefs are threatened[65]. These threats are most intense in the Philippines, Malaysia, Indonesia and Timor-Leste[66], where they affect essentially all reefs, while pressure is less in the Pacific nations (PNG and the Solomon Islands) due to their remote location and lower population densities.

Illegal, unreported and unregulated (IUU) fishing is an important issue throughout the Coral Triangle (and more widely in Asia) for both the near-shore/ small-scale and the commercial/ large-scale fishing further offshore[67]. Species that are overfished include pelagic ones, such as tuna, shark, ray and turtle, and near-shore reef fish species like the Napoleon wrasse. Three commercially important species of tuna found in Coral Triangle, the bigeye, Pacific and southern bluefin, are overfished, while yellowfin tuna is at or near the limit of sustainable exploitation. Overall, skipjack tuna populations remain in healthy condition but are under heavy fishing pressure in the Philippines and Indonesia (as well as Vietnam). In addition, unregulated catches of juvenile tuna in the Philippines and Indonesia continue to undermine regional sustainability efforts.[68]

The Coral Triangle's globally important populations of shark and ray are also threatened – Indonesia ranks first in the world for the capture of chondrichthyan fish (shark, ray and skate) – and the threat from over-fishing is exacerbated by illegal trade and direct consumption of meat, oils and fins; by-catch from trawlers, longlines and gillnets; and from habitat destruction as a result of coastal and industrial development, pollution, and climate change.[69]

Fish are not the only targets of intense commercial harvest. Sea cucumber populations are being decimated in the Coral Triangle as they are overexploited to feed an ever-increasing demand in China, where they are eaten as a delicacy and used in traditional medicine.[70]

2.1.2 Coastal development

Unsustainable development in the coastal zone, including human settlements, industrial and tourism-related development, infrastructure including blocking of estuaries and rivers for road construction, draining and filling of coastal habitats, and mining of coral to make cement and aquaculture, results in loss of coastal and marine habitats, sedimentation and pollution of marine ecosystems[71]. Seagrass beds and mangrove forests have been greatly reduced in many parts of the Coral Triangle, with an estimated 75 % loss in mangrove forest cover due to coastal development, although better and more recent data is needed on both seagrass beds and mangroves. Further coastal development is expected as the six Coral Triangle countries continue to industrialise and pursue economic development[72]. Coastal development threatens more than 30 % of Coral Triangle reefs, with 15 % under high threat.[73]

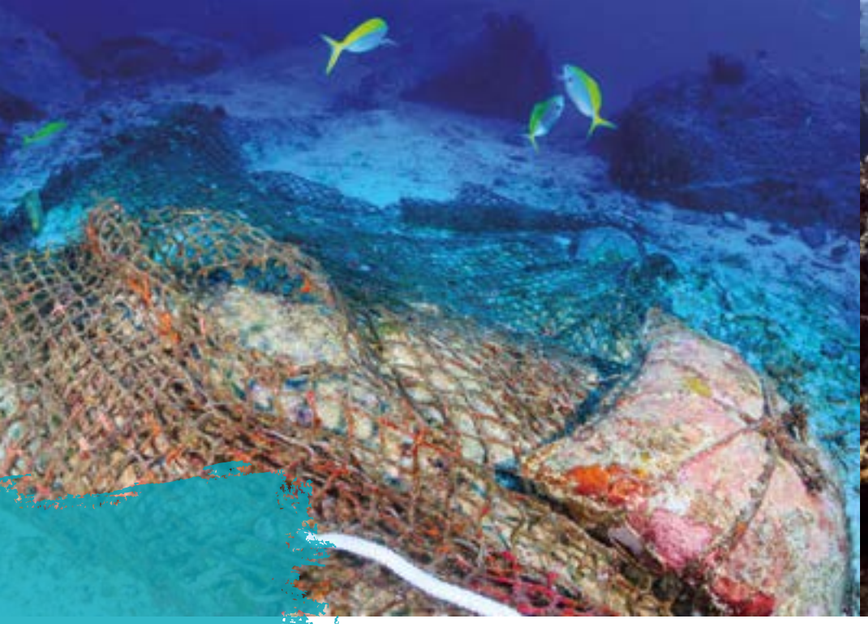
2.1.3 Watershed-based pollution

Watershed-based pollution, resulting from destructive land-use practices such as deforestation, agrochemical loading and mining, threaten more than 45 % of reefs within the Coral Triangle. Demand is increasing for land-based agricultural and mining products, such as palm oil and rare earth metals. Intensive and large-scale commercial agriculture continues to expand, particularly in Indonesia and Papua New Guinea, where some areas are being deforested rapidly for palm oil plantations, mining, and oil and gas extraction. Urban sprawl and expanding agriculture are prominent concerns in the Philippines, Indonesia and Malaysia, while pollution from poor drainage systems and inadequately designed infrastructure and logging, particularly in Pacific island countries such as the Solomon Islands, are also of concern. Marine litter is a growing problem, with Indonesia and the Philippines among the top three countries for ocean plastic pollution.[74,75]

2.1.4 Marine-based pollution and damage

Coastal, maritime and shipping industries (including commercial, recreational and passenger vessels) threaten marine life with contaminated bilge water, sewage, solid waste, fuel leakages and invasive species. Additionally, coral reefs can suffer damage from frequent anchoring, groundings and oil spills.[76] An estimated 4 % of coral reefs in this region face significant threat from marine-based sources of pollution and damage. Furthermore, mining for minerals, as well as for oil and gas, is moving increasingly offshore. Gas liquefaction plants are being developed in areas of Papua New Guinea and in Luwuk, Sulawesi, associated with sea-floor drilling around the Banggai Islands in Indonesia. Iron-ore rich sands from the seabed around Siau, North Sulawesi are being mined and the Sunrise gas and condensate fields between Timor-Leste and Australia are under development[77].

(64) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.
(65) Burke L. et al. (2012). Op. cit.
(66) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.
(67) http://www.fao.org/docrep/005/y3274e/y3274e09.htm
(68) ISSF 2016: http://iss-foundation.org/about-tuna/status-of-the-stocks/; SPC presentation, West Pacific East Asia Project annual meeting, Vietnam 2015 (Jose Ingles, pers. comm.).
(69) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.
(70) Anderson S.C., J.M. Flemming, R. Watson and H.K. Lotze (2011). Serial exploitation of global sea cucumber fisheries. Fish and Fisheries 12, pp. 317-339.
(71) Burke L. et al. (2012). Op. cit.
(72) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.
(73) Burke L. et al. (2012). Op. cit.
(74) Ibid.
(75) McKinsey & Company and The Ocean Conservancy (2015). Stemming the Tide: Land-based strategies for a plastic-free ocean. Available at http://www.oceanconservancy.org/
(76) Burke L. et al. (2012). Op. cit.
(77) CEPF (2014). Wallacea Biodiversity Hotspot Ecosystem Profile. Available at https://www.cepf.net/.



Abandoned nets and other marine garbage present a threat to fish, turtles, marine mammals and other marine life.

Bleached coral, Solomon Islands. Reefs become bleached when the symbiotic algae that live within the coral polyps are killed by warm water. Warming is happening more frequently because of climate change. Corals can recover from occasional, mild bleaching events if they are not also suffering from sedimentation or pollution.

Tropical fish and corals in an aquarium. Indonesia and the Philippines supply more than 90 % of ornamental corals and about 70 % of tropical reef fish. Some trade is certified, but most is damaging because it over-exploits target species, changing the balance of species in the reef ecosystem, and because cyanide used to stun fish leads to the death of surrounding corals.

2.1.5 Climate change

Global climate change represents both a direct threat and a driver of threats to the region. As a direct threat, climate change causes warming of the atmosphere and ocean, which causes coral bleaching and more frequent and severe weather patterns like typhoons and cyclones, resulting in damage to the coastal zone. Severe coral bleaching events have already occurred in Indonesia, Malaysia and the Philippines.[78] Moderate levels of thermal stress and bleaching were reported in eastern Papua New Guinea and the Solomon Islands early in 2015.[79] Corals can recover from mild bleaching events, but in combination with other factors such as those described above, climate change-related processes present a serious risk of permanent damage[80].

Ocean acidification occurs because increased concentration of carbon dioxide in the atmosphere leads to increased adsorption of carbon dioxide into seawater, and thus increased formation of carbonic acid. This presents a serious risk to coral and other shell-forming invertebrates (e.g. oyster, clam, crab, shrimp and lobster) because it inhibits their ability to use calcium carbonate to build their shells and/or exoskeleton. Coral skeletons form the physical reef system at the base of many marine food chains, so ocean acidification could severely impact entire fisheries, not just the reefs[81].

The indirect effects of climate change will include displacement of human populations and land use, increasing rainfall intensity and greater sediment loads. These will impact in complex ways with the management and exploitation of marine resources.

2.2 Drivers of threats

Drivers of the threats described in the preceding section include poverty, corruption, weak government institutions, low education rates and cultural challenges. Rapidly expanding populations, economic development and international trade, coupled with climate change-related impacts, are causing increased pressures on marine and coastal resources.[82]

2.2.1 Global demand for fish and other agricultural products

Globally, fish consumption over the last five decades has been steadily increasing.[83] Fish trade in the Coral Triangle has followed a similar pattern, with the value of traded fish increasing by 50 % over a 4-year period – a rate unsustainable in the longer term. There is rapidly increasing demand in Japan, China, Europe and the United States of America for resources such as tuna, live reef fish, sea cucumber and shrimp.[84] Supplying these markets is a multimillion-dollar industry in the Coral Triangle.

The global demand for live ornamental fish and corals is also increasing. Indonesia and the Philippines together supply >90 % of the ornamental corals and ~70 % of the marine ornamental fish traded.[85] The live reef fish trade is particularly destructive because in addition to overfishing target species, the use of cyanide to stun and capture the fish damages the surrounding reef system. The removal of fish species that graze on algae then allows harmful algal overgrowth, which can kill corals.[86]

Global demand for shrimp is also increasing, and is supplied from farms that are frequently developed at the expense of mangroves.

2.2.2 Human population growth

A significant driver of overfishing and coastal development is increased population and associated increase in resource use. Nearly one-third of people in the Coral Triangle rely on fish and other marine resources as their primary protein, the consumption of which has steadily increased over the last 20 years. Increased consumption of seafood coupled with steady population growth in the CT6 means that demand is expected to continue to increase from within the region and beyond[87]. The high rates of poverty among fishers and their families, and a lack of alternative livelihoods or supplemental forms of income drives fishing-dependent communities to overharvest or engage in illegal or destructive fishing.

(78) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.
(79) Eakin C.M., G. Liu, A.M. Gomez, J.L. De La Cour, S.F. Heron, W.J. Skirving, E.F. Geiger, K.V. Tirak and A.E. Strong (2016). Global Coral Bleaching 2014-2017: Status and an Appeal for Observations. Reef Encounter 43 31(1), pp. 20-26.
(80) Burke L. et al. (2012). Op. cit.
(81) Ibid.
(82) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.

(83) Food and Agriculture Organisation (FAO) (2014). The State of World Fisheries and Aquaculture: Opportunities and Challenges. Food and Agricultural Organisation of the United Nations, Rome, Italy.
(84) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines
(85) While old, (relative) numbers have not much changed since this report (S. Ferse, pers. comm.), see also Wabnitz C., M. Taylor, E. Green and T. Razak (2003). From Ocean to Aquarium. UNEP-WCMC, Cambridge, UK.
(86) Asian Development Bank (2014). State of the Coral Triangle: Solomon Islands. Mandaluyong City, Philippines, and S. Jupiter pers. comm.
(87) Asian Development Bank (2014). Op. Cit.

Indonesian marine police patrolling for poachers. Although policies and regulations have improved, enforcement across the waters and islands of the Coral Triangle is a huge challenge. Collaboration between government agencies, NGOs and communities has helped to overcome some of the shortfall in capacity and resources.

Local fisherman and commercial vessels, Indonesia. Industrial fishing activity is often in conflict with small-scale local fishing, but it can be difficult for local communities to influence the granting of licences for commercial trawling or the policing of illegal fishing, even though it directly impacts their livelihoods.

2.2.3 Governance and capacity

The ability of government agencies to plan and manage their marine resources sustainably is limited across the region. Overall, Malaysia has the most effective governance and capacity; Indonesia and the Philippines have moderately high capacity at central government level, but less at a provincial or district level where decisions are made and permits issued; and PNG and the Solomon Islands have inadequate capacity. Struggles with weak governance and corruption highlight the need for governance reforms, regional cooperation and exchange among the countries, knowledge management and socioeconomic incentives aligned with environmental sustainability.[88]

At community level, there are also challenges with capacity to manage resources, and to access and use the information that is available from external sources. Education and access to technical resources is a foundation for safeguarding resources and sustainably managing fisheries[89], as it improves the understanding of risks and harmful behaviours, informs communities about management approaches that have proven to be successful, and increases communities' capacity to adapt to changes and threats in their environment. Education also provides opportunities in fishing-dependent communities for employment outside the fishing sector, alleviating pressure on marine resources and reducing reliance on the industry to provide employment.[90] Educating women is of critical importance, as they play a crucial role in the food security of households, with women's educational attainment correlated with reduced malnutrition in children and a range of other development indicators relating to poverty and reduced birth rates[91].

