2. The Problems of Coastal Environment and Natural Resources: The Case of the Philippines

Rolan Jon G. Bulao

1. Introduction

The Philippines, composed of 7,641 islands located west of the Pacific Ocean, has a total territorial water area of 2,200,000 sq. km. and a coral reef area of 27,000 sq. km. It has vast marine ecosystems which serve as coastal protection and nutrient cycling producing beneficial aquatic goods. The country's sea waters cover an area of 266,000 sq. km with a shoreline that extends to more than 18,000 km. Millions of Filipinos live in more than half of the 1,493 municipalities in the country that are located in coastal areas. In 2018, the fishing activities accounted for about 16.4% of the agricultural sector's GVA which contributes 1.2% to GDP. The fisheries sector therefore directly generates employment for more than a million people, majority of whom are involved in small-scale fishing. Fish and other aquatic products serve as a major source of protein for Filipino families. The country's coastal resources are expected to thrive more due to nourishing tourism activities in the coastal areas which would require careful maintenance and management of the coastal system to have a sustainable path for tourism development (Angeles, 2018).

Thus, the fisheries sector is also facing threats and challenges such as overfishing, overexploitation and pollution affecting Philippine coastal resources, fishery habitats, and water quality. Being vulnerable to typhoons and effects of global warming, coastal communities are now facing worse threats from various unregulated and possibly detrimental human activities. The major fishing grounds in the country include Balayan Bay, Bohol Sea, Davao Gulf, Lagonoy Gulf, Lamon Bay, Lingayen Gulf, Manila Bay, Moro Gulf, Ragay Gulf, San Miguel Bay, Samar Sea, Sulu Sea, Visayas Sea, and the West Philippine Sea. Many of these areas experience coral reef destruction, which is caused by cyanide usage, industrial pollution, dynamite fishing, domestic wastes, and siltation. Conversion of mangrove forest into fishponds, beach resorts, and other commercial purposes reduces the natural habitats of aquatic species in the coastal areas.

The Philippine coral reef area is one of the biggest in the world with 797,814 hectares in 2016 (Philippine Statistics Authority, 2021). However, these coastal areas have been subjected to mismanagement and exploitation for the past decades. Figure 1 presents the result of a conducted assessment of coral reefs in the country. This was initiated in 2014 to update the information on the status of coral reefs in the country which was monitored from 2015 up to 2017. It was found that more than 90% of the same stations had fair and poor classifications according to its live coral cover (LCC) and none of them were classified in the excellent classification (Licuanan et al., 2017). Unlike in the first national assessment (1976-1981), there were still 5.5%

stations in the excellent category. The results show an average hard coral cover of 22% which implies a significant decline in the condition of local reefs.

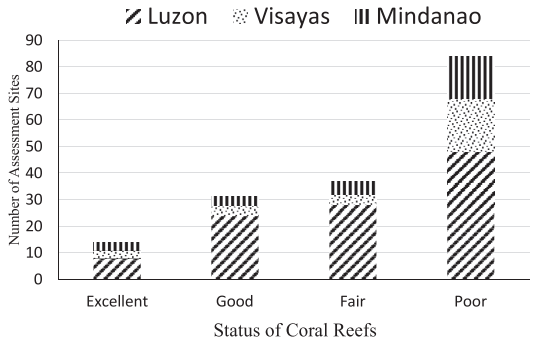

Figure 1 The current state of Philippine coral reefs based on live coral cover (2015-2017) (Licuanan et al., 2017).

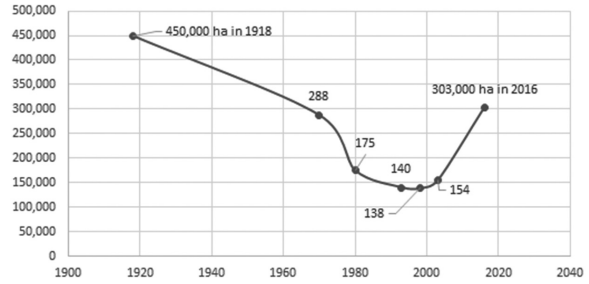

Figure 2 Area of Mangrove Forest (000' in hectares) 1918-2016 (DENR1988, 1995, 2013; White and De Leon (1996); White and Cruz-Trinidad (1998); PSA (2021)

Almost twenty years ago, mangrove forests had been declining from 450, 000 hectares in 1918, the mangrove forest cover had drastically dropped to 153,577 hectares in 2003, as presented in Figure 2. Despite the benefits of clean water, food, pharmaceutical products, and coastline protection, mangrove destruction is still observed due to residential and coastal zone expansion, tourism and agricultural activities, and other human activities. There is reason to be optimistic though as the total mangrove forest cover has significantly increased to 303,521 hectares in 2016. This could be attributed to the DENR's National Greening Program (NGP), especially their aggressive program to rehabilitate watershed areas and mangrove forests.

Over the period 2009-2019, municipal fisheries production has been relatively stagnant with noticeable declines annually (BFAR, 2020) (Figure 3). Other subsectors of the fishing industry also suffered a loss in fish production. Olaño et al. (2017) cited the contributing factors that adversely affect fisheries production in the case of Lagonoy Gulf. These include destructive overfishing, resource depletion in the coastal areas, and unregulated use of fishing gear. The damages in the coastal ecosystems reduce the reproduction rate of aquatic major species.

