



The Coastal Environmental Profiling (CEP) of Barangay Mana, Malita, Davao Occidental, Philippines: Insights and Implications for Sustainable Management

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study focused on ascertaining comprehensive coastal environmental profile of Barangay Mana, Malita, Davao Occidental. Coastal environmental profiling can help policy-makers design appropriate management strategies in the locality. A self-structured survey questionnaire and key informant interview were articulated to know the stratum of the coastal area in terms of socio-political setting, present natural resources, economic sector, existing people's organization and management issues and opportunities. Purposive sampling technique was employed for data

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gathering following one-shoot sampling technique. Mean, percentage and catch per unit effort (CPUE) formula were used in analyzing the findings of the data. Results revealed that the overall population were 5,679 people, their average age is 31.92 and the productive gender is male. The average of their monthly income is Php7, 550.00 and business and fishing activities were common sources of income. An approximate 6 hectares wetland ecosystem were occupied by mangroves and shrubs grown and 1,500m coastline and 0.4 hectares of estuaries were abundant with seaweeds, seagrasses, mollusks and crustaceans and by which has contributed to building marine species habitat and livelihood. Economic sector was uplifted by 16.32% of fishermen with their volume caught fishes that goes through fermented processing and fish selling. There were four (4) people's organizations that are engaging with product development and innovation. These People's Organization aims to generate alternative livelihood income, thereby reduce poverty dense in the barangay. They were likewise supplemented with opportunities designed to fish food security and resiliency and Sustainable Livelihood Programs (SLP) from Local Government Unit (LGU) and National Government Agencies (NGA's). With the result of the study, it is recommended that Barangay Mana is still in need of various supports from local and national offices in adopting and addressing management issues in both economic and coastal environments.

Keywords: Fisheries; coastal resource management; natural resources; coastal environmental profile.

1. INTRODUCTION

The coastal areas, especially in zones adjacent to major rivers and bays, have historically attracted human settlements. It offers opportunities and access to fisheries and commerce and location advantage to rich agricultural lowlands and recreational spots. Coastal municipalities are endowed with rich marine life that can be able to sustain livelihood and subsistence of its populace for decades. The economics returns from these coastal resources- dependent activities cannot be underestimated [1,2]. Habitat destruction, illegal fishing practices and an open access regime are usually the culprits in this problem [3]. The need for the improvement of the management of coastal resources must have an integrative effort with the local government units, fishing communities and other stakeholders as active participants towards the enhancing the awareness for the group of people who shares coastal resources [4,5]. A major reason for this diverging development path can be found in differing local elite structures, which emerged as a result of different historical experiences [6]. It is envisioned that a well- documented coastal environmental profile can help policy-makers design appropriate coastal resource management strategies in their locality [7,8]. It is hoped that the findings, as the results of the study will be able to suggest starting points for the collaborations of the agencies and LGU's on the formulation of a more holistic approach addressing coastal environment and economic issues and opportunities.

2. MATERIALS AND METHODS

This study was conducted in Barangay Mana which covers with approximate measurement of 744 1781 hectares located northeast of Brgy. Tingolo, Malita, Davao Occidental, west of Brgy. Bito, Malita, Davao Occidental, southwest of Brgy. Ticulon, Malita, Davao Occidental and southeast of Brgy. Lais, Malita, Davao Occidental. The three sitios covered in the study were Talisay, Talucanga and Pagatpat with approximate total land area of 35 hectares using Google Earth Application/website (Google Earth,2021). Descriptive research design was used in the survey since it will examine the socio-political setting, the abundance and availability of natural coastal resources, the economic status and as well as the environmental and economic management issues and opportunities [9,10]. The respondents of the study were taken purposively from the residents residing at the coastal area of Brgy. Mana. The researcher used purposive and one-shoot sampling technique in gathering necessary data. The researcher used a self- structured survey questionnaire and interview of key resource person from field surveys supplemented the secondary data (i.e. maps, reports, Brgy. Recorded data, Community organization and etc.) as the key. Percentage/frequency, mean and catch per unit effort (CPUE) formula was the statistical tools in analyzing the findings.