Access to formal and informal education is limited in many isolated small island and coastal communities throughout the region, but even where there is access, a criticism of the education systems of some Coral Triangle countries is that they do not teach students to solve problems and apply knowledge in different settings.

(88) Asian Development Bank (2014). Op. Cit.
(89) Burke L. et al. (2012). Op. cit.
(90) Abraham A. (2015). Stock-take of CTI-CFF Programs and Projects: Strategic Review of Progress and Future Directions. ADB/CTI-CFF Interim Regional Secretariat Jakarta, Indonesia.
(91) Smith L.C. and L. Haddad (2000). Overcoming child malnutrition in developing countries: past achievements and future choices: A 2020 vision for food, agriculture, and the environment. Washington, DC: International Food Policy Research Institute.

2.2.4 Conflict between formal and customary systems of resource allocations and management

The Coral Triangle is home to diverse cultural contexts, each shaping the use, management and control over marine resources (see section 3.2). Customary systems of management still operate in all of the Coral Triangle countries, but the degree to which these have been recognised and accommodated within formal legal frameworks varies. Pacific nations (PNG, Solomon Islands) use customary marine management and tenure as a basis for their regulations, while the South-East Asian countries (Indonesia, Timor-Leste, the Philippines, Malaysia) have developed regulations independently of customary systems[92,93]. As a result, the PNG and Solomon Islands operate systems aligned with customary tenure and approaches, while the South-East Asian countries' fisheries are effectively open-access with rights distributed among corporate interests and the tourism economy[94]. The Asian countries have rarely recognised traditional or customary systems of natural resource management, although Indonesia's Law 1/2014 aims to change this situation in favour of 'traditional' communities, and the Philippines has given considerable recognition to local rights (see section 3.2). The conflict between customary and official systems of resource management has undermined the effectiveness of both and resulted in unregulated exploitation.

(92) Asian Development Bank (2014). State of the Coral Triangle: Solomon Islands. Mandaluyong City, Philippines; S. Jupiter pers. comm.
(93) Cohen P. J. and D. J. Steenbergen (2015). Social dimensions of local fisheries co-management in the Coral Triangle. Environmental Conservation 42 (3) pp. 278-288.
(94) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.

3

Ongoing conservation efforts

Mangrove forest, Indonesia. Although large areas of mangrove forest have been cleared, this is still one of the Coral Triangle's most important ecosystems, providing vital products and services for local livelihoods. Governments and communities have recognised this role, and there are many examples of mangrove protection and rehabilitation throughout the Coral Triangle.

3 _ Ongoing conservation efforts

3.1 Government policies and programmes

3.1.1 Institutions for conservation

Each Coral Triangle country has at least one government ministry responsible for the management and enforcement of natural resource laws that govern marine resources. The most relevant and prominent agencies involved in coastal and marine management and their areas of focus are summarised in Table 3.1, while the overall functions and policies for marine resource management are described below.

Indonesia

The governance of natural resources is highly centralised, despite moves toward more decentralisation in the last decade. The national Ministry of Marine Affairs and Fisheries and the Ministry of Environment and Forestry are responsible for the development of policy and enforcement of laws on marine resources. Additionally, at least 9 line departments, 3 state ministries, 1 coordinating ministry, 4 non-departmental government agencies, and 1 inter-ministerial council are involved in national-level coastal management.[95]

The management of coastal waters is divided among the district, provincial and national governments. Districts have control over coastal waters out to 4 nautical miles, provinces from 4 to 12 nautical miles, and the national government from 12 to 200 nautical miles but, nevertheless, jurisdictional overlap and conflict sometimes occur, particularly between subnational and national governments[96]. Furthermore, enforcement has been a challenge given a general lack of resources and poor coordination.

Indonesia has 17 natural resource laws and regulations that pertain to the conservation and management of marine and coastal resources: 15 on natural resource management and ocean activities, and 2 national laws on the ratification of international conventions. There is a specific Coastal Zone and Small Islands Management Act (Law 27/2007, revised as Law 1/2014) as well as various policies concerning fishing, mining, tourism, forestry and transportation[97]. The Government of Indonesia has in recent years increased focus on and allocation of resources to address illegal, unreported and unregulated fishing.

Malaysia

At least 5 federal departments and 3 ministries are responsible for marine biodiversity management and conservation in Malaysia[98,99]. In 2004, a new federal Ministry of Natural Resources and Environment was formed, which has improved coordination and cooperation among agencies related to environment and natural resources.[100] Malaysia has numerous federal laws and national policies that address marine and coastal resource management, including the Fisheries Act 1985, the Malaysian Maritime Enforcement Agency Act 2004, the Wildlife Protection Act 2010, and the National Biodiversity Policy 1998. Malaysia's federal system gives broad powers to the state governments in Sabah, Sarawak and the Peninsula States, with weak coordination at national level, and this creates issues of jurisdictional overlap at the state and federal level[101]. State policies generally follow their federal counterparts, although the State of Sarawak (part of the semi-autonomous region of Borneo) has enacted an independent biodiversity policy. Sabah, also part of Borneo, has enacted a number of state laws pertaining to resource management, including the Environment Protection Enactment 2002 and Sabah Biodiversity Enactment 2000.

Papua New Guinea

Several national laws govern marine resources in PNG[102,103], and 4 institutions (see Table 3.1) at the national level have the authority for establishing policies for protecting and regulating the use of the marine environment[104]. The country has 11 national laws that pertain to the governance of oceanic resources: i.e. Customs Recognition Act, Environment Act,

(95) Asian Development Bank (2014). State of the Coral Triangle: Indonesia. Mandaluyong City, Philippines.
(96) Conservation and Community Forum (CCIF) (2013). Country Report: Indonesia – Assessment of the Enabling Conditions for Rights-Based Management of Fisheries and Coastal Marine Resources.
(97) Ferrol-Schulte D., P. Gorris, W. Baitoningsih, D.S. Adhuri and S.C.A. Ferse (2015). Coastal livelihood vulnerability to marine resource degradation: A review of the Indonesian national coastal and marine policy framework. Mar Pol 52, pp.163-171. See also Burke L. et al. (2012). Op. cit.
(98) Asian Development Bank (2014). State of the Coral Triangle: Malaysia. Mandaluyong City, Philippines.
(99) Government of Malaysia (2010). State of the Marine Environment Report. Malaysia Ocean Policy (2010-2020). National Oceanography Directorate, Ministry of Science, Technology and Innovation, Malaysia, Kuala Lumpur.
(100) Ministry of Natural Resources and Environment (2006). Biodiversity in Malaysia. Conservation & Environmental Management Division. Ministry of Natural Resources & Environment, Kuala Lumpur. Malaysia. 32 pp.
(101) Plumpton R. (2015). Op cit.
(102) Burke L. et al. (2012). Op. cit.
(103) Asian Development Bank (2014). State of the Coral Triangle: Papua New Guinea. Mandaluyong City, Philippines.
(104) National Plan of Action (2010). PNG Marine Program on Coral Reefs, Fisheries, and Food Security 2010-2013. Department of Conservation and Environment; National Fisheries Authority.

Table 3.1 Primary government agencies involved in coastal and marine resource management and enforcement

Country/agency	Mandate
Indonesia	
Ministry of Marine Affairs and Fisheries (MMAF)	Responsible for overall management of coastal and marine resources, including policy development and implementation.
Ministry of Environment and Forestry	Manages protected areas/ reserves/ parks (terrestrial and some marine, which eventually will all be transitioned to MMAF); manages forests, which include mangroves, manages trade of endangered plant and animal species.
Ministry of Energy and Mineral Resources	Regulates mining activities, including coastal areas.
Ministry of Trade and Industry	Regulates industrial development in the coastal zone and oversees trade activities of marine and coastal resources, including endangered species.
Malaysia	
National Council on Biodiversity and Biotechnology of the Ministry of Nat-ural Resources and Environment	Principal agency governing conservation and management of marine biodiversity. Includes Department of Forestry, which is responsible for mangroves and coastal forest management.
Ministry of Agriculture (Department of Fisheries)	Responsible for the development and implementation of modernisation strategies for the fisheries sector.
Prime Minister's Department (Environmental and Natural Resource Economics Division of the Economic Planning Unit)	Responsible for leading and coordinating national-level resource management for better sustainability and effectiveness.
Ministry of Science, Technology and Innovation	Responsible for innovation, research and technology for societal well-being and prosperity. Involved in the development of fishery-related technologies.
Papua New Guinea	
Conservation and Environment Protection Authority	Responsible for the protection of the physical environment and also ensuring the protection and sustainability of its biodiversity.
National Fisheries Authority	Responsible for the economic development of marine resources and to ensure the sustainability of commercial marine species. The agency also supports locally managed marine areas (LMMAs) at the community level as a tool for small-scale fisheries management and promotes an ecosystem approach to fisheries management.
Office of Climate Change and Development	Oversees climate change mitigation, vulnerability assessments and adaptation projects in PNG in relation to the coastal zone.
National Maritime Safety Authority	Primarily responsible for dealing with offshore fishing matters. Has authority to board, inspect and detain vessels for purposes of compliance with International Maritime Organisations' conventions.
Philippines	
Department of Environment and Natural Resources – Biodiversity Management Bureau – Coastal and Marine Division	Responsible for the formulation and implementation of national policies and regulations that inform environmental management, wildlife protection, pollution prevention, conservation, development, and the use and replenishment of natural resources, including marine.
Department of Agriculture – Bureau of Fisheries and Aquatic Resources	Responsible for managing and conserving the country's fisheries and aquatic resources, including management and supervision of foreign and Filipino commercial fishing vessels.
Department of Energy	Responsible for energy exploration (including offshore areas), development, utilisation, distribution and conservation.
National Economic and Development Authority	Responsible for the formulation and development of plans that foster social and economic development nationwide.
Climate Change Commission	Responsible for government programmes to ensure mainstreaming of climate change in national, local and sectoral development.
Solomon Islands	
The Ministry of Environment, Climate Change, Disaster Management and Meteorology	Responsible for protection of the environment, disaster risk reduction and climate change adaptation.
Ministry of Fisheries and Marine Resources	Responsible for coordination and research on fisheries resources and aquaculture, and Fisheries Extension Services.
Timor-Leste	
Ministry of Agriculture and Fisheries	Responsible for developing and managing the fisheries industry.

Source: Asian Development Bank (ADB) (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.

Fishing boats on Langkawi island, Malaysia. Across the Coral Triangle, governance of marine resources requires coordination between agencies concerned with fisheries, economic and social development, customs and security, conservation, mining and other sectors. Such coordination is challenging, and is complicated by overlaps between the jurisdictions of local, provincial and national governments.

Fisheries Management Act, Land Dispute Settlement Act, Mining Act, National Maritime Safety Authority Act, National Seas Act, Oil and Gas Act, Organic Law on Provincial Governments and Local-level Governments Act, Ports Authority Act and Village Courts Act.

Philippines

The Philippines Constitution of 1987 states that fish are vital marine living resources and that the State has a duty to protect the rights of subsistence fishers and local communities, safeguarding their preferential use of these resources, both inland and offshore[105]. Although the importance of marine resources is recognised at national level, their management is largely decentralised. The Local Government Code of 1991 empowers local (municipal) governments to establish and manage marine protected areas within municipal waters (defined as 15 kilometres from the shoreline). Local government units (LGUs) govern and manage the vast majority of MPAs (roughly 1 500 small-scale MPAs (<1 km²).

The national Department of Environment and Natural Resources (DENR) is mandated under the National Integrated Protected Areas Act of 1992 to designate and manage nationally significant marine protected areas, in collaboration with local governments[106]. Establishment and management occur through a Protected Area Management Board consisting of both local and national stakeholders and agencies, chaired by the DENR.

In 1994, the Philippines passed the National Marine Policy that provided a framework for managing the entire country's marine, coastal and ocean-related interests. The policy was established to refocus attention on the marine and coastal zone from policies that were terrestrially biased. Another important policy is the Agriculture and Fisheries Modernization Act of 1997 that established linkages among community-based organisations, NGOs and cooperatives, and provided technical support services within the fisheries sector. Under this policy is the Fisheries Administrative Order No 60, which pertains to mangrove protection, prohibiting large-scale conversion of mangroves into fishponds.

The Philippine Fisheries Code of 1998 (revised in 2015) focuses on micro- and operational-level issues that pertain to fishing and fishing-related activities. The code also sets targets for MPA coverage (15 % of municipal waters as no-take MPAs) and provides legislation for the development, conservation and management of fisheries and aquatic resources. It also elucidates the boundaries of LGU jurisdiction and the extent to which commercial fishing operations have access to municipal waters.