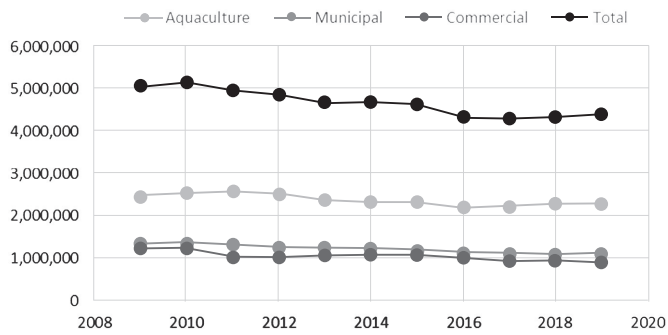

Figure 3 Fish Production by Sector in volume (in MT),2009-2019 (BFAR, 2020)

These problems in the Philippine coastal environment and resources also reflect worldwide realities where the unsustainable utilization and mismanagement of coastal environment and resources resulted in the destruction of coastal life support systems. According to the Food and Agriculture Organization (2005), from a

record high of 89 million tons of world catch of marine life in 1989, the world fish catch has been declining since then. Globally, there were 99.5 million tons of coastal plastic waste that had been produced within 50 kilometers of the seashore in 2010 (Geyer et al., 2017). Thus, plastic pollution could be more harmful to coral reefs due to its microbes that can settle in corals and can physically damage them. Lamb et al. (2018) concluded that the general likelihood of coral diseases increases from 4% for corals without plastic to 89% with plastic debris. Finally, the world population reached 7.7 billion in 2020 which could worsen plastic pollution in the major oceans (World Bank, 2021).

Due to these environmental problems, government intervention is necessary to protect the country's coastal resources. The promulgation of Executive Order (EO) No. 533 in 2006 has adopted integrated coastal management (ICM) as a national strategy for the sustainable development of the coastal and marine environment and resources in the country (Official Gazette, 2006). This order intends to attain food security, sustainable employment, poverty reduction, and natural hazard vulnerability reduction while preserving natural resources. The implementation of EO 533 is also anchored to the Philippine Development Plan (PDP) 2011-2016 that includes social development goals and strategies for sustainable economic development. The PDP's goal in Chapter 4 (Competitive and Sustainable Agriculture and Fisheries Sector) aims to attain prudent utilization of the natural resources to improve food security, increase rural incomes, improve climate change resiliency, and enhance policy environment. PDP's Chapter 5 aims to boost economic and infrastructure development including the aspects of education, health, and housing. The Environmental and Natural Resources Sector is discussed in Chapter 10 of the PDP, which prioritizes environmental resources preservation and restoration. With the DENR's Integrated Coastal Resources Management Project (2013), the government aimed to sustain the management of coastal environment and natural resources and improve the wellbeing of people in coastal areas.

The PDP 2017-2022 prioritizes the aggressive rehabilitation and restoration of exploited Philippine environmental resources while aiming to raise the living standards of resource-dependent communities. Towards this end, the government implemented major policies and laws which include a) Implementation of National Integrated Protected Area System Act; b) Executive Order No. 26 on the National Greening Program; (c) Executive Order No. 23 that prohibits illegal logging; (d) Amended Fisheries Code, and (e) Wildlife Resources Conservation and Protection Act. In addition, the PDP 2017-2022 aims to (a) establish identification of municipal water boundaries; (b) systematically identify marine protected areas (MPAs) with its network; (c) promote research on coastal and environmental resources, and (d) improve the conduct of regular data collection, scientific assessment, and determining reproducing areas for major fish species. This will ensure that ICM will be implemented effectively to achieve food security, sustainable livelihood, and climate resiliency.

This chapter will review recent literature, studies, and data on integrated coastal resource management in the Philippines. The analysis of this information shows some success in multi-stakeholder efforts towards sustainable management of the country's coastal environment and natural resources. However, despite winning some battles for environmental protection and conservation, there are still several challenges that remain unaddressed. These findings will be discussed in detail in this chapter.

2. ICM Sustainable Development Framework for Coastal Areas

According to Courtney and White (2000), ICM comprises activities that aim for a sustainable utilization and management of valuable coastal resources which also considers the benefit of the stakeholders within resource systems through the practice of coastal resource management (CRM). CRM is a process involving active participation of the community and other stakeholders in the planning, implementation, and monitoring of sustainable utilization of coastal environment and natural resources through the cooperation and coordinated actions of government, non-government, and environmental sectors to attain the common goals.

An ICM legal framework is a basis for the integrated management and conservation of coastal environment and resources being backed by the Philippine Constitution, which is the main basis of state laws, presidential or executive orders, court decisions, and LGU ordinances. Sections of Article II of the Philippine Constitution aims to "promote the right to a balanced and healthful ecology in accord with the rhythm and harmony of nature and encourage non-governmental, community-based, and sectoral organizations that promote the nation's welfare." Moreover, a section in Article XII of the same constitution declares "that all natural resources are owned by the State and accordingly, the State has the duty to protect marine wealth and to provide preferential treatment to subsistence fishermen."

The Local Government Code (LGC) or Republic Act (RA) 7160 has granted autonomy to LGUs to administer their respective territories including the coastal resources which was further strengthened through the enactment of RA 8550 or the Fisheries Code of the Philippines in 1998. RA 8550 has expanded the municipal waters to 15 km, established the Fisheries and Aquatic Resources Management Council (FARMC) that recommends relevant policies and local laws or ordinances in relation to fisheries development, and assigned competent deputy fish wardens from fisherfolk organizations that collaborate with the local police in patrolling and related operations.