3. RESULTS AND DISCUSSION

3.1 Socio-political Setting

There were 5,679 overall population occupies the whole area of Barangay Mana, Malita, Davao

Occidental. The productive age (31-40 years old) which has the garnered 19.19% while the lesser number of population ages 61 years old and above that consisted the 6.97% from the ages of overall population. Males were 50.70% and 1336 were females with 49.30 %. Other 27 individuals are completed vocational courses and skills trainings which gathered 1.00% because of job opportunities offered by companies are technical rather than professional and associated with lower income levels. Highschool students have the most numbered individuals which has the percentage of 16.90% with same finding from POPCEN, 2015. There are 301 of them engaged in business in forms of fish dealing, owning a store, online selling, RTW, small eatery, kangkong dealing and computer shop owner which owned 19.97 percent which dominates from other types of livelihood and employment. There are 477 individuals who earns Php 0.00 - 3,000.00 in a month and they are mostly laborers, stone pickers, kangkong dealers, other fishermen and farmers with small owned land area garnered the percentage of 34.77 percent. Sixty-eight (68) percent were catholic Christians w dominates among other kind of religion with same findings on POPCEN, 2015. Bisaya/Cebuano were 62.73 percent among all tribal groups. As reported, there are 417 households were members of Water

Cooperatives such as Mana Water Supply Cooperative (MAWASCO) have piped water as a type of water source which gained 64.95 percent. There are 430 households have water sealed toilet which garnered 66.98 percent and reported as the highest one. Heath programs and services include immunization which served to 74 babies at the present which has a percentage of 3.59 percent, maternal care essentially helped pregnant woman over the years and has benefited by 211 pregnant women at the present which has a percentage of 10.22 percent. In 642 households, 276 settled in their owned house and rented free lot which has a percentage of 42.99 percent since in the coastal communities, only few legally owns the land area. Among the household, 434 of them owned a motorcycle with a percentage of 64.97 percent for family used and livelihood. Twenty (20) of them owns a fish car for delivering fishes to nearby municipalities which garnered the percentage of 2.99 percent.

Over the years Smart Communication Inc. has provided network services among the area and as of June 2021, PLDT and Globe had entered the community. The present infrastructures in the study site were 4 churches, 1 high school building, 2 basketball open courts, 1 fish fermented processing plant building and concrete roads along Sitio Pagatpat.

Table 1. Socio-political setting of the study area

Demographic Profile	Frequency	Percentage	Mean
Population			
Households	912		
Individuals	6,866		
Age range (in years)			
0-10	386	14.24%	
11-20	515	19.00%	
21-30	401	14.80%	
31-40	520	19.19%	
41-50	422	15.57%	
51-60	277	10.22%	
61- above	189	6.97%	
Total	915	100.00%	31.92
Gender			
Male	1374	50.70%	
Female	1336	49.30%	
	2710	100%	
Educational Attainment			
Pre-school student	104	3.84%	
Elementary Level	282	10.41%	
Elementary Student	445	16.42%	
Elementary Graduate	274	10.11%	
High School	255	9.41%	
High School Student	458	16.90%	

Demographic Profile	Frequency	Percentage	Mean
High school graduate	323	11.92%	
College level	171	6.31%	
College student	71	2.62%	
College graduate	160	5.90%	
Vocational	27	1.00%	
N/A	140	5.17%	
Total	2710	100%	
Labor and Employment			
Fisherman	246	16.32%	
Farmer	40	2.65%	

Demographic Profile	Frequency	Percentage	Mean
Driver	123	8.16%	
Gov't Employee	107	7.10%	
Laborer	216	14.33%	
Businessman/ Manufacturer	301	19.97%	
Unemployed	135	8.96%	
Livestock	65	4.31%	
Poultry	84	5.57%	
Others (baker, nanny, cooker)	190	12.61%	
Total	1507	100%	

Income range (in Php)	Frequency	Percentage	Mean
0-3,000	477	34.77%	
3001-6,000	373	27.19%	
6001-9,000	156	11.37%	
9001-12,000	109	7.94%	
12,001-15,000	56	4.08%	
15,001- 18,000	27	1.97%	
18,001- 21,000	43	3.13%	
21,001- 24,000	43	3.13%	
24,001- 27,000	33	2.41%	
27,0001-30,000	23	1.68%	
30,001-33,000	16	1.17%	
33,001- above	16	1.17%	
Total	1372	100%	7550.9