Progress in marine and coastal management is demonstrated by Executive Order No 533 on the adoption of integrated coastal management for the promotion of food security, sustainable livelihoods, poverty alleviation, and reduced vulnerability to natural hazards, while the Philippine Marine Sanctuary Strategy (2004) lays out a framework for MPA management and sets a target of 10 % of coral reefs protected under no-take MPAs by 2020.

(105) Asian Development Bank (ADB) (2014) State of the Coral Triangle: Malaysia. Mandaluyong City, Philippines.
(106) Asian Development Bank (2014). State of the Coral Triangle: the Philippines. Mandaluyong City, Philippines.

Balicasag Island, Bohol, Philippines. The island's marine life is a tourist attraction, and there is a locally managed marine protected area. The vast majority of Philippine MPAs are managed by local government units.

Solomon Islands

Management of natural resources is generally decentralised in the Solomon Islands. The Fisheries Act (1998), Wildlife Protection and Management Act (1998), Shipping Act (1998), Environment Act (1998) and Protected Areas Act (2010) collectively establish the legality for marine environmental protection and sustainable use and management. Within this legislation, the national government grants overall management responsibility to provincial and local governments[107]. The Provincial Government Act 1997 grants provincial governments jurisdiction over 3 nautical miles offshore from the low water mark.

Timor-Leste

The national government holds all of Timor-Leste's natural resources, with the Ministry of Agriculture and Fisheries (MAF) responsible for overall fisheries and protected area management across the country. The ministry has passed a number of laws regulating fishing within the country and has plans to create an integrated fisheries strategy for responsible development and management.[108]

Striped sweetlips, Dampier Straits MPA, Raja Ampat, Indonesia. The Raja Ampat local government became the first in Indonesia to create an MPA, in 2006. There are now 7 MPAs in Raja Ampat, covering over 10 000 km² of reefs, mangroves, seagrass beds and turtle nesting beaches. The MPAs help to ensure the sustainability of livelihoods of the 40 000 people living in 135 villages across the islands.

3.1.2 Marine protected areas

Coverage

MPAs are recognised as one of the most effective tools for biodiversity conservation and marine resource management in the region, given their potential for protective and spillover effects.[109] There are many types of MPA (or zones within a larger MPA), including multiple-use, those that restrict fishing to local communities, and fish recovery/no-take zones. MPAs need to be designed and implemented in concert with fisheries reform, threatened species management, ecosystem-based management, marine spatial planning, and marine industry regulation. Over the last 40 years, 1 972 MPAs covering about 200 881 km² have been established within the CT6[110]. Constituting 1.6 % of the six countries' exclusive economic zones, they include both small-scale MPAs (<1 km²), established and managed through local-level and traditional processes, and large-scale MPAs (>1 000 km²), established through national mandates[111].

Indonesia currently has more than 150 MPAs covering about 158 000 km², with an additional 70 protected areas that include both terrestrial and marine ecosystems. While Indonesia has legally established MPAs, studies indicate that fewer than 15 % are effective and meeting management objectives. In response,

(107) Asian Development Bank (2014). State of the Coral Triangle: Solomon Islands. Mandaluyong City, Philippines; S. Jupiter pers. comm.
(108) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.
(109) White A.T., P.M. Aliño, A. Cros, N.A. Fatan, A.L. Green, S.J. Teoh, L. Laroya, N. Peterson, S. Tan, S. Tighe, R. Venegas-Li, A. Walton and W. Wen (2014). Marine Protected Areas in the Coral Triangle: Progress, Issues, and Options. Coastal Management 42(2), pp. 87-106. Available from: http://dx.doi.org/10.1080/08920753.2014.878177; 2016 update from Marthen Welly, CTC, citing http://www.kkji.kp3k.kkp.go.id/ (in Indonesian)
(110) Maps of each country's MPAs are available here: http://ctatlas.reefbase.org/mapgallery.aspx(
(111) CTFI-CFF Interim Regional Secretariat (2014). Monitoring and Evaluation System Operations Manual. http://www.coraltriangleinitiative.org/library/monitoring-and-evaluation-system-operations-manual

A giant clam, Tridacna gigas*, grows on a shallow reef in the Solomon Islands. The world's largest shelled molluscs, giant clams have declined across their range in East and South-East Asia because of hunting for food, and are classified as 'vulnerable' on the IUCN Red List. MPAs provide a sanctuary for these and other species of clam.*

Fishing in the mangroves of the Pulau Dua Nature Reserve, Bali, Indonesia. The mangroves protect the coast from abrasion, and help prevent intrusion of salt water into freshwater aquifers. Despite their key role in protecting coastlines and reefs, mangroves are often heavily exploited for firewood, or cleared to make way for aquaculture and coastal infrastructure.

Indonesian institutions, in collaboration with the CTI and the five other Coral Triangle countries, have developed management training and a protocol for evaluating MPA management effectiveness that is being applied across the region[112].

Malaysia has established 51 MPAs that are managed under national and state agencies, covering 4 675 km of coastline and 1 698 km² of coral reef area. Malaysia's protected areas constitute 3.5 % of its EEZ. Most of Malaysia's reef habitat occurs in Sabah, in northern Borneo, where the recently gazetted Tun Mustapha Park will cover over 10 000 km² and be the largest MPA in Malaysia. The area is a source of livelihood for over 80 000 coastal residents, and the park is to function as a multi-use area with areas set aside for protection, recreation and tourism, artisanal and commercial fishing, among others.[113] Malaysia has not yet adopted a standard monitoring protocol that includes measures for management effectiveness.

Papua New Guinea has established at least 59 MPAs, the majority of which have been declared at the local level under the LMMA network, although 35 have boundaries that are legally recognised at the national level in PNG. One area (11.8 ha) has been set aside as a tambu (taboo or forbidden fishing closure area) and designated a national Wildlife Management Area. Kimbe Bay has a large MPA network designed with support from The Nature Conservancy (TNC) and partners, including nine LMMAs, although implementation and effective management has been a challenge, as elsewhere.

In the **Philippines**, local (municipal) governments have the authority to establish small, community-based MPAs without national approval, and as a result the Philippines has around 1 600 MPAs, although their extent totals only ~240 km². At the national level, 28 MPAs have been declared and cover roughly 14 500 km². The Philippines national government has a Marine Sanctuary Strategy under which a target exists for 10 % of marine waters to be fully protected by 2020 in an MPA network. Currently, these MPAs cover 3.4 % of the country's total coral reef area, with estimates of slightly more than 1 % of reef area effectively protected. Nationwide, 30 % of MPAs are well managed[114], with incentive systems implemented to recognise outstanding MPAs.

The **Solomon Islands** government has officially recognised customary marine tenure and integrated it into their recent 2010 Protected Areas Act. Many of the small reserves are effectively managed, though some are not, with the oldest and largest community MPA (established in the Arnavon Islands in 1995) recognised but not yet legally designated by the government[115].

Timor-Leste is the smallest country in the Coral Triangle region, with about 700 km of coastline that includes several offshore islands. In 2007, through the support of the CTI, Timor established its first MPA, the Nino Konis Santana National Park, which also includes terrestrial areas. Management has been initiated through community-based approaches in selected areas within the park, which constitutes 1.3 % of the national EEZ and covers 29.5 % of coral reefs[116]. A network of seven shallow and five deep-water MPAs have also been proposed.

Representativeness

A regional network of MPAs, known as the Coral Triangle Marine Protected Area System, was assessed to determine its efficacy in protecting threatened species, and coastal and marine habitats across the entire region, and in addressing climate-change adaptation measures[117]. MPAs cover 17.8 % of coral reef habitat, roughly 7 757 km²[118]. A similar percentage of seagrass is covered because it occurs with reefs. These figures suggest that the region is on track to meet the CTI-CFF regional goal of 20 % of coral reefs being under some form of marine protection by 2020.

Coverage of mangroves in MPAs ranges from 0.01 % (Malaysia) to 9 % (Indonesia)[119], although actual protection is more difficult to estimate because the laws protecting mangroves vary. In the Philippines, all mangroves are protected by law but few are in protected areas. In Indonesia, mangroves are not protected overall and generally not included in MPAs either. Thus, to accurately determine the protected status for mangroves, a review of all laws that cover mangroves is needed, but this has not yet been done[120].

Effectiveness

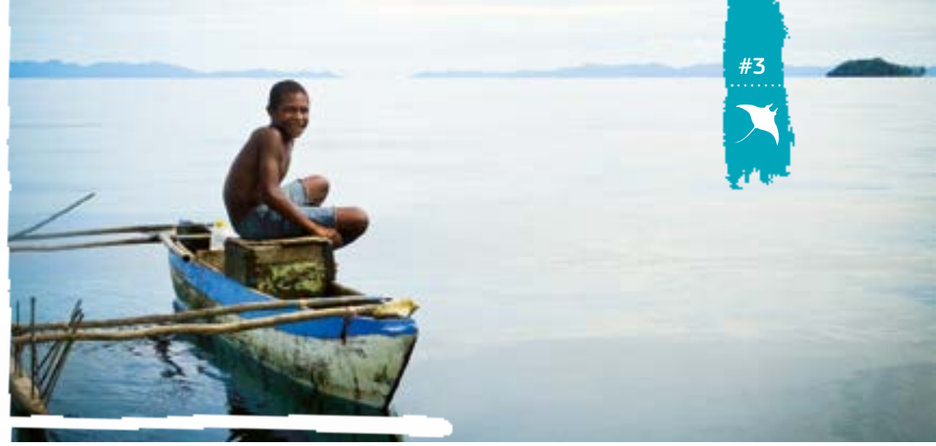
Many MPA management agencies lack the capacity to enforce, monitor and manage the area they are responsible for, and the fully protected ('no-take') area is much smaller than the total given for MPAs above. A consistent framework to help standardise MPA development, implementation and effectiveness across the region has been developed and endorsed by country leaders, the Coral Triangle MPA System Framework and Action Plan, launched in 2014 and moving towards full-scale operation. A monitoring and evaluation system to track progress toward regional MPA targets is still needed, although a manual that can be built on has been developed[121]. The forms and sizes of MPAs across the region varies greatly and reflects the different contexts for establishing and managing MPAs in each country, which adds difficulty to streamlining evaluation metrics for management effectiveness[122]. It is estimated in the Philippines, for example, that only about 1 % of coral reef habitat is under

(112) White, A.T. et al. (2014). Op Cit.
(113) http://www.sabahparks.org.my/index.php/the-parks/tun-mustapha-park-newly-gazetted, accessed 21 February 2018
(114) Maypa A.P., A.T. White, E. Cañares, R. Martinez, R.L. Eisma-Osorio, P. Aliño [sic: should be Aliño] and D. Apistar (2012). Marine protected area management effectiveness: Progress and lessons in the Philippines. Coastal Management 40(5), pp. 510-524.
(115) White A.T. et al. (2014). Op cit.

(116) Abraham A. (2015). Op. cit.
(117) Beger M., J. McGowan, S.F. Heron, E.A. Treml, A. Green, A.T. White, N.H. Wolff, K. Hock, R. van Hooidonk, P.J. Mumby and H.P. Possingham (2013). Identifying conservation priority gaps in the Coral Triangle Marine Protected Area System. Coral Triangle Support Program, The Nature Conservancy, and The University of Queensland, Brisbane, Australia. 55 pp. A themed issue in Coastal Management is also dedicated to MPAs in the Coral Triangle region: Volume 42(2), 2014. Special Issue: Establishing a Region-wide System of Marine Protected Areas in the Coral Triangle.
(118) Cros A., R. Venegas-Li, S.J. Teoh, N. Peterson, W. Wen and N.A. Fatan (2014). Spatial data quality control for the Coral Triangle Atlas. Coastal Management 42, pp 128-142.
(119) Total mangrove area and mangroves in MPAs for each country available at http://ctatlas.reefbase.org/mapsofthemonth.aspx (Maps 03 to 08),
(120) A. White, pers. comm.
(121) CTFI-CFF Interim Regional Secretariat (2014). Monitoring and Evaluation System Operations Manual. http://www.coraltriangleinitiative.org/library/monitoring-and-evaluation-system-operations-manual
(122) White A.T. et al.(2014). Op cit.

Papua, Indonesia. Marine police serve a warning on a fisherman suspected of illegally capturing whale shark for export. Alternatives to formal law enforcement are often more acceptable and practical, especially in regions where customary practices and legal regulations are not well aligned.

Dried manta gills seized during a raid on illegal wildlife trafficking in Surabaya, Indonesia. The dried gills are marketed for the traditional Chinese medicine trade, for their supposed immune system-boosting properties. The trade is illegal in Indonesia.