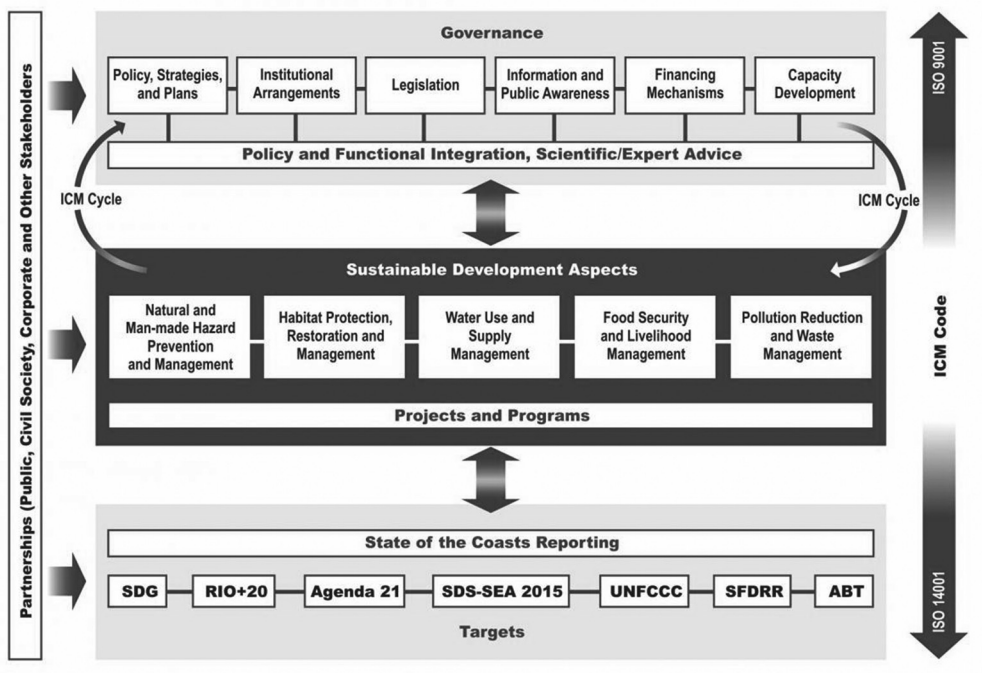

Figure 4 Framework for Sustainable Development of Coastal Areas through ICM Implementation (SDCA) (PEMSEA, 2021)

Furthermore, RA 8550 has given the local governments and their jurisdictions the opportunity to sustainably manage their coastal environment and resources. Thus, local governments have been empowered to develop programs related to integrated coastal management and eventually formulate CRM plans to address the growing problems faced by the coastal communities.

The Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) Framework for Sustainable Development of Coastal Areas (SDCA) through ICM or simply SD Framework gives a more comprehensible illustration for the inclusion of the National ICM Program into the PDP 2011-2016 and 2017-2022. The SD Framework in Figure 4 has four main components, which are discussed below.

1. **A governance component** that emphasizes the use of policy, strategies, and science-based recommendations in creating guidelines that ensure the sustainable development of coastal environment and resources;
2. **A sustainable development program** that has five main aspects of sustainable development that are essential in protecting and managing coastal environment and resource services such as natural and man-made disaster risk reduction and management, including climate change; biodiversity protection and restoration management; water use and supply management; food security and livelihood management; and pollution reduction and waste management;
3. **A State of the Coasts (SOC) reporting system**, using an agreed set of indicators, aims to assess and monitor baseline conditions and responses, impacts, trends, and ICM program outcomes; and
4. **Development and implementation of ICM** as the systematic process in attaining the intended outputs and outcomes based on the SD Framework.

All of these components in SD Framework are incorporated and mainstreamed in PDP 2017-2022 particularly its goal to ensure environmental integrity and health. The PDP recognizes the environment and natural resources (ENR) sector's significant contribution to economic development. This includes food, raw materials, and freshwater provision; local climate and air quality regulation, soil erosion prevention, and carbon sequestration; habitat for different species support and genetic diversity maintenance; and cultural promotion through recreation, tourism, etc. These contributions, in turn, boost the economic performance of other sectors such as agriculture and fisheries, industry, and services, and create livelihood for coastal communities. Despite these essential services, the country's environment and natural resources have still been compromised due to mismanagement, abuse, and overuse of people. This is the reason why the National Economic and Development Authority (NEDA), the lead agency in crafting and implementing the PDP, developed a midterm goal that includes the prioritization of aggressive rehabilitation and restoration of degraded natural resources, and safeguarding of the declared protected areas while enhancing the wellbeing of resource-dependent communities.

3. Wins and Challenges in ICM

3.1. Implementation of ICM Policies in the Philippines

3.1.1. Habitat Protection

The PEMSEA ICM considerably emphasizes the management of coastal and marine habitats that include mangroves, coral reefs, seagrass beds and other wetlands in pursuit of sustainable development. Natural

habitats are a priority concern because of critical threats and are thus addressed by developing and implementing programs that intend to protect, restore and manage them. Areas that observe ICM aim to protect and preserve biodiversity and ensure sustainable provision of goods and services that come from their respective coastal environments through those programs.

RA 7586 or the National Integrated Protected Areas System (NIPAS) Act of 1992 was enacted to establish and manage the national integrated protected areas system. Its salient features include: (i) properly defining the system, (ii) integrating more areas to the system, (iii) creation of buffer zones, (iv) formulating management strategies to serve as guide for the individual plans for each protected area, (v) administration and management of the system, (vi) establishment of a Protected Area Management Board for each of the established protected area, and (vii) punishing violators of the law and other related issuances by the DENR.

3.1.1.1. Coral Reefs

In the Municipalities of Pio Duran, Ligao, Oas, Libon, and Rapu-Rapu, Albay Province, Cabiles et al. (2017) assessed the coral reef system inside the Marine Protected Areas (MPA) through Reef Check which aimed to determine its reef health status in terms of types of substrate present, percent cover per substrate and benthic life forms. They made observations on reefs and conducted three replicates per station. They concluded that the Municipalities of Pio Duran, Ligao, Oas, and Libon were dominated by abiotic (non-living) type of substrate with 72%, 68%, 70% and 56% cover respectively, while Rapu-Rapu was mostly dominated by biotic component with 60% cover in terms of life form composition.

Table 1 The Status of Coral Reef System in the Selected Municipalities of Albay (Cabiles et al., 2017)

Municipalities	% Coral Cover (HC + SC)	Status
Pio Duran	21	Poor
Ligao	28	Fair
Oas	27	Fair
Libon	35	Fair
Rapu-Rapu	56	Good

Table 1 shows that only the reef areas of Rapu-Rapu were in good condition with 56% coral cover. Oas, Ligao, and Libon were in fair status (27%, 28%, and 35%) while Pio Duran was in poor reef health status with 21% coral cover. Based on the authors' regular monitoring, the impacts in the form of trash, coral damage, and bleaching were prevalent in the reef areas of the five municipalities of Albay.