Religion			
Catholic	1847	68.15%	
Islam	325	11.99%	
Iglesia	40	1.48%	
Christians	134	4.94%	
His Mission	107	3.95%	
Pentecostal	33	1.22%	
Alliance	83	3.06%	
Others: Foursquare, Adventist, PBMA, Orthodox	141	5.20%	
Total	2710	100%	

Ethnicity			
Muslim	284	10.48%	
Tagakaulo	381	14.06%	
Manobo	217	8.01%	
B'laan	116	4.28%	
Bisaya	1700	62.73%	
Others (Ilonggo, Ilokanano)	12	0.44%	
Total	2710	100%	

Heath, Sanitation and Medical Care			
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Source of Water of the households		
Piped Water	417	64.95%
Dug Well	218	33.96%
Water from Spring	7	1.09%
Total	642	100%
Toilet Facilities		
Demographic Profile	Frequency	Percentage
Water Sealed	430	66.98%
Unsanitary (Open Pit)	90	14.02%
Communal Toilet	108	16.82%
Others/PAIL SYSTEM	14	2.18%
Total	642	100%
Health Programs, Services and facilities		
Immunization Program	74	3.59%
Maternal care (Pre- Natal, Post- Natal)	211	10.22%
Brgy. Health Facilities (rescuer car, etc)	1053	51.02%
OTHERS/Family Planning Methods, Free Medicine, Free Check-up	726	35.17%
Total	2064	100%
Tenure status of housing unit and lot		
Owned House and lot	171	26.64%
Owned House and rented lot	152	23.68%
Owned house and rented free lot	276	42.99%
Rented House including lot	15	2.34%
Rented free house and lot	28	4.36%
Total	642	100%
Transportation means and owned by the households		
Motorcycle	434	64.97%
Tricycle	44	6.59%
Close cabs	75	11.23%
Fish cars	20	2.99%
Others like bongo, hilux, multicab	95	14.22%
Total	668	100%

3.2 Natural Resources

3.2.1 Aquatic resources and ecology

Going through the research area which are the three sitios located in coastal part, Sitio Pagatpat covers up the land area 16.8 hectares, Sitio Talucanga measured to have 15.9 hectares and Sitio Talisay covers up 3 hectares (Google Earth, 2021). Coastal wetlands are also measured to totally describe the richness of resources from wetland ecosystems. Coastline measured 1,500 approximately and Sitio Talucanga's wetland area measured to be approximately with 3 hectares and Sitio Pagatpat with 3.8 hectares. Among approximate measurement of overall wetland areas in study site which is 6.8 hectares,

there are different mangrove species and other shrubs were found in the assessment done and these were Bakhaw lake (*Rhizophora apiculata*), Pagatpat (*Sonneratia caseolaris*), Bakhaw baye (*Rhizophora mucrunata*), *Nypa fruticans* and Kangkong (*Ipomoea Aquatica sp.*) in wetlands ecosystem. Mangroves in the areas are potentially provides habitat and breeding ground for marine species, livelihood for local settlers, house construction, wind breaker and prevent coastal tidal erosion. Seaweeds species found in the assessment were peacock's tail (*Padina pavonica*), Turner (*Sargassum aquifolium*) and (*Sargassum polycystum*) and it supports livelihood, provides habitat and breeding ground for many marine organisms and decoration decoration.