Fishermen in Alotau, PNG, strengthened local MPA management with CTI-CFF support. Launched in 2007, the CTI-CFF brings together governments, NGOs, private sector and communities to address threats to the Coral Triangle through law enforcement, MPAs, capacity building and sustainable development. The initiative works through a regional action plan and national plans.

effective protection. Furthermore, challenges in governance systems and insufficient participation in establishment and management still hamper both MPA establishment and effectiveness[123].

3.1.3 Wildlife law enforcement

To date, progress across the Coral Triangle on addressing the wildlife trade and improving the status of threatened species has been variable[124] (see also the terrestrial sub-regional chapters for more detail on each country). Where species are protected by law or managed by fisheries agencies, enforcement and implementation are major shortcomings in most countries in Asia. Each country has its own mechanisms to implement the Convention on International Trade in Endangered Species (CITES) with, for example, the Philippines banning the collection of Appendix 2-listed species. The inclusion of species on CITES appendices creates a need for additional capacity for enforcement, which cannot always be met[125], and the countries have made variable progress in addressing the live reef-fish and sea turtle trade, as well as shark fin and manta ray product trade. Indonesia, the Philippines and Malaysia have each initiated a national plan of action for shark protection[126]. Regionally, an implementation road map for action on IUU fishing and the live reef-fish trade has been prepared. However, unresolved issues that remain include:

- the need for better governance systems to incentivise compliance, stimulate cooperative agreements and reduce conflict among the countries on transboundary fishery issues;
- poor information on the value chain for important commercial species such as those associated with the live reef-fish trade and pelagic species, including tuna, and on the social behaviour of fishers, including costs and expenses associated with income from fishing[127].

Concerted efforts have raised the profile of the problem, which has led to a series of declarations and regulations, as well as increased action on the ground in the last 5 years, e.g. by the Wildlife Conservation Society's (WCS) Wildlife Crime Unit in Indonesia, which might prove readily adaptable to other countries in the region. In 2013, the Government of Indonesia banned the capture and sale of shark and manta ray species in Raja Ampat, a popular dive destination[128], and then enacted a national ban on manta ray hunting in 2015[129]. Raja Ampat is the first area in Indonesia, and in the Coral Triangle, to establish a shark sanctuary.

(123) Abraham A. (2015). Op cit.
(124) CTI Financial Resources Working Group (2014). Stock-take of CTI-CFF Programs and Projects: A Strategic Review of Progress and Future Directions. CTI-CFF Interim Regional Secretariat, Jakarta, Indonesia.
(125) Christie P., E.G. Oracion and L. Eisma-Osorio (2011). Impacts of the CITES listing of seahorses on the status of the species and on human well-being in the Philippines: a case study. FAO Fisheries and Aquaculture Circular, no 1058. Food and Agriculture Organisation, Rome. 44 pp. http://www.fao.org/docrep/013/i2003e/i2003e00.pdf
(126) Abraham A. (2015). Op. cit.; CTI Regional Business Forum in Bali in August 2015.
(127) Ibid.
(128) Conservation International (2013). Victory for Sharks: Government of Raja Ampat Declares the first Shark and Manta Ray Sanctuary in Indonesia and the Coral Triangle. Press Release. 2 February 2013. Available at http://www.conservation.org/NewsRoom/pressreleases/Pages/Victory-for-Sharks-Government-of-Raja-Ampat-Declares-the-first-Shark-and-Manta-Ray-Sanctuary-in-Indonesia-and-the-Coral-Tri.aspx
(129) http://voices.nationalgeographic.com/2014/02/21/indonesia-announces-worlds-largest-sanctuary-for-manta-rays/, accessed 7 September 2016.

3.1.4 International institutions, agreements and commitments

Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security

The CTI-CFF[130] has been one of the biggest conservation initiatives ever undertaken in the marine sector, with financing in the order of EUR 450 million since 2009[131]. First discussed at the 8th Convention on Biological Diversity (CBD) in Brazil in 2006, the CTI-CFF was proposed by Indonesian President Yudhoyono during the Sydney Asia-Pacific Economic Cooperation (APEC) Summit in September 2007, and officially launched in December 2007 during the 13th Conference of the Parties to the UN Framework Convention on Climate Change in Bali.

In May 2009, the Coral Triangle countries (Indonesia, Malaysia, Papua New Guinea, the Philippines, Solomon Islands, Timor Leste) released their Regional Plan of Action (RPOA) with five goals: strengthening the management of seascapes, promoting an Ecosystem Approach to Fisheries Management (EAFM), establishing and improving effective management of MPAs, improving coastal community resilience to climate change, and protecting threatened species. Each of these goals has an associated technical working group. These have been established on different timelines and have variable rates of progress. The technical working groups on MPAs and EAFM, for example, were established early with a strong programme of work, while the technical working group on threatened species was only endorsed in May 2014[132], and needs further development and support to secure memberships and participation, and establish a feasible work plan. Expertise on threatened species action planning and secure sources of funding are needed to allow the working group to continue. In implementing the actions, Malaysia, Indonesia and the Philippines have drafted National Plans of Action for the protection of sharks, sea turtles and other threatened species, as well as on invasive species[133]. The whole region still needs to complete assessments for the IUCN Red List of threatened species and critical habitat[134].

In addition to the technical working groups, the CTI-CFF featured multi-day regional exchange meetings to work on the goals and foster interactions across the CT6.[135] These events were successful and beneficial in building strong networks, and transformative in helping develop leadership capacity and new technical skills. However, evaluation suggested that the exchanges should be streamlined, to reduce the time commitment and management burden involved.

The Agreement on the Establishment of the Regional Secretariat of CTI-CFF came into effect in 2015, strengthening the legal, institutional and financial aspects of the Regional Secretariat. Papua New Guinea ratified the agreement in July 2016, prior to the country hosting the 12th Senior Officials' Meeting and 6th Ministerial Meeting[136]. Brunei Darussalam was admitted as a

(130) http://www.coraltriangleinitiative.org/
(131) Abraham A. (2015). Op. cit.
(132) Abraham, A. (2015). Op. cit.
(133) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.
(134) Abraham, A. (2015). Op cit.
(135) Pietri D.M., T.C. Stevenson and P. Christie (2015). The Coral Triangle Initiative and regional exchanges: Strengthening capacity through a regional learning network Global Environmental Change 33, pp. 165-176.
(136) http://coraltriangleinitiative.org/news/rs-cti-cff-visit-papua-new-guinea-day-1

Community monitoring of fish catch provides input to MPA management, Palawan, Philippines. The CTI-CFF supports communities and governments throughout the Coral Triangle to develop their capacity to manage marine resources more sustainably and effectively.

CTI-CFF member, endorsed at the 11th Senior Officials' Meeting in December 2015 in Manado.[137]

The CTI-CFF is the first regional agreement of which all six countries are a part. It therefore provides the opportunity to synchronise and integrate existing multilateral coordination mechanisms, such as Partnerships in Environmental Management for the Seas of East Asia (PEMSEA), a 20+ year-old intergovernmental effort in East Asia. While many of these institutions have similar goals (PEMSEA's for example is 'to foster and sustain healthy and resilient oceans, coasts, communities and economies across the region'[138]), the inclusion of the Pacific countries makes the CTI a unique regional body[139]. This is an opportunity to target more focused management on coral reefs and fisheries in the region, which is connected both ecologically and by threats that are moving eastward (e.g. the live reef-fish trade and tuna fisheries)[140].

The Coral Triangle countries participate in various long-standing institutions for regional collaboration, for example ASEAN, Secretariat of the Pacific Regional Environment Programme, Secretariat of the Pacific Community and the Forum Fisheries Agency (see Table 3.2). The countries are also signatories to a number of binding and nonbinding agreements[141]. All six are signatories to the CBD and all but Timor-Leste are signatories to CITES.

Throughout this process, conservation NGOs provided critical behind-the-scenes support, funded in large part through the United States Agency for International Development's (USAID) Coral Triangle Support Partnership (CTSP), which supported a consortium of NGOs: TNC, Conservation International (CI) and WWF.

In response to the threat from climate change to the region, CTI-CFF has developed an Early Action Plan for Climate Change Adaptation with dual objectives: (i) to maintain the biological diversity and the ecosystem services provided by marine and coastal resources that are particularly critical to income, livelihoods and food security of coastal communities; and (ii) to support livelihood diversification strategies that assist coastal communities in adapting to future adverse impacts of climate change on marine-based livelihoods. Integrating disaster risk reduction and management with climate change adaptation is a promising strategy and could allow, for example, the development of insurance products that take into account the integrity of natural systems (e.g. mangroves and coral reefs) and the link between them, and their resilience against climate impacts.

(137) CTI-CFF (2015). CTI-CFF Senior Officials Endorse 2016 Programs of Work, Admit Brunei Darussalam. CTI-CFF Press Release. Available from http://nr.iisd.org/news/cti-cff-senior-officials-endorse-2016-programs-of-work-admit-brunei-darussalam/
(138) http://pemsea.org/
(139) White A.T. (2016). Ocean Governance Initiatives in the East Asian Seas – Lessons and Recommendations. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Manila, Philippines.
(140) Asian Development Bank (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.
(141) Fidelman P. and J.A. Ekstrom (2012). Mapping Seascapes of International Environmental Arrangements in the Coral Triangle. Marine Policy 36(5), pp. 993-1004.

In addition to MPAs (see section 3.1.2 above), the Philippines and Indonesia have established national-level **seascapes** (e.g. the Verde Island Passage in the Philippines; Banda Sea, Lesser Sunda and Bird's Head Seascapes in Indonesia). Currently, the establishment of a number of transboundary seascapes is under way, including the Sulu-Sulawesi Seascape involving Malaysia, the Philippines and Indonesia, and the Papua-Bismarck Solomon Sea, involving Indonesia, Papua New Guinea and the Solomon Islands.

One of the most important initiatives has been the establishment of the Bird's Head Seascape in Indonesia. The initiative was launched in 2004 with significant funding from the Walton Family Foundation, and is supported through a collaboration between CI, TNC and WWF. The initiative has involved collaboration between industry, government and international and local NGOs, and has demonstrated a gradual but effective approach to building capacity in MPA and fisheries management in an area that previously had no existing management mechanisms in place.

As the Coral Triangle countries are members of the **United Nations**, the 2030 Agenda and the Sustainable Development Goals (SDGs) are relevant, in particular Goal 14 (Conserve and sustainably use the oceans, seas and marine resources for sustainable development). The United Nations Environment Assembly adopted a draft resolution on sustainable coral reef management in May 2016. Work by UNEP and others continues to provide support to member states in implementing the resolution, and to recommend key technical, operational and financial needs in implementing the resolution.[142]

Indonesia is currently the only Coral Triangle country member of **Mangroves for the Future**, a partnership chaired by IUCN and the United Nations Development Programme (UNDP) that promotes investment in coastal ecosystem conservation and sustainable development. The programme provides a platform for collaboration among various partners and agencies across Asia, with the aim of promoting investment in building the resilience of coastal communities and ecosystems[143].

3.2 Community-based conservation

Communities play a critical role in the management of marine resources throughout the region. This section reviews the legal and informal regulations that govern this management. Many of these community-based systems are under pressure from population increases, introduction of a cash-based economy, and a loss of traditional authority and values.[144] Government support to customary management and building capacity at the local level is needed.

In **Indonesia**, a number of traditional management systems exist but only a few are practised, such as sasi (temporary closure in access to a fishing ground or coral reef area for a certain amount of time) in the Maluku and Papua region. Under Indonesian national legislation, nearshore marine and coastal areas are deemed common property, but the revised Law 1/2014 contains provisions for the role of local communities in utilisation and management of local coastal resources[145], and coastal communities have the right to assert traditional tenure rights under local resource management legislation[146]. Increasingly, Indonesia is adopting co-management regimes in coastal areas to foster greater environmental stewardship within these local systems.[147]

In **Malaysia**, degradation of coastal resources in the latter half of the 20th century encouraged the Malaysian Government to begin sharing responsibility with local communities for monitoring, control and surveillance in managing coastal resources[148]. Under this system, NGOs and community fisher organisations are responsible for monitoring and surveillance, while the federal government maintains authority over control and enforcement.[149] However, highly centralised policies still dictate coastal and fishery management, which has resulted in few community-based management regimes in Malaysia. Limited transfers of funds from the federal to state level have been cited as a structural obstacle for decentralised governance, leaving local governments unable to finance management activities.[150]

Although the national government in **Papua New Guinea** sets policies, most management occurs at the local level[151]. Local communities may put in place a large variety of management measures within their marine tenure areas for a variety of

(142) https://sustainabledevelopment.un.org/sdg14; Jerker Tamelander, pers. comm.
(143) http://www.mangrovesforthefuture.org/who-we-are/about/who-we-are/
(144) Asian Development Bank (2014). State of the Coral Triangle: Solomon Islands. Mandaluyong City, Philippines.
(145) Cribb, R.B. & Ford, M. (2009) Indonesia as an archipelago: managing islands, managing the seas. In: Indonesia Beyond the Water's Edge: Managing an Archipelagic State, ed. R. B. Cribb & M. Ford, pp. 1–27. Singapore: Institute of Southeast Asian Studies.
(146) Cohen P. and D. Steenbergen (2015). Social dimensions of local fisheries co-management in the Coral Triangle. Environmental Conservation 42, pp. 278-288.
(147) Phillips A. (2003). Turning ideas on their head: the new paradigm for protected areas. The George Wright Forum 20, pp. 8-32.
(148) Siry H.Y. (2006). Decentralized Coastal Zone Management in Malaysia and Indonesia: A Comparative Perspective. Coastal Management 34, pp. 267-285.
(149) Asian Development Bank (2014). State of the Coral Triangle: Malaysia. Mandaluyong City, Philippines.
(150) vernment of Malaysia (2010). State of the Marine Environment Report. Malaysia Ocean Policy (2010-2020). National Oceanography Directorate, Ministry of Science, Technology and Innovation, Malaysia, Kuala Lumpur.
(151) Phillips A. (2003). Op. cit.