3.1.1.2. Covered Mangrove Forest Area

In Table 2, we can see that there is a significant increase in the area of mangrove forest in the Philippines from 154,893 hectares in 2003 to 303,521 hectares in 2016 after various reforestation and conservation efforts made by different stakeholders. These efforts in mangrove reforestation are part of the National Greening Program (NGP), which aimed to plant 1.5 billion trees in 1.5 million hectares of land from 2011 to 2016. In these government initiatives, there have been accounts of successful implementation. For example, Garcia et al. (2019) noted that the program is directly helping communities in Region 8 (Eastern Visayas), which was badly hit by Typhoon Haiyan in 2013, due to the rehabilitation of coastal areas. This implementation is supported by the fact that mangroves may contribute to prevent loss of life and damage to property from possible

Table 2 Area of Mangrove Forest (in hectares) 2003 vs. 2016 (DENR, 2013 and PSA, 2021)

REGION		Area of Mangrove Forest (in hectares)	
		2003	2016
	PHILIPPINES	154,893	303,521
	LUZON	*59,599*	*121,251*
NCR		-	106
I - Ilocos Region		85	1,378
II - Cagayan Valley		3,069	5,742
III - Central Luzon		137	1,900
IVA - CALABARZON		5,237	19,303
IVB-MIMAROPA		44,373	68,417
V - Bicol Region		6,698	24,405
	VISAYAS	*31,542*	*67,637*
VI - Western Visayas		2,306	14,400
VII - Central Visayas		5,949	19,037
VIII - Eastern Visayas		23,287	34,200
	MINDANAO	*63,752*	*114,633*
IX - Zamboanga Peninsula		14,977	25,275
X - Northern Mindanao		1,297	5,218
XI - Davao Region		799	3,501
XII - SOCCSKSARGEN		504	1,848
XIII - Caraga Region		13,808	27,049
ARMM		32,367	51,742

devastation of typhoons, as they reduce the impacts of waves, storm surges and high winds in coastal communities (McIvor et al., 2012). Some challenges remain though, such as the case of Malabungot Protected Landscape and Seascape (MPLS) in Garchitorena, Camarines Sur. Nieves and Bradecina (2020) conducted a study to assess mangroves in MPLS. The study found 13 species belonging to seven families of true mangrove species that contributed to more than 33% of the identified "true mangroves" known to the country. The authors identified two common threats in MPLS: (a) cutting of mangrove forest for firewood and (b) domestic wastes although to a minimal extent. It is worth noting however that the mangrove communities covered by the study areas in MPLS were generally in good condition.

3.1.2. Food Security and Livelihood

Coastal and marine resources provide essential livelihood opportunities for various economic sectors in the country. However, uncontrolled utilization of such resources for their livelihood has resulted in the destruction of habitats and coastal ecosystems, which in turn harmed biodiversity. Consequently, the capacity of the country's ecosystem to provide goods and services, such as safe and sufficient food supply and livelihood opportunities have been negatively affected.

The problem remains to be in the mitigation of the increasing rate of exploitation of resources, destruction of ecosystems, and degradation of environmental quality. The Philippines has made initiatives to deal with the issues of livelihood management and food security through sustainable farming, fishing, post-harvest industries, and ecotourism undertakings. Pursuant to the ICM framework, the DENR, in partnership with the

Table 3 Major Species Volume of Production (in '000 mt), 2012-2020
(Philippine Statistics Authority Fisheries Situationer, 2020,2017, and 2015)

Major Species	Volume of Production (in 000' tons)								
	2012	2013	2014	2015	2015	2017	2018	2019	2020
1.Milkfish (Bangus)	391.33	405.78	401.98	392.74	402.66	416.16	400.12	414.94	422.79
2.Skipjack (Gulyasan)	206.46	212.23	241.6	233.54	220.11	241.67	258.38	266.38	262.08
3.Seaweed	1,751	1,558.40	1,549.50	1,566.36	1,404.52	1,415.32	1,478.30	1,499.96	1,467.82
4.Round Scad (Galunggong)	233.4	270.81	261.02	225.1	211.78	186.6	171.31	189	202.86
5.Yellowfin Tuna (Bariles)	125.27	130.14	140.77	143.39	103.04	105.69	99.44	99.35	95.85
6.Frigate Tuna (Tulingan)	131.69	134.24	133.64	137.68	133.89	122.61	111.92	111.51	110.52
7.Big-eye Scad (Matangbaka)	114.85	117.06	116.46	116.75	112.83	109.1	110.92	109.44	105.08
8.Bali Sardinella (Tamban)	246.06	229.23	256.58	290.65	280.47	242.95	259.13	247.5	339.23
9.Squid (Pusit)	54.88	57.18	55.69	52.95	52.12	49.92	47.33	46.95	44.3
10.Grouper (Lapulapu)	20.45	19.37	19.2	19.07	17.81	17.47	17.78	19.73	19.53

Biodiversity Management Bureau, is implementing its strategic action programs stipulated under the DENR Department Order No. 2016-26 which aimed for a sustainable coastal and marine resources management to achieve food security and improve people's welfare especially in coastal communities.

Table 3 shows the top 10 major aquatic species in the country and their respective volumes of production from 2012 to 2020. Among these major species, four have shown a significant increase in volume in 2020. They are milkfish, skipjack, round scad, and yellowfin tuna. On the other hand, the other six major species'

Table 4 Average Annual Fishing Income in Individual MPAs (Model 1) and in Regular Managed (SMI) and Erratic Managed MPAs (Model 2) in Time 1 (2004) and Time 2 (2010) periods and their differences (Bradecina, 2017)

	2004	2010	2010-2004
Model 1 (Individual MPA Categories)			
Regular Managed MPA (San Miguel Island)	44,984	50,182	5,198
Non-Regular Managed MPA (Atulayan)	14,063	25,987	11,925
Unmanaged MPA (Malinao)	28,761	50,022	21,161
Model 2 (Regular Managed and Erratic Managed MPAs)			
Regular Managed MPA (SMI)	44,984	50,182	5,198
Erratic Managed MPA	21,412	38,004	16,593
(Atulayan + Malinao/2)			

production volume has declined.