3.3 Economic Sector in Brgy. Mana

3.3.1 Capture fisheries

Fishing is a subsistence livelihood in the profile area and many people start to work in the sea in their younger years. Based on the conducted interviewed on fishermen, seasonal peaks for fishing occur from the month of March to June. The fisher folk observe that most species are gravid during this period and that, because the weather is calm and the water is warm, the fish rise to the water surface. During this period also, fishers are sighted within the province's seawater boundary. There are many types of fishing gears they have with them every time they go out fishing. Table 3 below shows the fishing gears inventory of the fisherman in the study area. Table shows that out of 246 fishermen from the three coastal sitios of Brgy. Mana, many fishermen engage in using multiple hook and line "palangre" as it earns the highest rate of 17.71%, for the reason that it is inexpensive and easy to use techniques in luring fishing and the best methods when it comes to sustainability as the catch can be selective depends on the hook size they are using. Lines are the most abundant gears as supported by the volume of catches and species recorded and this type of fishing gears are also less exploitative (SBPS, 2020). Small fishes can be placed back to the water without being harm through the use of this fishing gear as they are not fit for the hook size. While on the other side, "taraya" and "kuryente" earns the lowest percentage rating (0.49%) in catching fish it's because nowadays, abundance of fishes was not the same as time pass by. As population increases in the coastal area, water pollution arises because of improper ways of throwing garbage causing the fishes and fishes habitat nearby shoreline to be destroyed due to contamination. Toxic compounds are commonly found in trash discharged into the oceans, which absorb all of the ocean's oxygen. This causes a significant reduction in the amount of oxygen accessible to animals and other fish, resulting in their death in their natural habitat (Marine Insights, 2019).

3.3.2 Fishing boats

A fishing vessel is a boat or ship that is used to catch fish (Piscary) in a lake, sea, or river. Fishing can be done in saltwater or freshwater. Study shows (Table 1) that the majority of fishermen own their fishing boats (bancas), and most boats are motorized (84.19%). Pump boats

or Bangkang de-makina is powered by a small gasoline or diesel engine are widely used by the fisherman because of its design and appearance. They are so important in the fisheries sector for balancing demand and supply that if they were not there, a very simple but equally important activity would come to a halt. Lansa on the other hand earned the lowest rate of 14.71% this is because Brgy. Mana is just a rural community where fisherman can only afford to buy small fishing boats.

3.3.3 Fish catch composition and its market value

Table presented below (Table 1) are the popular types of fishes that are mostly caught by the fishermen in the profile area, with their local names, scientific names and market price. The most common fish caught in the profile area that were identified by the fishermen were; Matambaka (*Selar crumenophthalmus*) that has a market value of Php 100-140/Kilogram, Nokus (*Loligo duvauceli*) that has a market value of Php 80-140/Kilogram, Pirit (*Acanthurus dussumieri*) sold in the market for Php 100-130/Kilogram.

3.3.4 Catch Per Unit Effort (CPUE)

Catch per Unit Effort is usually a derived quantity obtained from the independent values of catch and effort. Fishing gears like lift nets, entangling nets, hook and line and the use of "lagtang" are all applicable in fishing at daylight within a range 4-8 hours and estimated catch rate ranging from 3 kg. - 10kg. per boat trip. Palaran which is fishing all night long within a range of 10-15 hours and estimated catch rate are about 10 Kg.- 25 Kg. per boat trip". Payao or pamayao which refers to fishing that consumed more than a day as it range 12-60 hours or 1 day-3 days fishing. Estimated catch rate are about 15 Kg.-50Kg.per boat trip. Multiple hooks and line "Palangre" and the use of "lagtang" in the area of Talucanga are usually the favorable fishing gear in line with pamayao.

In the table presented below (Table 3), estimated Catch per unit effort (CPUE) of undak are about 0.007kg or 7 grams per hour for every 214 fishers in the coastal sitios. Estimated Catch per unit effort (CPUE) in "Palaran" are about 0.010 kg.or 10 grams per hour for every 246 fishers in the profile area. Estimated Catch per unit effort (CPUE) in "payao" is 0.06 kg. or 7 grams for every 220 fishers. It is evident that "Palaran" dominates the estimated Catch per unit effort

(CPUE). This is because many fishers go out fishing at night especially “himatayon” wherein volumes of catch of Nokus and Matambaka are caught in long night fishing. In the previous years, study shown that fisheries production went down by 4.06% in Davao region (PSA. Gov) as there were cases of illegal, unreported and unregulated fishing including overfishing, which has resulted in depletion of fishery resources. Aside from this, fishermen often say that fishes tend to deplete due to the Coal power plant nearby the area located at Brgy. Culaman, Malita, Davao Occidental. The fishermen surveyed have reported a reduction in their catch over the years due to damage and destroyed ecosystem brought by the effect of coal power plant that harm and kill fishes. Study shows that coal power plants have detrimental effect on the aquatic and marine ecosystem as residues in the

fly ash contain a cocktail of heavy metals such as mercury, cadmium, arsenic, nickel, lead, and etc which contaminates the water ecosystem.