Caringo Island, Philippines. A barangay *(village) chairman writes up the crews of two illegal fishing boats. Customary management is under pressure from increasing population, cultural and economic change. Alignment of formal and customary practices can help to make both more effective.*

motivations.[152] This includes the tambu system of temporary fishing closures, practised in many coastal communities throughout PNG, where communities have the right to exclude other users[153]. Under PNG's constitution, the federal and provincial governments are legally obliged to recognise customary marine tenure. As such, the National Fisheries Authority, which has jurisdiction over all fisheries in PNG's exclusive economic zone, has supported LMMAs at the community level to ensure that the customary needs of coastal communities are respected and recognised. LMMAs are designed to promote community participation in small-scale fishery management that support livelihoods and provide equitable benefits[154,155]. The National Fisheries Authority has also established several national-scale fishery regulations, including a moratorium on sea cucumber harvesting, and rules banning industrial tuna catches within 12 nautical miles of coastlines.

The **Solomon Islands** constitution recognises customary laws and the traditional rights of Solomon Islanders to exercise control over their resources. This is significant given that a substantial portion (87 %) of the administrative jurisdiction of each province's coastal environment is under customary marine tenure[156]. The Fisheries Act 1998 recognises customary fishing rights, and grants management authority for coastal and inshore fisheries to the nine provincial governments. However, neither provincial governments nor communities have the human and financial resources needed for effective resource management. The Solomon Islands locally managed marine area network was attempting to address this issue by helping build capacity at the local level, but it is not functional at present[157].

Although governance is largely centralised, **Timor-Leste's** constitution acknowledges traditional natural resource management practices under its adat system of sacred laws and beliefs. As such, MAF intends to establish a nation-wide community-based marine protected area network. The establishment of Nino Konis Santana National Park marks the first MPA in the network.

3.3 CSO INITIATIVES

Given the geographic scope and important biodiversity of the Coral Triangle, many NGOs and civil society organisations have been involved in marine biodiversity activities in the region over the past several decades. WCS, TNC, CI and WWF have all been active in the region for more than 20 years. In 2009, a consortium of the latter three NGOs was funded through USAID's CTSP to support CTI-CFF. The Coral Triangle Center (CTC) has a capacity development MoU with CTI-CFF to develop training modules related to MPA design, sustainable fisheries and sustainable marine tourism, and to conduct training in Coral Triangle countries. In 2011, CTSP in Indonesia was replaced with the Marine Protected Area Governance project (MPAG, a consortium between CI, CTC, TNC, WCS and WWF) to help the Indonesian

(152) Govan H. (2009). Status and potential of locally-managed marine areas in the South Pacific: meeting nature conservation and sustainable livelihood targets through wide-spread implementation of LMMAs. SPREP/WWF/WorldFish-Reefbase/CRISP, Suva, Fiji 95 pp. + 95 pp. annexes. Also Jupiter S.D. et al. (2014). Locally-managed marine areas: multiple objectives and diverse strategies. Pacific Conservation Biology 20, pp. 165-179.
(153) Cohen P. and D. Steenbergen (2015). Op. cit.; Phillips A. (2003). Op. cit.
(154) Asian Development Bank (2014). State of the Coral Triangle: Papua New Guinea. Mandaluyong City, Philippines.
(155) National Plan of Action (2010). PNG Marine Program on Coral Reefs, Fisheries, and Food Security 2010-2013. Department of Conservation and Environment; National Fisheries Authority.
(156) Burke L. et al. (2012). Op. cit.
(157) Fidelman P., L. Evans, M. Fabinyi, S. Foale, J. Cinner and F. Rosen (2012). Governing large-scale marine commons: Contextual challenges in the Coral Triangle. Marine Policy 36, pp. 42-53.

TABLE 3.2 Regional institutions and projects

Arrangement		Institution/project	INO	MLY	PNG	PHI	SOL	TIL
Regional fisheries bodies	Regional FMOs	Ministry of Marine Affairs and Fisheries (MMAF)	X	X				
		WCPFC: Western and Central Pacific Fisheries Commission			X	X	X	
	Fisheries advisory bodies	APFIC: Asia-Pacific Fishery Commission	X	X		X		
		FFA: Pacific Islands Forum Fisheries Agency			X		X	
		SEAFDEC: South-East Asian Fisheries Development Centre	X	X		X		
Regional arrangements/ networks/cooperation/ projects	Scientific bodies	INFOFISH: Intergovernmental Organisation for Marketing Information and Technical Advisory Services for Fishery Products in the Asia-Pacific region	X	X	X	X	X	
		NACA: Network of Aquaculture Centres in Asia-Pacific	X	X		X		
		SPC: Secretariat of the Pacific Community			X		X	
	Economic cooperation	APEC: Asia-Pacific Economic Cooperation	X	X	X	X		
		ASEAN	X	X		X		
		PIF: Pacific Islands Forum			X		X	
	Fisheries/environmental arrangements	BOBLME: Bay of Bengal Large Marine Ecosystem project	X	X				
		COBSEA: Coordinating Body on the Seas of East Asia	X	X		X		
		CTI: Coral Triangle Initiative	X	X	X	X	X	X
		PEMSEA: Partnerships in Environmental Management for the Seas of East Asia	X	X		X		X
		SAP: Strategic Action Programme of the Pacific Small Island Developing States			X		X	
		RPOA: Regional Plan of Action to promote responsible fishing practices including combatting IUU fishing in the region	X	X	X	X		X
		SCA: UNEP/GEF South China Sea Project	X	X		X		
		SPREP: Secretariat of the Pacific Regional Environment Program			X		X	
	Scientific networks	GoFAR: Asia-Pacific Group of Fisheries and Aquatic Research	X	X	X	X	X	

Source: Asian Development Bank (ADB) (2014). Regional state of the Coral Triangle – Coral Triangle marine resources: their status, economies, and management. Mandaluyong City, Philippines.

Mambungalon, Philippines. A facilitator for the Fish Forever programme, a partnership of international NGOs, conducts an initial community consultation. The programme works to secure local community rights to fisheries, and empower them to manage these resources more effectively.

Community training on seagrass monitoring, PNG. NGOs can bring together funding, scientific expertise and local community knowledge to address challenges in marine management.

Government achieve their target of 20 million hectares of MPAs by 2020.

The Environmental Defense Fund and Rare, Inc., a behaviour change-focused conservation NGO, are working in Indonesia and the Philippines. Together with the Sustainable Fisheries Group of the University of California-Santa Barbara, these groups have launched Fish Forever[158], an initiative which seeks to establish exclusive fishing access privileges for local communities based on legal or traditional tenure systems, in combination with areas where fishing is prohibited (also called territorial user rights in fisheries and reserves). International NGOs' engagement in countries and with communities can change, depending on the resources available. For example, CI's peak investment in PNG was in the early to mid-2000s; in 2016 most work was transferring to local NGOs, with a focus on Milne Bay.

Other organisations are important actors in some countries, e.g. WorldFish and the Consultative Group on International Agricultural Research, both of which have a strong role in food security and aquaculture development in the region; and SEA-EU-Net[159], an ASEAN-EU initiative to enhance scientific collaboration within South-East Asia.

NGOs play an important role facilitating community engagement in marine resource management. One strategy of WCS and other organisations is to work with community groups to develop sustainable management plans, often targeting areas with high biodiversity where communities also have interests. CI and the Government of the Solomon Islands have developed the Expanding the Reach of Community-based Marine Management in the Solomon Islands initiative, with the goal of dramatically increasing the number of communities with access to management guidance and support by working through permanent government programmes, NGOs and community partners[160]. Projects are often focused on sustainable harvesting and livelihoods, for example how to generate income from natural resources or tourism. A large component of this cooperative engagement work is recognising and revitalising the cultural and traditional practices communities have of being resource stewards. A focus on women's empowerment and initiatives is an important component of community work. This includes working with the existing Women Leaders' Forum, which is intended to provide capacity building, training and networking opportunities to the women of the Coral Triangle. Community-based fishery work that includes a strong focus on women's economic empowerment can help to address some of the underlying socio-economic drivers of unsustainable practices. For example, a micro-savings scheme established in the Western Province of the Solomon Islands in late 2013 now has a membership of 725 women who have saved over EUR 23 076[161].

Numerous local NGOs work on specific issues or more localised geographies with some excellent national NGOs that are less well known. Many community-based initiatives are supported by both local and international NGOs in the region. These initiatives are particularly prevalent in the Solomon Islands, Papua New Guinea and the Philippines, where resource management is much more decentralised. In general, NGO conservation initiatives increasingly focus on fostering positive community impacts, although some in the Solomon Islands have been met with criticism for being too focused on biodiversity conservation and not sufficiently allowing for alternative livelihoods or income generation.

Given that good information is frequently needed to back up management and policy-making, multiple international, regional and national universities and research institutes are important CSO actors in the Coral Triangle. A number of EU Member States are involved in the area, both conducting fundamental marine biodiversity and taxonomy studies, and engaging in applied science and conservation. Examples include the Dutch Museum of Natural History (Naturalis) in Leiden, which has long been involved in Indonesia and neighbouring countries. The Netherlands Organization for Scientific Research has a branch devoted to global development, which for several years had a dedicated Indonesia programme, and researchers at Wageningen University and the International Institute for Asian Studies have worked on marine governance and livelihoods, while the Royal Netherlands Institute of Southeast Asian and Caribbean Studies in Leiden is an important centre for research on Indonesia, particularly humanities. The French Institute for Research and Development currently works in collaboration with the Indonesian Ministry of Marine Affairs on marine spatial planning, and the United Kingdom has a long history of engagement in Sulawesi with Operation Wallacea. Since 2003, the German-funded Science for the Protection of Indonesian Coastal Ecosystems has fostered joint research on topics with policy relevance for Indonesia, such as environmental change and governance, or reef fisheries and marine management.[162] The American Museum of Natural History first visited the Solomon Islands nearly a century ago, and is now supporting the development of community-based partnerships that provide incentives for combined forest and near-shore marine biodiversity conservation[163]. The University of Malaysia Terengganu hosts the European Commission-funded Erasmus Mundus Tropical Marine Biodiversity Course[164]. This university has the goal of conducting CTI-relevant research and increasing capacity to influence decision-makers using science, improved governance and policy implementation through the different ministries and the Science Advisor's office, at federal and state levels, to support the blue/green economy. Many other national[165] and regional universities (such as the University of the South Pacific) conduct relevant studies on coral reefs and associated ecosystems and species.

3.4 Private sector and blue economy initiatives

The concept of a 'blue economy' is that the involvement of private and public spheres will provide both social and economic benefits to coastal populations, streamlining coastal and marine management plans in the region and fostering a greater connection among integrated ecosystem management interventions. The blue economy/blue growth features strongly in EU programmes such as Horizon 2020; the current Indonesian administration is strongly embracing this concept as well. One key point is the need for cross-sectoral communication and integration to avoid conflicts among stakeholders and activities such as aquaculture, tourism, renewable energy and fisheries.

Private sector conservation initiatives are growing throughout the region. The initiatives mainly involve companies from the seafood, tourism, shipping, manufacturing and telecommunication sectors, which are working to establish environmentally responsible business practices.[166] To capitalise on this, NGOs and governments are coming together to work with the private sector to facilitate both economic growth and income security, while simultaneously ensuring the sustainability of

(158) http://www.fishforever.org
(159) The programme is funded from the EU Seventh Framework Programme for research, technological development and demonstration. See https://sea-eu.net/
(160) S. Atkinson, pers. comm.
(161) J. Thomas, pers. comm.; WWF and partners in SI and PNG helped establish micro-savings schemes.
(162) Ferse S., M. Glaser, C. Schultz and J. Jompa (2012). Linking research to Indonesia's CTI Action Plan: the SPICE Program. Proceedings of the 12th International Coral Reef Symposium, Cairns, Australia, 9 to 13 July 2012; S. Ferse, pers. comm., 9 July 2016.
(163) AMNH (2014). A century in the Solomon islands. http://www.amnh.org/explore/news-blogs/research-posts/a-century-in-the-solomon-islands, accessed 21 February 2018
(164) www.tropimundo.eu
(165) In the Coral Triangle countries, as well as Australian, Japanese, US and European institutions.
(166) http://wwf.panda.org/wwf_news/?208057/Private-Sector-Commit-to-Blue-Economy-for-the-Coral-Triangle; S. Jupiter pers. comm.