Jontila et al. (2018) present the nature and status of the sea cucumber fishery in the Province of Palawan. They found that the country's sea cucumber production has been decreasing. In contrast, the trading prices of the resource had increased several folds which could further put pressure on the resources. The authors recommended that the existing legal and management measures to protect the sea cucumber resources in the country should be revised to ensure the sustainable growth of the industry.

Meanwhile in the Province of Camarines Sur, Bradecina (2017) investigated whether MPAs in Lagonoy Gulf increase mean annual fishing income of fishers and reduce poverty over a specific period of time. Table 4 shows that the annual fishing income of fishers in regularly managed MPA is relatively higher than fishers in non-regularly managed and unmanaged MPAs. As such, the study found a positive effect on average annual fishing income of fishers in regularly managed MPAs against MPAs without or almost without management. In 2004-2010, the unmanaged MPAs posted an average annual fishing income higher than the non-regular managed MPAs which could be explained by the existence of an open access situation that allowed unregulated fishing within the MPA.

3.1.3. Pollution and Waste Management

The country's rich natural resources are being damaged by land-based pollution of marine and coastal environments. Because coastal communities are heavily reliant on the resources provided by their environment, there is a need for sound pollution management in the country's local and national coastal management strategies.

With the foregoing, the government has formulated strategic programs for pollution control. The Philippines is located in the so-called pollution hotspots, a region with serious pollution problems. Most local governments addressed nutrient reduction and other pollution problems to mitigate the negative effects of eutrophication, marine litter, hospital wastes, and urban garbage, which are detrimental to people's health and coastal environment quality.

Table 5 presents the concentration level of dissolved oxygen of selected marine water bodies in the country. In the DENR's National Water Quality Status Report (2014), dissolved oxygen (DO) is defined as the oxygen concentration calculated in its dissolved form which is needed to be at least five milligrams per liter (mg/L) of DO to sustain aquatic life's growth and productivity. From 2010 to 2017, 25 coastal and marine waters had been assessed and monitored as part of the Environmental Management Bureau (EMB) Beach Watch Program, 15 of which have SB classification (Recreational Water Class I, Tourist Zones, and Fishery Water Class II), eight are Class SC (Recreational Water Class II, Fishery Water Class III,, and Marshy and/or Mangrove Area declared as as Fish and Wildlife Sanctuary), while one marine water body is classified as Class SA (Fishery Water Class I and Protected Water). Based on the data, most of Central Luzon's coastal areas had recorded below 5 mg/L of DO which could result in massive fish kill. These were attributed to waste being disposed of in the seas causing water pollution. On the other hand, there were significant improvements in water quality in some areas in 2017, including Manila Bay, Limay Mariveles Coast, Iba Beach, Sabang Bay, Boracay Coastal Water, and Caragasan Beach. RA 9275 or the Philippine Clean Water Act was enacted in 2004 to execute policies on water quality management and rehabilitation, provide investment initiatives in sanitation, sewerage, and wastewater treatment, and prioritize research and development (R&D) for the improvement of water quality in the country.

Table 5 Concentration Level of Dissolved Oxygen (DO) of Selected Marine Water Bodies by Region 2010 to 2017 (milligrams per liter) (Philippine Statistics Authority, 2021)

(milligrams per liter)

Region	Water Body	Class	2010	2011	2012	2013	2014	2015	2016	2017
III - Central Luzon										
	Bulacan Bay	SB	...	...	7.4	4.8	...	...	...	...
	Manila Bay (bathing beaches)	SB	...	...	5.6	5.3	...	3.8	5.8	6.0
	Limay Mariveles Coastal	SB	...	...	...	5.4	4.2	3.6	4.1	6.3
	Beach Monitoring (Iba Zambales)	SB	...	...	...	5.1	4.2	3.3	3.6	5.8
	Pampanga Bay	SB	...	...	5.8	5.0	...	4.3	4.9	...
MIMAROPA										
	Bacuit Bay	SB	...	...	6.7	6.8	7.2	...	5.4	4.2
	Coron Bay	SB	5.9	...	7.0	9.1	5.4	8.6	6.7	3.8
	Sabang Bay	SC	...	...	7.7	9.7	6.7	...	...	9.2
VI - Western Visayas										
	Iloilo Coastline	SC	7.0	...	6.3	...	...	7.0	...	...
	Boracay Coastal Water	SC	6.8	...	6.7	...	7.0	7.0	7.1	7.6
	Guimaras Strait	SC	7.4	...	7.2	7.0	7.3	7.3	6.8	7.0
	Iloilo Strait	SC	7.1	6.7	6.7	6.4	7.5	7.2	...	6.4
	Roxas City Coastline	SB	...	...	6.0	...	...	6.5	...	...
VIII - Easten Visayas										
	Ormoc Bay	SC	9.6	10.3	10.0	9.4	7.9	9.6	7.7	10.7
IX - Zamboanga Peninsula										
	Bolong Beach	SB	...	...	...	...	...	...	6.3	6.3
	Caragasan Beach	SB	...	6.6	6.1	6.6	...	...	6.9	7.3
	Cawa-cawa Beach Resort	SB	6.6	6.0	5.6	6.6	...	5.6	6.7	6.2
	Golf Course Beach Resort	SB	7.5	6.6	6.8	6.9	...	6.3	...	...
	La Aplaya Bonita Beach	SB	...	7.0	6.9	6.9	...	...	...	...
	La Vista del Mar Beach Resort	SB	...	6.7	6.6	6.7	...	6.5	...	...
	Puerto Villa Beach	SB	...	7.5	6.6	6.9	...	...	6.7	6.9
X - Northern Mindanao										
	Macalajar Bay	NC	6.6	5.2	5.7	7.6	...	...	...	...
XII - SOCCSKSARGEN										
	Sarangani Bay	SC	6.0	6.2	5.7	5.9	5.9	...	5.9	5.4
XIII - Caraga										
	Hinagkaban Bay	SC	...	6.4	6.6	...	...	...	...	...
	Taganito Bay	SA	6.7	6.4	6.5	...	...	...	...	...