3.3.5 Agriculture sector

Agriculture sector in the coastal area of Brgy. Mana is divided into three classifications. This includes the farming, livestock and poultry. Farming focuses on crops such as coconut, banana, cassava and manga in which 40 individuals are engage earning 21.16% presented in the table below. Livestock includes pig, goat and cow wherein 65 individuals involve earning 34.39% and poultry in which chicken, ducks, and turkey are being raised by about 84 individuals earning the highest percentage of 44.44%.

Table 2. Natural resources present in the study area

Particulars	Estimated area	Uses
Aquatic Resources and Ecology		
Mangroves and shrubs in Wetlands		
Bakhaw lake (<i>Rhizophora apiculata</i>)	1.5 ha	These potentially provides habitat and breeding ground for marine species, livelihood for local settlers, house construction, wind breaker and prevent coastal tidal erosion.
Pagatpat (<i>Sonneratia caseolaris</i>)	2.0 ha	
Bakhaw baye (<i>Rhizophora mucronata</i>)	2.0 ha	
<i>Nypa fruticans</i>	0.5 ha	
Kangkong (<i>Ipomoea aquatica sp.</i>)	0.8 ha	
Specie of seaweeds and seagrasses found in coastlines and beaches		
peacock’s tail (<i>Padina pavonica</i>),	600 sq	It supports livelihood, provides habitat and breeding ground for many marine organisms and decoration.
Turner (<i>Sargassum aquifolium</i>)	780 sq	
(<i>Sargassum polycystum</i>)	120 sq	
Estuary hipon (<i>Pandaka pygmaea</i>)		Some benefits provided by estuaries and their resources includes food, livelihood, pollutant filtration, nursery areas and protection from storm events.
Eel (<i>Anguilliformes</i>)	0.4 ha	
Crabs (<i>Brachyura sp.</i>)		
Mollusks (<i>Mollusca sp.</i>)		
Aquaculture		
Freshwater aquaculture		These raised by the respondents
<i>Pterophyllum scalare</i>		
<i>Carassius sp.</i>		For displays, stress, business, reliever and decoration.
<i>Cichlasoma sp.</i>		
<i>Cyprinus carpio</i>		
<i>Poecilia sp.</i>		
<i>Betta sp.</i>		

Table 3. Economic sector in Brgy. mana

Particulars	Frequency	Percentage	Remarks
Capture Fisheries			
Fishing Gears and Methods			
Taraya	6	0.14%	available
Sudsuray	21	1.71%	available
Sigpaw	182	14.78%	available
Pukot	9	0.73%	available
Pang-nokus	196	15.92%	available
Sarangat	156	12.67%	available
Pasol	179	14.54%	available
Palangre	218	17.71%	available
Pana	13	1.06%	available
Panalom	11	0.89%	available
Panulo	0	0	Not available
Pingwit	9	0.73%	available
Lagtang	206	16.73%	available
Kuryente	6	0.49%	available
Baling	19	1.54%	available
Total	1,231	100%	
Fishing Boats			
De-mano	40	14.71%	available
De-Makina	229	84.19%	available
Puso	2	0.74%	available
Lansa	1	0.37%	available
Total	272	100%	
Fish Catch Composition and its Market Value			
Bolinao	Php100-120/kl		available
Katambak	Php 160-180/kl		available
Matambaka	Php 100-140/kl		available
Bogaong	NO PRICE		available
Sapsap	Php 150-200/kl		available
Tabangko	Php 130-160/kl		available
Pirit	Php 100-130/kl		available
Karaballas	Php 60-90/kl		available
Nokus	Php 80-140/kl		available
Salmon-salmon	Php 130-160/kl		available
Kubal-kubal	Php 100-120/kl		available
Tulingan	Php 140-180/kl		available
Timbungan	Php 200-250/kl		available
Tanguige	Php 250-300/kl		available
Lapis	Php 100-120/kl		available
Badlon	Php 250-300/kl		available
Balo	Php 90-120/kl		available
Diwit	Php 60-90/kl		available
Amag	NO PRICE		available
Tabas	Php 50-90/kl		available
Hipon	Php 120-180/kl		available
Bariles	Php 250-300/kl		available
Puyo	Php 100-120/kl		available
Burot	Php 70-100/kl		available
Bangsi	Php 70-100/kl		available
Pandawan	Php 130-180/kl		available
Budburon	Php 130-180/kl		available
Bilong-bilong	Php 70-90/kl		available
Lukay-lukay	Php 50-80/kl		available