Diver photographing a manta ray, Indonesia. Flagship species such as manta ray and whale shark are helping to drive the growth of a multi-million-dollar marine tourism industry in the Coral Triangle. The industry brings challenges of increased resource use and waste management, but also offers new economic opportunities to communities on remote islands.

Tourist accomodation, Raja Ampat. Marine conservation projects have supported the development of local small businesses which provide accommodation, guides and transport for visitors. The initiative has enabled local people to benefit from the growing tourism sector in the area.

resources for coastal communities. One example of a public-private partnership intended to contribute to the improved management of resources is the partnership between the Solomon Islands Ministry of Fisheries and Marine Resources and Solomon Islands Telecom. Together they have created a mobile inshore fisheries data platform (Hapi Fis, Hapi Pipol) that has provided a mechanism for collecting fishery data, both inshore and at fish vendors, where it is sent to a central server at the ministry for analysis, although quality control and management impacts remain issues[167].

Various blue carbon initiatives seek to develop management approaches, financial incentives and policy mechanisms for ensuring the conservation, restoration and sustainable use of carbon-rich coastal ecosystems such as mangroves and seagrasses. They include a 5-year Philippine-Indonesian-Japanese project entitled Comprehensive Assessment and Conservation of Blue Carbon Ecosystems and Their Services in the Coral Triangle (BlueCARES)[168].

A Coral Triangle Regional Business Forum has been initiated by the CTI to facilitate the engagement of the private sector in marine biodiversity conservation[169], and to leverage public-private partnership assistance to address unsustainable consumption patterns, including the live reef-fish trade, shark fin products and unsustainable tourism operations, as well as create new markets that incentivise sustainable business operations and demand sustainable products and processes.

Fisheries

The EAFM technical working group has been working on issues of certification, detection and traceability, and combatting IUU fishing and enhancing food security, with USAID support. NGOs are also encouraging governments to come together as a group to collaborate on tuna and snapper-grouper governance in the broader realm of regional fisheries management organisations, recognising the need for hard science on carrying capacity. The engagement of large companies is needed to drive change in the supply chain. One example is the multi-stakeholder collaboration among Coop/Bell Seafood of Switzerland, Seafresh of The Netherlands, the Government of Germany, the Philippine Bureau of Fisheries and Aquatic Resources, and WWF-Philippines. The goal of the partnership is to provide consumers overseas with sustainable small-scale tuna products alongside improving the management of tuna handline fisheries in Philippine coastal communities.[170] Industry and NGO efforts continue to reform the supply chain for the ornamental marine fish trade, while recognising that the aquarium trade can be an important source of income for artisanal fisherman.

Sustainable tourism

Tourism already brings significant revenue to the economies of the Coral Triangle countries, some of it based around charismatic marine fauna, reefs and shark/manta diving. However, if developed irresponsibly, coastal and marine tourism can have detrimental impacts on local ecosystems, including reef degradation and habitat loss, due to the conversion of coastal zones into tourism infrastructure (hotels, restaurants, etc.). The contribution of tourism to the conservation of marine resources has so far been limited. There is a risk of further marginalisation of coastal inhabitants, with subsequent increases in unsustainable resource use, if they are not involved and do not benefit from tourism activity. High-end tourism generally does not generate income opportunities for unskilled local inhabitants, unless accompanied by specific efforts to build capacity and create opportunities.

Actions to enhance the contribution of tourism to conservation include: fostering regional and national policies; planning and developing frameworks that encourage sustainable nature-based tourism (high-value, low-impact and niche tourism markets rather than mass tourism); providing enabling conditions that enhance the adoption of sustainable practices; and facilitating public-private collaboration for environmental protection and natural resource management.

Preliminary work on sustainable tourism in the Coral Triangle has been initiated[171], but the scale of the potential of tourism for the CT6 countries, in particular for the Pacific countries, is not yet clear. Methodologies and approaches for sustainable tourism development in the region are needed, with the next steps in this process creating locally developed and owned 'destination development plans'[172] . At regional level, capacity development and the creation of enabling conditions for community-related private sector investments are a priority.

3.5 Donor programmes

In Malaysia and Indonesia, the net official development assistance (ODA) receipts from countries which are members of the Organisation for Economic Cooperation and Development's (OECD) Development Assistance Committee (DAC) have declined, and aid as a percentage of gross national income (GNI) is close to 0.01 %. The Philippines is following a similar pattern, but receipts of foreign aid spiked in 2014 in response to typhoon Haiyan. Timor-Leste is more aid-dependent, with net aid flows of EUR 114 million in 2015 equivalent to 6 % of GNI. PNG was the highest aid recipient in the region on average between 2010 and 2015, although even here aid has declined by 30 % over 20 years, from EUR 692 million per year in the 1990s to EUR 350 million in 2015[173], around 3 % of GNI. The Solomon Islands aid receipts declined by nearly 50 % between 2010 and 2015, but aid dependency remained by far the highest in the region, at 14 % of GNI in 2015 (Table 3.3).

The largest donor to the region by far was Australia, which contributed over EUR 822 million in 2015, followed by the USA and France (Table 3.4).

Bilateral donors

Table 3.5 lists the bilateral and multilateral donors contributing to CTI-CFF activities during the period 2010-2015, a total of EUR 120 million.

European Union

The EU provides bilateral aid to Papua New Guinea, the Philippines, Solomon Islands and Timor-Leste. Indonesia and Malaysia are not eligible for bilateral aid but qualify for assistance under thematic budgets. PNG, Solomon Islands and Timor-Leste are members of the Africa, Caribbean and Pacific country grouping, and so qualify for European Development Fund assistance. EU allocations in the multiannual indicative plans for the four bilateral aid countries total nearly EUR 667 million for the period 2014-2020. Environment no longer features strongly on the agenda however, and the multiannual indicative plans (2014-2020) focus on:

- Philippines: sustainable energy and job creation, and on strengthening the rule of law;
- PNG: entrepreneurship, water and education[174];
- Timor-Leste: good governance, including reforms to public finance, and rural development, with an emphasis on agroforestry and nutrition;
- Solomon Islands: water, sanitation and hygiene; rural development.

(167) Cohen P. and D. Steenbergen (2015). Social dimensions of local fisheries co-management in the Coral Triangle. Environmental Conservation 42, pp.278-288.
(168) http://thebluecarboninitiative.org/
(169) Abraham A. (2015). Op cit.
(170) http://wwf.panda.org/what_we_do/where_we_work/coraltriangle/solutions/partnerships/

(171) For example, the 2-year Australian Government-funded project 'Developing & Promoting Sustainable Nature Based Tourism in the Coral Triangle' implemented by WWF; J. Thomas, pers. comm.
(172) Abraham A. (2015). Op. cit. CTI Regional Business Forum in Bali in August 2015.
(173) Prizzon A. (2014). The age of choice: Papua New Guinea in the new aid landscape. ODI, London. Available at https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/9396.pdf
(174) European Union – Papua New Guinea National Indicative Programme for the Period 2014-2020. http://eeas.europa.eu/papua_new_guinea/documents/nip_png_signed_2014-2020_en.pdf

Table 3.3 Net ODA receipts per country in the Coral Triangle

Country	Net ODA (EUR million)					GNI (EUR million)	ODA as % of GNI
	2011	2012	2013	2014	2015	2015	2015
Indonesia	84.69	-67.23	9.77	-236.62	3.62	641 466	<0.01
Malaysia	18.62	6.38	-102.15	-7.54	-12.69	221 519	0.01
PNG	429.08	410.15	384.31	357.08	350.23	12 713	3.75
Philippines	-174.54	-22.62	160.85	485.69	410.69	271 533	0.15
Solomon Islands	230.38	209.38	198.23	140.08	126.08	888	14.20
Timor-Leste	187.00	161.46	153.23	141.08	114.31	1 838	6.22
Total	775.23	697.54	804.23	879.77	992.23	1 149 957	0.09

Source: OECD (2017).[175]

The EU is an important trade partner for the region, and so has impacts on biodiversity beyond its role as an ODA contributor. For example, the regulation banning the import of untraceable tuna (2010) catalysed Philippine tuna fishers to organise and secure approval for a tracing system[176].

Australia

Australian ODA was cut by 40 % in 2015, but most of the cuts fell on programmes in Africa, with aid to neighbouring PNG, Solomon Islands and Timor-Leste cut the least[177]. Aid to Indonesia is seen as part of a transition to an economic partnership, and emphasises governance and capacity building in support of the national medium-term development plan. Australia remains the largest ODA donor to PNG, Solomon Islands and Timor-Leste. Aid to these countries focuses on governance, the justice systems, infrastructure, and health and education, with no direct support for marine or environmental issues, although 13 to 20 % of the aid to these countries focuses on agriculture, including fisheries.

USA

USAID is part of the Oceans and Fisheries Partnership, with the South-East Asian Fisheries Development Center and the CTI-CFF, which aims to support regional cooperation to combat illegal, unreported and unregulated fishing, promote sustainable fisheries and conserve marine biodiversity in the Asia-Pacific region.

USAID's 5-year, EUR 32 million Coral Triangle Initiative Support Program facilitated the Coral Triangle countries' implementation of the CTI Regional Plan of Action. USAID, the National Oceanic and Atmospheric Administration and the State Department committed over EUR 30 million for the project from 2009 to 2013, with the main conduit being the Coral Triangle Support Partnership, a 5-year project implemented by WWF, TNC and CI (until 2013). The program works with other donors including the Government of Australia and the Asian Development Bank (ADB).

In 2012, USAID launched the Marine Protected Areas Governance (MPAG) program in Indonesia, with an overall aim of assisting Indonesia to achieve its target of 200 000 km² of MPAs by 2020. Four international NGOs – CI, Coral Triangle Centre, TNC and WCS, and a national NGO, WWF-Indonesia, implement the program.

The Sustainable Ecosystems Advanced project will focus on fisheries and marine habitat conservation in three provinces in Indonesia (North Maluku, Maluku and West Papua). USAID funding is EUR 33 million (2016-2021) with 30 % targeted at the national level and 70 % for local capacity development.

USAID in the Philippines has supported a range of marine conservation projects, including the ecosystems for improved sustainable fisheries project (EUR 1 million).

([175]) OECD (2017). Geographical Distribution of Financial Flows to Developing Countries 2017: Disbursements, Commitments, Country Indicators. OECD, Paris. Available at: http://www.keepeek.com/Digital-Asset-Management/oecd/development/geographical-distribution-of-financial-flows-to-developing-countries-2016_fin_flows_dev-2016-en-fr#page244

([176]) http://wwf.panda.org/wwf_news/?188441/Europe-accepts-responsibly-caught-Coral-Triangle-tuna

([177]) Lowry Institute for International Policy: http://www.lowyinstitute.org/issues/australian-foreign-aid, accessed 29 May 2016.

Table 3.4 Net ODA receipts over EUR 7 M, per donor country (in millions of euro)

Country (ISO code)	ODA (EUR million) (2015)						
	EU	Australia	Canada	France	Germany	Japan	Korea
IDN	38.54	286.92	10.85	51.15	239.62	-768.54	30.46
MYS	1.46	1.62	0.08	4.00	7.38	-37.15	0.38
PNG	16.85	320.38	0.00	0.00	0.69	2.85	1.38
PHL	7.92	71.15	12.15	-10.62	25.08	54.08	33.85
SLB	4.38	93.85	0.00	0.00	0.23	12.92	2.15
TLS	8.85	48.46	0.23	0.38	5.62	14.85	6.92
Total	78.00	822.38	23.31	44.92	278.62	-721.00	75.15

Table 3.4 (continued)

Country (ISO code)	ODA (EUR million) (2015)							
	New Zealand	Norway	Spain	Switzerland	UK	USA	Other	Total
IDN	7.00	24.69	-11.46	10.85	23.38	100.38	-1.69	42.15
MYS	0.23	0.23	-0.23	0.08	6.62	3.46	0.62	-11.23
PNG	15.08	1.85	0.08	0.00	1.15	6.15	61.08	427.54
PHL	4.92	1.31	0.92	1.23	10.69	192.54	-47.08	358.15
SLB	15.62	0.00	0.00	0.00	0.62	0.69	0.00	130.46
TLS	11.46	2.23	0.00	0.00	0.08	13.69	10.38	123.15
Total	54.31	30.31	-10.69	12.15	42.54	316.92	23.31	1 070.23

Source: OECD (2017).[178]

([178]) OECD (2017). Ibid.