Notes: … no data
NC - not yet classified
*Dissolved Oxygen (DO) was not monitored during CY 2018 and 2019 as per Memorandum Circular 2015-006, recreational waters shall be monitored using fecal coliforn and pH
Source: Environmental Management Bureau, DENR

3.2. Challenges in the Implementation of ICM Framework

With fisheries production decreasing, pollution levels rising, mangrove forests and coral reefs being degraded, and extreme poverty in many coastal communities worsening, the Philippines experiences numerous challenges in the management of its coastal resources. More than two decades ago, coastal management initiatives started in the country through various community-based programs. New approaches being undertaken through the CRM Project support are linked to collaboration, prioritization, education, communication, identifying the responsible stakeholders, and extending the project (Courtney and White, 2000).

Population growth in the country particularly in coastal areas worsens environmental issues. The country's rapid population growth of 1.4 percent annually puts an increasing pressure on coastal communities (World Bank, 2021). Given that all major cities and most large industries are located near the seas, over 60 percent of Filipinos are living within the coastal areas. This congestion in some coastal areas worsens environmental problems such as pollution, land reclamation and conversion, and overexploitation of natural resources.

In Table 6, a regression analysis shows that an increase in the Philippine population causes the fisheries production to decline. As Choudhary (2020) puts it, when the total population rises, the quality of the environment is adversely affected because of the pollution from human activities. The Philippine government badly needs to control population growth so that the gains from sustainable environmental management could not be reversed by overpopulation which contributes to pollution and waste management problems.

Table 6 Results of Regression Analysis of Fisheries Production and Philippine Population

Source	SS	df	MS	Number of obs	=	11
				F(1, 9)	=	91.06
Model	8.4343e+11	1	8.4343e+11	Prob > F	=	0.0000
Residual	8.3366e+10	9	9.2628e+09	R-squared	=	0.9100
				Adj R-squared	=	0.9001
Total	9.2680e+11	10	9.2680e+10	Root MSE	=	96244

FISH_PROD	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
PHIL_POP	-.0552813	.0057933	-9.54	0.000	-.0683867	-.042176
_cons	1.02e+07	582300.3	17.58	0.000	8919711	1.16e+07

Figure 5 illustrates the trend of the country's fisheries production and population from 2009 to 2019 which shows a negative relationship in the regression analysis. While the population is growing exponentially, the fisheries production volume has been decreasing which creates a widening gap between demand for and supply of fish.

This assertion is supported by Morooka et al. (2008), who focused on the MPA with coastal communities as its core and reviewed the marine policies in the Philippines by documenting the annual changes of the state of ecosystems, mainly seaweed beds, in Bicol and Cagayan Regions, both in the island of Luzon. The study found that the main issues in the implementation of maritime policies in the country are: (1) the rapid and localized urbanization due to country's economic development and expansion putting environmental pressures on rivers and coastal areas, (2) the harmonization of social concerns and policies relative to environmental protection, and (3) the widespread overfishing in the area.

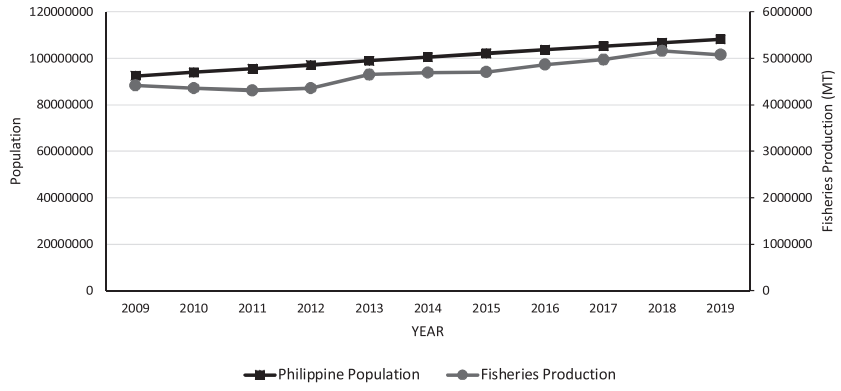

Figure 5 Fisheries Production (in MT) and Population, 2009-2019

In the study of Christie et al. (2005), although there are several national and municipal laws and ordinances that provide policy and regulated framework for ICM especially in the case of Mabini, Batangas, and Bais Bay, Negros Oriental, such laws are not properly enforced due to roles confusion, conflicting policies, political intervention, lack of interest in punishing violators, incosistent enforcement, and informal enforcement mechanisms. As a result, the wins in the battle for sustainable development in coastal areas are hampered.

White et al. (2007) expounded the major emerging trends that contribute to the institutional and policy frameworks of coastal resource management. First, ICM now focuses on the need for improved integration and collaboration among various stakeholders. Thus, partner institutions such as national government agencies, non-government organizations, universities, and donors are highly encouraged to work effectively with LGUs. A multi-sectoral collaboration is beneficial in finding solutions to the complex and deeply embedded CRM problems. Second, LGUs are assuming more responsibility when it comes to municipal waters and coastal resources management vis-a-vis their past reliance on the national government. This is even more pronounced starting in 2022 when additional national tax allotment from the national government is transferred to LGUs. To be more effective though, there is a need to provide incentives to local communities as a strategy to promote the sustainable use of natural resources (Azanza et al., 2017). Accordingly, local communities have a big role in CRM and incentivizing them for conservation efforts can further enhance the success of CRM programs in the country.

One such incentive is involving local fisherfolks in the governance of their coastal environment and natural resources. According to the sampled leaders of fishing communities in the municipalities of Tinambac, Calabanga, and Siruma, Camarines Sur Province, the fishermen organizations' membership in the Municipal Fisheries and Aquatic Resources Management Council empowers them to participate in governance which is an avenue for them to recommend policies regarding CRM. The identified problems include the intrusion of commercial fishers within the 15-km municipal waters and fishpond conversion which adversely affect the marine habitat and the natural cycle in the environment (Faustino and Madela, 2018). Faustino and Madela (2018) noted the importance of strengthening LGU efforts in formulating programs on the different CRM components. As the study revealed, the modest implementation can be attributed to the lack of scientific and baseline data such as community needs assessment. It is because the needs assessment could serve as a basis for identifying relevant strategies to address the various problems and challenges faced by coastal communities.