Table 3.5 Main bilateral donor disbursement in support of CTI-CFF activities, 2010-2015

Agency	Amount (EUR million)
USAID	63.6
GIZ	34.3
FAO	15.1
Australian Government	7.3
Total	120.3

Source: Abraham, 2015.[179]

Japan
In 2016, the Japan International Cooperation Agency working with the Japan Science and Technology Agency announced the acceptance of a 5-year Philippine-Indonesian-Japanese project entitled, Comprehensive Assessment and Conservation of Blue Carbon Ecosystems and Their Services in the Coral Triangle (BlueCARES).[180]

Germany
The German Development Cooperation agency (GIZ) is implementing a project funded by the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, in Indonesia, Malaysia and the Philippines. The project, Implementation of the Sulu-Sulawesi Marine Ecoregion trilateral action plan, will be implemented from 2012 to 2017. A second project, Marine and coastal biodiversity management in the Pacific island states and atolls (2013-2018), includes the Solomon Islands.

UN Agencies
UNEP is working with the Governments of Indonesia, Malaysia and Timor-Leste to implement a GEF project on enhancing the conservation effectiveness of seagrass ecosystems across the Indian and Pacific Ocean basins, which support globally significant populations of dugong.

Multilateral donors

Asian Development Bank
The Asian Development Bank supports work on sustainable finance models for the Coral Triangle (analogous to those that have been established for Micronesia and the Caribbean), including feasibility studies of different options. TNC has also led work on sustainable financing and identifying public funding that could feed into the Coral Triangle.

World Bank
The World Bank has supported a 15-year partnership in Indonesia, the Coral Reef Rehabilitation and Management Programme (COREMAP). The latest phase (2014-2019) is funded through a EUR 7 million grant from the Global Environment Facility (GEF) (see below), which is matched with loans totalling EUR 36 million. This phase will support 13 MPAs covering 57 000 km², and 2 fishery management zones[181].

Multi-donor funds and programmes

Critical Ecosystem Partnership Fund
The Critical Ecosystem Partnership Fund (CEPF)[182] is currently funding projects, including marine conservation, in two regions: the Wallacea hotspot, which covers central Indonesia and Timor-Leste (investment is EUR 4 million over 5 years) and the East Melanesia hotspot, which includes the Solomon Islands and the Bismarck Archipelago of PNG (investment of EUR 6 million over the period 2013-2021). Previous funding has supported conservation in the Philippines (2002-2007, EUR 5 million) and Sumatra.

Global Environment Facility
The Global Environment Facility (GEF)[183] has allocated EUR 140 million to the CT6 in its current 5-year cycle. The allocation for biodiversity conservation is 68 % (EUR 95 million), and of that 46 % goes to Indonesia, 25 % to the Philippines, 12 % each to Malaysia and PNG, 4 % for the Solomon Islands and 2 % for Timor-Leste. There are nine GEF projects relevant to marine biodiversity conservation, representing EUR 42 million of GEF support. Six of these are single country: three of them in Indonesia, two in the Philippines, and one in PNG; and three are multi-country: one in Indonesia and the Philippines, one in Indonesia, Malaysia and other countries, and one in the Solomon Islands and other countries.

Over the past 5 years, GEF has been a major donor to marine conservation in the region, investing over EUR 56 million, and leveraging nearly EUR 400 million in co-financing (Table 3.6).

Private foundations
Private foundations have made a significant contribution to marine conservation in the Coral Triangle, with the Walton Family Foundation contributing significantly to the creation of the Birds Head Seascape. Other foundations that have supported activities in the Coral Triangle include M.A. Cargill, and the David and Lucille Packard Foundation[185].

(179) Abraham A. (2015). Op. cit.
(180) http://thebluecarboninitiative.org/blue-carbon-initiative-project-funded-by-satreps/
(181) http://www.worldbank.org/en/news/press-release/2014/02/21/world-bank-indonesia-coral-reefs-coastal-communities
(182) CEPF is a joint initiative of l'Agence Française de Développement, Conservation International, the European Union, the Global Environment Facility, the Government of Japan, the MacArthur Foundation and the World Bank.
(183) GEF is a multi-donor fund established to fund global environmental projects. The GEF6 cycle of funding (2014-2018) has pledges of EUR 3.4 billion from 30 countries including Indonesia. See http://www.thegef.org/partners/participant

Fish for sale, West Papua, Indonesia. Fish is the main source of animal protein for a third of the people in the Coral Triangle, and a critical resource for many poor coastal communities. Improving livelihoods through sustainable management of coastal fisheries is a key element of donor support to marine conservation in the region.

Table 3.6 Summary of GEF funding and associated co-funding in the Coral Triangle region, by implementing agency bilateral donor disbursement in support of CTI-CFF activities, 2010-2015

Implementing agency	GEF grant (EUR million)	Co-funding (EUR million)	Total funding (EUR million)
Asian Development Bank	28.8	202.6	231.5
UNDP	11.8	90.5	102.4
World Bank	13.4	87	100.6
FAO	2.3	6.3	8.6
Total	56.3	386.4	443.1

Source: Abraham, 2015.[184]

(184) Abraham A. (2015). Op. cit.
(185) https://www.packard.org/what-we-fund/grants-database/coral-triangle-center-foundation-2/

4

Lessons learned

Whale shark and diver, Cendrawasih Bay, Indonesia. Whale sharks, the world's largest fish, are harmless plankton feeders. Where they can be viewed regularly, including at sites in the Philippines and Indonesia, they are the basis of significant local tourism industries.

4 _ Lessons learned

4.1 Marine protected areas and seascapes

The lessons and opportunities for the development of MPAs and protected seascapes are as follows:

- MPA governance operates at three very different scales: nationally managed marine national parks/MPAs, MPAs managed by local government, and locally managed MPAs (LMMAs or village-based MPAs). These different levels present different challenges in terms of funding and management.
- At all levels, the emphasis on expanding MPA coverage to meet Aichi Targets is leading to a large number of MPAs that exist on paper but lack capacity and sustainable financing to function on the ground. Work is needed to strengthen MPA management institutions – making them locally relevant/accepted or supported by communities and local government, ensuring long-term financing from government or non-government sources, and resolving overlapping enforcement mandates. In Indonesia, in particular, the legal basis of local government and community MPAs is unclear.
- The current spatial coverage of the MPA network is below the recommended targets in multiple countries so deliberate and objective-based network design and expansion is called for.
- Better collaboration with industry (e.g. fisheries and tourism) on design, management and funding of MPAs is needed to optimise the design and minimise the conflict with commercial activities.
- More work is needed to understand how MPAs function, how to enhance and accelerate information exchange among the countries, and how MPAs can form part of broader, multiple-use, marine management regimes, e.g. seascapes.
- Integrated coastal management is an interdisciplinary, multi-sectoral approach to coastal governance, which emphasises ridge-to-reef approaches and can help address the threat to marine ecosystems from terrestrial sources. While scaling-up is warranted, it is important to consider 'right-sizing', i.e. not scaling up beyond institutional capacities[186].
- The tourism industry in general is gaining considerably from biodiversity (e.g. diving/snorkelling on reefs) and efforts to conserve it (e.g. use of MPAs as a tourist attraction) but making very minor contributions to protection and management.
- MPAs are generally not at a scale that can be expected to cope with threats such as pollution and climate change. Seascapes are large marine areas that allow for coordinated approaches to management over multiple EEZs, various types of ecosystems and varying levels of government. They can accommodate the highly mobile nature of marine biodiversity and the interconnected nature of threats in a way that MPAs cannot. There are challenges in terms of coordination across multiple jurisdictions and mandates, especially internationally, something which the CTI-CFF mechanisms are helping to address[187].

4.2 Blue-green economy

The blue-green economy is a pathway to sustainable reef use and the achievement of Sustainable Development Goals and other targets. Illustrative examples identified from a stock-take of CTI-CFF programmes and projects[188] include:

- customised financial products and services targeting resource-poor coastal populations (e.g., microfinance options linked to alternative livelihood programmes to establish revolving funds for fisher-based enterprises);
- market-driven scientific research and development (e.g. bio-economic modelling in relation to fishing efforts; technologies such as low-impact fishing gear, 'smart' trawling, hand-held tracking devices linked to databases, which monitor total allowable catch);
- port infrastructure and 'cold chain logistics' (e.g. refrigeration, ice-making and cold storage);
- sustainable, low-footprint aquaculture (e.g. develop regulatory frameworks, zoning and siting tools; initiate aquaculture improvement and other demonstration projects);
- experimentation with hybrid fishery management tools where appropriate (e.g. property rights instruments such as TURFs or Individual Transferable Quotas; spatial and seasonal arrangements linked to innovative monitoring, control and surveillance);
- cultivation of socially responsible enterprises (e.g. develop policies and fiscal incentives conducive to emphasising triple bottom line approach and 'blue economy' growth, and assist firms in transition to sustainable models).

(186) Christie P., D.L. Fluharty, A.T. White, AR.L. Eisma-Osorio and W. Jatulan (2007). Assessing the feasibility of ecosystem-based fisheries management in tropical contexts. Marine Policy 31, pp. 239-250.
(187) Campbell S. and L. Pet Soede (2016). The Coral Triangle: Securing Investments for Oceans. Chapter 11 in Mackelworth P. (Ed.). Marine Transboundary Conservation & Protected Areas. Routledge. www.routledge.com/9781138851139
(188) Abraham A. (2015). Op. cit.

El Nido, Philippines. El Nido is part of the country's largest marine protected area. The site is the centre of a tourism industry, and tourists are encouraged to contribute to the management costs of the protected area.

4.3 Action against unsustainable exploitation

The illegal wildlife trade drives over-exploitation of some of the region's most threatened species. The trade networks are international, with many resources from Melanesia going to Asia. Key lessons are:

- Enforcement and coordination at key points for transit is important for controlling trade.
- Large-scale species-focused protected areas (e.g. a sea turtle protection network in the Sulu-Sulawesi Seascape[189] and Indonesia's 46 000 km² shark and manta ray sanctuary in the Bird's Head Seascape) are effective.

Efforts against the illegal wildlife trade are reviewed in more detail in the Greater Mekong chapter in this report.

(189) Pilcher, N. J. (2009). Design for a network of protected areas to safeguard marine turtles in the Sulu-Sulawesi Seascape. Conservation International Philippines Available at: https://www.conservation.org/archive/philippines/publications/Documents/Network_of_PAs_for_Marine_Turtles.pdf#search=network of PAs for marine turtles. Accessed 21 February 2018

^

Seaweed farm, Look Butun, Malaysia. Seaweed farming has grown in importance and now forms an important source of income for many coastal communities where the conditions (calm, clear waters) are available.

^

Surveyors laying a transect line as part of an assessment of coral cover, Solomon Islands. Development of local capacity to monitor and manage coastal ecosystems is crucial for their long-term protection.

4.4 Regional collaboration

Mechanisms for coordination, within and between countries and across donors, governments and NGOs, are important to tackle threats and manage resource issues that are interrelated and cross international boundaries.

Key lessons on structures for coordination and project design are as follows:

- Regional ocean governance is an important foundation for environmental sustainability, although the challenges of dealing with very different governance and cultural contexts may make it more practical to develop and field implementation projects within countries.
- Development of Regional and National Plans of Action (including the RPOA developed by CTI-CFF) requires a multi-year, participatory, science-based process, which needs considerable resources and time, posing challenges for sustainable financing. In the case of the CTI-CFF, the RPOA guides the structure of governance of the CTI-CFF, with periodic re-assessment of the progress on regional priorities that then determines the next set of regional priorities.
- Given the complex issues and stakeholder groups in the Coral Triangle, new programmes should invest in learning lessons, establishing relationships with existing organisations, and ensuring that systems for monitoring and evaluation and collaboration are in place, and are aligned with existing arrangements as far as possible.
- Funding arrangements need to be designed to support collaboration, for example by creating incentives for collaborative leadership and rewarding collective impact. This requires coordination between funding agencies and proponents of projects and programmes, from both government and NGO communities. The Philippines stands out for its success in getting donor funds to LGUs, overcoming institutional barriers in planning and disbursement.

4.5 Capacity development

Key lessons on capacity development are as follows.

- 'Learning networks' around priority transboundary issues, e.g. wildlife and seafood trade, or the smart design of MPAs, serve as professional and personal development opportunities.
- It is important to identify key individuals with clear technical reasons to participate in capacity-building opportunities, and ensure that their job descriptions in their home institution are adjusted to allow them to practise what they have learned.
- A marine protected area management training was successful in large part because it became embedded in Indonesia's government training programme through the Ministry of Marine Affairs and Fisheries' professional certification, eventually reaching approximately 2 500 MPA staff.
- Timor-Leste offers a success story with a government-supported co-management model that developed as a result of the country's engagement with regional partners; learning networks gave them access to considerable knowledge and support.
- A useful framework for capacity development in the Pacific islands has also recently been developed by IUCN and Biodiversity and Protected Areas Management, detailing three types of capacity development (accredited qualifications, tailored training, and informal learning and mentoring) and three cross-cutting themes that are essential to support any type of capacity development (enabling conditions, information exchange and monitoring and evaluation).[190]

([190]) Scherl L.M. and A.J. O'Keeffe (2016). Capacity Development for Protected and Other Conserved Areas in the Pacific Islands Region: Strategy and Action Framework 2015-2020. IUCN, Gland, Switzerland. vi + 42 pp.

5

Strategic approaches

Broadclub cuttlefish has a wide distribution, including in the Coral Triangle, but is fished throughout its range and may therefore be endangered. Lack of knowledge on the taxonomy and population size of the species means it is classified as 'data deficient' by IUCN. Inadequate data is a major constsraint for identifying priorities and taking action for conservation of marine biodiversity.

5 _ Strategic approaches

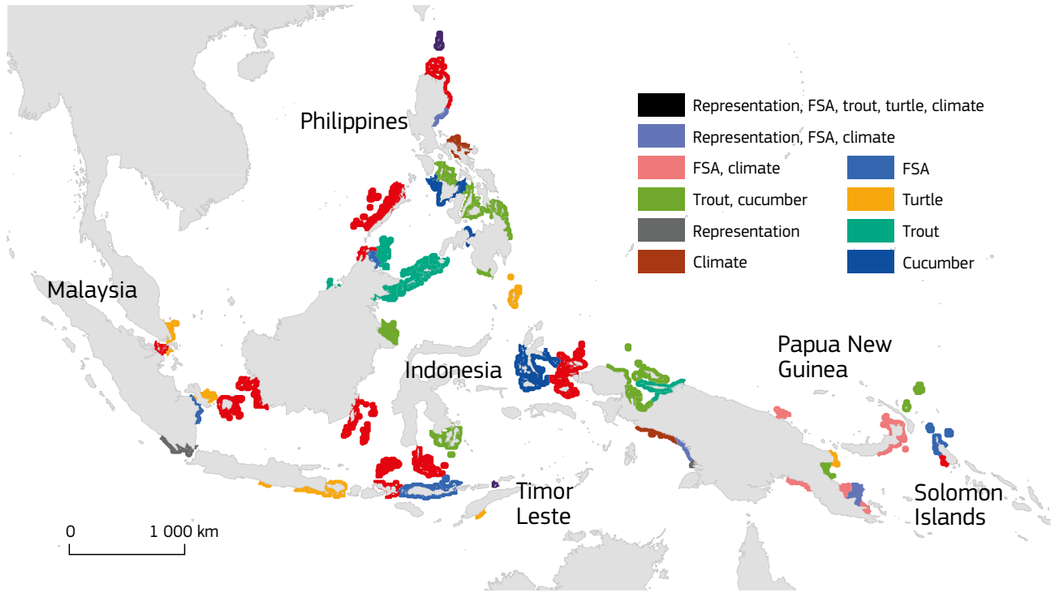
5.1 Priority geographies

The Coral Triangle is the centre of global marine biodiversity, and, as such, conservation efforts should be prioritised across the entire Coral Triangle area, including the 11 Ecoregions identified in Figure 1.2. Within those ecoregions, the analysis by Beger et al. (2015)[191] (section 1.2.4, Figure 5.1) is the most appropriate scale for broad priority setting, and is adopted here to define key seascapes for conservation (KSCs). KSCs are thus areas identified for:

- representation of marine habitats;
- grouper spawning aggregation;
- sea turtle habitat;
- larval dispersal between reefs for coral trout and sea cucumbers;
- reefs with lower vulnerability to climate change.

It should be noted that the data which underpins the identification of priorities (and the KSC), is poor, especially in PNG and the Solomon Islands, and that data on the use and management of resources is lacking throughout the region. These data gaps should be addressed in future, and the priorities reassessed in the light of new information. In addition, it is important that prioritisations are conducted at finer spatial scales, e.g. at national, provincial and local levels, using appropriate methodology for local settings, ideally locally-led or at least well embedded.

Figure 5.1 Key seascapes for conservation in the Coral Triangle (based on complementary priorities and subject to data limitations).



Note: FSA: fish spawning aggregation. Source: Beger et al. (2015). See footnote

([191]) Beger M. et al. (2015). Op. cit.

Leopard coral grouper, Plectropomus leopardus, *live on reefs throughout the western Pacific Ocean. They gather in spawning aggregations at the same sites every year, making them very vulnerable to overfishing. Careful siting of MPAs is critical to ensure that all stages of the target species' life cycles are protected.*

5.2 Strategic approaches to addressing the main pressures on biodiversity and ecosystems

The current threats of overfishing and IUU fishing, as well as poorly managed coastal development (significant threats to coral reefs and mangrove and seagrass ecosystems, respectively), are being joined by increasing threats from illegal wildlife trade and climate change. Responding to many of these threats requires regional coordination as well as 'on the ground' work. Therefore, the strategic approaches outlined here combine regional and site-level support, as well as cross-cutting, innovative approaches for capacity development, which will be needed to ensure sustainability.

5.2.1 Support sustainable MPA management

The network of ~2 300 MPAs in the Coral Triangle plays a key role in conservation of biodiversity and ensuring sustainable exploitation. An approach combining clarification of policies and regulations, sustained financing, and the development of adequate capacity within management institutions is essential to ensure that MPAs can perform their function.

- Build on the existing institutional structures of the Coral Triangle MPA System as a basis for capacity building and identifying gaps. Expand programmes of support and capacity building. Develop effective monitoring and evaluation using evidence-based tools that focus on aspects of MPA management and performance.
- Expand MPA networks so that they 1) meet fishery management objectives (i.e. they protect the life history range of target species), 2) protect critical habitats and life history stages of endangered and threatened species, and 3) protect representative habitats.
- Seek to develop synergies between MPA development and fishery governance reform, including rights-based management. Work on financing mechanisms to support fishers affected by policies designed to reduce overfishing, and market-based approaches, including various fishery and aquaculture improvement projects.
- Ensure that MPA management benefits from the expanding role of technology in fisheries management.

5.2.2 Address the impacts of poor coastal and watershed management and climate change

The divide between marine and terrestrial ecosystems is an artificial one, imposed by institutions and budgets. Ecosystems are highly interconnected across the tide-line, and a significant proportion of the damage to marine biodiversity and ecosystems is from terrestrial sources.

- Make the integration of 'ridge to reef' approaches in spatial planning compulsory where sensitive marine ecosystems are affected by vulnerable water catchments. Ensure that terrestrial planning and environmental impact assessments address the risks from pollution, agricultural nutrients and

Forested hills above a reef. Coastal marine environments are strongly affected by the management of adjacent land. Ridge-to-reef approaches take into account this interdependence, integrating marine and terrestrial conservation to increase the effectiveness of both.

Confiscated seahorses seized by the Fish and Wildlife Service on import to the USA. Growing wealth, improved communications and consumer trends are driving the illegal trade in marine products. International cooperation on information sharing, capacity building and joint law enforcement is an essential part of efforts to combat the trade.

sediments, wastewater or natural resource extraction.
- Support the development of capacity and creation of watershed-based decision-making mechanisms (e.g. multi-jurisdictional framework for objective setting, planning and decision-making that allows agencies to fulfil their mandates but complements others), including consideration of models for future climate change impacts.
- Assess how the completed regional MPA gap analyses for each country aligns with threats from the land, to prioritise areas for integrated approaches.
- Undertake economic valuation of coastal ecosystem services and their contribution to fisheries, tourism and coastal protection, including comparing natural vs. built infrastructure[192], to support improved decision-making on catchment management.
- Incorporate models of climate change impacts and disaster risk-reduction principles into economic modelling to demonstrate the increasing importance of maintaining natural ecosystem functions.

5.2.3 Build enduring capacity for conservation in the region

- Building on the work of the Coral Triangle Center, undertake a capacity needs assessment in each country, with the goal of designing a capacity development programme to meet each country's needs.
- Many materials for capacity development were produced as part of the Coral Triangle Support Program, and there are opportunities to improve their dissemination and use. Work has begun to review these materials, to summarise what is available (capacity development programmes, curriculum and other materials).[193]
- Address the lack of technical support available to community MPA managers by professionalising the career path of marine resource managers and extension services. Empower government fishery agency extension services, and other trainers and facilitators from advanced partner communities and local universities, to support a much larger number of communities working on near-shore coral reef and fishery management.
- Invest in long-term, high-level capacity building, including scholarships for post-graduate education and research. This is a long-term investment but will likely have a high return on investment as the young professionals trained become the next generation of leaders.
- Provide small grants to local committees and community-based organisations to engage in economic development and management of their key biodiversity areas, within an enabling legal environment and with appropriate technical support. Ensure a specific focus on women's involvement and empowerment.

5.2.4 Improve local and regional coordination and transboundary enforcement against wildlife crime

- Undertake monitoring and research to better understand the role of markets and demand in the over-exploitation of the region's marine resources.
- Invest in regional coordination platforms and developing capacity for transboundary enforcement and sharing of intelligence systems related to wildlife crime. Involve the home countries of fishers and poachers who are the main actors in the illegal trade.
- Expand and continue awareness and enforcement campaigns targeting consumer markets, supported by better private sector engagement and partnerships across NGOs, government and corporations[194].

5.2.5 Increase flows of finance for marine conservation

The Coral Triangle has attracted significant donor funding, but long-term sustainability of financing is essential to secure the future of MPAs and other management mechanisms.

- Engage with governments and the private sector to encourage investment in sustainable blue-green business, including technological developments, trade chain enhancement, and fish breeding and management.
- Work to ensure that tourism meets criteria for positive, equitable and sustainable impacts on communities and ecosystems. Pilot a system of promoting MPAs that meet criteria for sustainable management as tourism destinations.
- Continue support for ongoing work to establish sustainable finance models that would be effective in the Coral Triangle (analogous to those that have been established for Micronesia and the Caribbean).
- Create a 'funder's forum' of the many agencies investing in the Coral Triangle, to improve coordination and dissemination of learning.

(192) Waite R., B. Lauretta, E. Gray, P. van Beukering, L. Brander, E. McKenzie, L. Pendleton, P. Schuhmann and E. Tompkins (2014). Coastal Capital: Ecosystem Valuation for Decision Making in the Caribbean. World Resources Institute.

(193) Per request of CTI SOM, Eleanor Carter, Sustainable Solutions International Consultants, pers. comm.

(194) Pomeroy R., J. Parks, K. Courtney, P. Collier and N. Mattich (2014). Southeast Asia Regional Fisheries Stakeholder Analysis: a study undertaken for USAID/RDMA. Tetra Tech, ARD, Bangkok, Thailand.

Hatchling green turtles ready for release, Indonesia. To avoid predation by people, dogs, pigs or other predators, and to maximise hatching success, turtle eggs are dug up and re-buried in buckets of sand. Hatchlings are released to the sea. Long-term secure financing is essential to sustain interventions for the protection of vulnerable species and ecosystems.

5.2.6 Improved data, knowledge and learning in support of biodiversity conservation

Limitations of data and lack of understanding of the bio-physical processes that underpin the marine ecosystem of the region reduce the accuracy of priority setting for sites and species, make it more difficult to advocate sustainable practices and counter unsustainable ones, and make planning and the evaluation of management interventions less precise.

- Support priority, applied social and biological research and survey work, ensuring that it builds local capacity, and that results are effectively disseminated.
- Support knowledge management and data sharing/open source data mechanisms to disseminate new marine conservation science and experiences of conservation management efforts. Ensure that relevant staff are trained to interpret data to inform decisions and policy-level interventions.
- Maintain and update the Coral Triangle Atlas as a basis for promotion and dissemination of basic information on the importance of the Coral Triangle.

Coral reefs and islands, Sabah, Malaysia. The initiatives being taken to further marine conservation in the Coral Triangle need to be continued and expanded. They provide lessons for other regions facing similar problems.

5.3 Conclusion

The economic and social case for taking action to preserve the diversity and wealth of the Coral Triangle's biodiversity is strong, given its immense importance for the livelihoods of coastal communities, the national economies of the region, and its global attraction as a tourism destination. The resources and intangible services provided by the reefs are likely to become increasingly valuable as the impacts of climate change are felt. Mainstreaming sustainable practices across the many industries and sectors that affect the condition of the marine environment is a huge task, but the countries of the Coral Triangle are starting to pay attention to issues of sustainability and environment in their decision-making. The region is currently the focus of a unique multi-national effort to promote and coordinate the conservation of marine resources. As the interest of governments and the capacity of civil society organisations grow, there are important opportunities for donors to target investment towards building more sustainable livelihoods and economies in the region.