In Iligan Bay, fisherfolks were facing serious problems such as depleted fishery resources, lack of alternative livelihood, and limited institutional capabilities (Santos et al., 2017). As a response to these challenges, the Iligan Bay Alliance of Misamis Occidental was formed to explore opportunities in addressing issues and restoring and sustaining the fisheries in Iligan Bay.

Another problem faced by coastal communities in the Philippines is the management control of the elites. Larsen et al. (2010) examined how the objectives of ICM address the problems of a community in Babuyan Islands, a group of islands north of Luzon and south of Taiwan. Babuyan had not yet implemented a large-scale ICM program which could have mitigated some of the experienced challenges, which include continuous resource degradation, questioning of the exercise of stakeholder involvement, and rising resource conflicts. In Babuyan Islands, there were controversial issues in terms of divisive alliance politics and unethical control of the elite alliances. Coastal management could be controlled by local elites whose priorities are often for the welfare of intended beneficiaries of ICM. The study recommended the need for solving the destructive consequences for the victims due to the mismanagement of the Philippine coastal environment.

4. Discussion and Conclusion

We have seen that the Philippine government's implementation of ICM programs and projects have succeeded in improving habitat protection; food security and livelihood of coastal communities; and pollution and waste management in the country. First, there have been various policies and programs on habitat protection that contribute to the improvement of the coastal environment like the mangrove reforestation efforts which resulted in an increase from 154,893 hectares in 2003 to 303,521 hectares of mangrove forest areas in 2016. ICM programs also helped improve food security and livelihood of the people in the country. Through effective management of MPAs, the annual fisheries production and annual income of the fishermen of Lagonoy Gulf has increased in a span of a decade (Bradecina, 2017). Finally, the programs have also helped mitigate the adverse effects of pollution and waste disposal on coastal waters which was shown in the annual record of water quality of marine bodies in the country. This was made possible through the implementation of the Philippine Clean Water Act of 2004.

While there were several wins in the continuing fight for the sustainable management of coastal environment and resources, challenges still remain. These challenges include resource use conflicts, population growth and poverty, overfishing, and pollution. Resource use conflict is a particular issue that requires much attention from the government. In general, there is still a need to control the intrusion of commercial fishing in municipal waters and strictly implement specific regulations for fishing activities within known productive fishing grounds to protect small-scale fishers who are heavily dependent on the coastal resources for livelihood (Morooka et al., 2008; Bradecina, 2017; Santos et al., 2017; Faustino & Madela, 2018). In terms of population growth and poverty, a regression analysis showed that population growth negatively affected fisheries production in the country. A rapid increase in population creates an increasing environmental degradation from pollution, reclamation and conversion of fragile habitats, and overuse of natural resources (Morooka et al., 2008). In addition, pollution causes the depletion of coastal environment and natural resources (Lamb et al., 2018) as in the case of Albay's coral reefs (Cabiles et al., 2017) and the mangrove forest of MPLS in Garchitorena, Camarines Sur (Nieves and Bradecina, 2020). The lack of alternative livelihood due to poverty among coastal communities also affects fisheries and CRM (Santos et al., 2017). National strategies are recommended to continue and further improve ICM such as multi-sectoral collaboration, incentivizing the local communities, and proper delineation of LGUs' role in policy-making process and ICM programs implementation (White et al., 2007; Azanza et al., 2017).

Indeed, despite the country's accomplishments in managing its coastal environment and natural resources, there still remains some room for improvement, especially in terms of law enforcement and access to updated scientific and baseline data to ensure the sustainable management of the country's coastal resources. In law enforcement, the government needs more effort to properly implement the ICM programs which are not properly enforced due to confusion of roles, political interference, and questioning of the exercise of stakeholder involvement (Santos et al., 2017); Christie et al., 2005; Jontila et al., 2018). This is an important aspect of the ICM framework in terms of the governance component which could mirror the effectiveness of policy implementation/strategies in the management of the coastal resources of the country. In terms of access to updated scientific and baseline data, there is a need to improve regular data collection to monitor the trends, outcomes, and impacts of ICM programs on the country's coastal environment. This is because most of the available reports were outdated (Faustino and Madela, 2018). It is important to address this issue since it will be a good basis for monitoring and assessing the current state of the coastal environment and aptly formulate

policy strategies that will effectively attain the goals of the ICM framework. In conclusion, problems of coastal environment and natural resources in the Philippines still remain, which necessitates further improvement and updating of the implementation of ICM. The related statistics and studies presented in this chapter provide the real situation of the Philippine coastal environment. However, more studies should be undertaken to identify and address other current challenges to the country's management of its coastal environment and natural resources.

Acknowledgements

The author expresses his profound gratitude to Dr. Teruyuki Shinbo of Kochi University for his valuable insights and guidance; Dr. Raul Bradecina of Partido State University for his undying support in all our research undertakings in the university; Anthony James Albis for his generous assistance in the gathering and organizing of data; and his wife, Joyce, for her constant encouragement and assistance in proofreading. This book chapter is inspired by and dedicated to all Filipinos living in coastal communities.

References

Angeles, P. (2018). Coastal Development: Sustainability or Destruction? De La Salle University, Manila, Philippines. February 7-8. Retrieved from https: //www. dlsu. edu. ph/wp-content/uploads/pdf/conferences/arts-congress-proceedings/2018/dd-03.pdf

Azanza, R. (2017). Valuing the Blue Economy Using a Philippine Lens. Retrieved from https://dfa.gov.ph/images/APEC/Volume_II/Valuing_the_Blue_Economy_using_a_Philippine_Lens.pdf

Bradecina, R. (2017). Impact of MPA management variations on fishing income and movement in poverty among fishing households in Lagonoy Gulf, Philippines. Kuroshio Science 11(1), 31-42.

Cabiles, C. et al. (2017). Coral reef assessment in selected marine protected areas in Albay, Philippines. Kuroshio Science 11-1, 50-53.

Choudhary, V. (2020). Population growth and its impacts on nature and natural resources. Retrieved from http://natureconservation.in/population-growth-and-its-impacts-on-nature-and-natural-resources/

Courtney, C. and White, A. (2000) Integrated Coastal Management in the Philippines: Testing New Paradigms. Coastal Management, 28, 39-53.

Christie, P. et al. (2005) Legal Issues Affecting Sustainability of Integrated Coastal Management in the Philippines. Ocean & Coastal Management 48, 336-359.

Department of Environment and Natural Resources (DENR) (2014) National Water Quality Status Report (2006-2013). Retrieved from http://water.emb.gov.ph/wp-content/uploads/2016/06/NWQSR2006-2013.pdf

Department of Environment and Natural Resources (DENR) (1988). Mapping of the natural conditions of the Philippines, Final Report. Swedish Space Corporation, Solna, Sweden.

Department of Environment and Natural Resources (DENR) (1995). Philippine forestry statistics. Forest Management Bureau, DENR, Quezon City, Philippines.

Department of Environment and Natural Resources (DENR) (2013). Mangrove Management. Retrieved from

http://faspselib.denr.gov.ph/sites/default/files//Publication%20Files/2.MANGROVES_FINAL.pdf

Faustino, A. and Madela, H. (2018) Local Government Units Initiatives on Coastal Resource Management in Adjacent Municipalities in Camarines Sur, Philippines. IOP Conf. Ser.: Earth Environ. Sci. 139.

Food and Agriculture Organization of the United Nations (2021). Summary Tables of Fishery Statistics. Retrieved from http://www.fao.org/state-of-fisheries-aquaculture

Garcia, M. et.al (2019). State of the Mangrove in Central and Eastern Visayas: A Synthesis of Experiences, Lessons, and Management Recommendations. Retrieved from https://mangroveecology.files.wordpress.com/2019/03/6. -synthesis. pdf#: ~: text = All%20 provinces%20in%20Central%20and%20Eastern%20Visayas%20 employed,and%20monitoring%2C%20and%providing%20support%20for%20livelihood%20projects.

Geyer K. et al. (2017). Production, use, and fate of all plastics ever made. Retrieved from http://advances.sciencemag.org/content/3/7/e1700782.full

Jontila, J. et al. (2018). The sea cucumber fishery in Palawan, Philippines. Kuroshio Science 12(1), 84-88.

Lamb, J. et al. (2018). Plastic waste associated with disease on coral reefs. Retrieved from https://www.researchgate.net/publication/322703874_Plastic_waste_associated_with_disease_on_coral_reefs

Larsen, R.K. et.al (2010). Philippines Integrated Coastal Management: Diverging Stakeholder Agendas and Elite Co-option in the Babuyan Islands. Stockholm Environmental Institute, Working Paper 2010.

Licuanan, A. et al. (2017) Initial Findings of the Nationwide Assessment of Philippine Coral Reefs. Philippine Journal of Science 146(2), 177-185, June 2017 ISSN 0031-7683.

McIvor, A. et al.. (2012) Reduction of wind and swell waves by mangroves. Natural Coastal Protection Series: Report 1. Cambridge Coastal Research Unit Working Paper 40. Published by The Nature Conservancy and Wetlands International. 27 pages. ISSN 2050-7941

National Economic Development Authority (2021). Philippine Development Plan. Retrieved from https://pdp.neda.gov.ph/updated-pdp-2017-2022/

Official Gazette of the Republic of the Philippines. Executive Order No. 533, s. 2006. Retrieved from https://www.officialgazette.gov.ph/2006/06/06/executive-order-no-533-s-2006/

Olaño, V. et.al. (2017). Assessment of Fishery Resources in the Lagonoy Gulf, Philippines. The Philippine Journal of Fisheries 25 (1), 62-76.

Morooka, Y. et al. (2008) Maritime Policies for the Protection of the Coastal Environment in the Philippines with reference to Seaweed-based Ecosystem in the Marine Protected Area. Kuroshio Science 2(1), 93-102.

Nieves, J. and Bradecina, R. (2020). Assessment of mangroves in Malabungot Protected Landscapeand Seascape in Garchitorena, Camarines Sur. Kuroshio Science 14(1), 60-70.

Partnerships in Environmental Management for the Seas of East Asia (PEMSEA). Integrated Coastal Management. Retrieved from http://www.pemsea.org/our-work/integrated-coastal-management

Philippine Statistics Authority (PSA) (2021). Metadata Environment: Concentration Level of Dissolved Oxygen (DO) of Selected Marine Water Bodies by Region 2010 to 2017. Retrieved from https://openstat.psa.gov.ph/Metadata/Environment

Philippine Statistics Authority (PSA) (2021) Fisheries Situation Report, January to December 2020. Retrieved from https://psa.gov.ph/sites/default/files/Fisheries%20Situation%20Report%2C%20January%20to%20December%202020.pdf

Philippine Statistics Authority (PSA) (2018) Fisheries Situation Report, January to December 2017. Retrieved

from https://psa.gov.ph/content/fisheries-situation-report-january-december-2017-1

Philippine Statistics Authority (PSA) (2015) Fisheries Situation Report, January to December 2015. Retrieved from https://psa.gov.ph/sites/default/files/FStatPhil13-15docx.pdf

Santos III, L. et al. (2017) Challenges and Opportunities in Implementing the Ecosystem Approach to Small-scale Fisheries Management (EAFM) in Misamis Occidental, Philippines. Asian Journal of Agriculture and Development, 14(2), 17-30.

White, A. et. al (2007). Integrated Coastal Management in Philippine Local Governance: Evolution and Benefits. Retrieved from file:///C:/Users/James/Downloads/white2006%20(1).pdf

World Bank (2021). World Total Population. Retrieved from https://data.worldbank.org/indicator/SP.POP.TOTL