Particulars	Frequency	Percentage	Remarks
asohos	Php 200-250/kl.		available
maya-maya	Php 200-250/kl		available
lipipan	Php 200-250/kl		available
Marang	Php 200-250/kl		available
Lipti	Php 200-250/kl		available
Ganting	Php 200-250/kl		available
Sagisi	Php 200-250/kl		available
Rompe-kandado	Php 200-250/kl		available
Talakitok	Php 200-250/kl		available
Catch Per Unit Effort (CPUE)			
Undak	0.007kg./hour for every 214 fishers		available
Palaran	0.010kg./hour for every 246 fishers		available
Payao	0.006kg./hour for every 220 fishers		available
Agricultural Sector			
Farming/cros	40	21.16%	available
Livestock	65	34.39%	available
Poultry	84	44.44%	Available
Total	67	100%	
Manufacturing and Business Sector			
Sari2 store	65	21.45%	Available
Computer shop	8	2.64%	Available
Kakanin selling	22	7.26%	Available
Fish selling	57	18.81%	Available
Kangkong harvesting	14	4.62%	Available
Bukag2 fish delivery	10	3.30%	Available
Online seller	11	3.63%	Available
Rtw/ukay2	9	2.97%	Available
Small carinderia/barbequ ehan	16	5.28%	Available
Gulayan	10	3.30%	Available
Cuconut wine seller/gatherer	8	2.64%	Available
Stone picking	49	16.17%	Available
Space rental	3	0.99%	Available
carwash	5	1.65%	Available
Hollowblock production	2	0.66%	Available
Lumber trading	1	0.33%	Available
Salon	2	0.66%	Available
Volcanizing shop	3	0.99%	Available
Motor parts	3	0.99%	Available
hardware	2	0.66%	Available
resort	1	0.33%	Available
Furniture shop	2	0.66%	Available
Water refilling station	1	0.33%	Available
Total	303	100%	Availabe

3.4 People's Organization and Cooperative

There were three existing People's Organization and one cooperative in costal sitios of Barangay Mana, Davao Occidental which continues to adhere and reach their goals for member's

benefits throughout the years. The Mana Water System Cooperative (MAWASCO) is a cooperative in which members are piped water users from same reservoir and water system. It composed of 1,467 member that represented by each household and 417 of them were from the three coastal sitio. The officials of the

cooperative actively facilitate seminars like AGRIPINAY that offers income generating project to housewives and capital loans amounting 100,000.00 for 30 selected individuals from its members in coordination with Department of Agriculture (DA). Existing associations are in the study are widely and purely related to fisheries and anchored to the Fisheries and Aquatic Resources Management council (FARMC) who targets actions to reduce poverty and generate economic transformation to improve their livelihood in the fisheries sector. Pagatpat Fisherman Association (PAFIA) has 24 members and legally registered to Department of Labor and Employment (DOLE) last July 3, 2020. They receive the Bureau of Internal Revenue issuance of receipt las September 04, 2020. The other association namely Mana Fermented Fish Processing Women Association (MFFPWA) composed by 58 women led by their focal person and it was registered in Department of Labor and Employment last August 2, 2019 and have their business permit at same date. There is a new-built building for them - the Fish Processing Plant which was turned over by Governor Claude P. Bautista last December 11, 2020 and it is in partnership with other business departments like Department of Trade and Industry (DTI) Davao Occidental and Municipal administrator leagues to MATINLA Farmers Association and MATINLA Fish Processors Association. They productively produced ginamos, Vinegar, salted peanut, dayok, dried squid and fish. The Department of Trade and Industry (DTI) grant funds with the amount of 300,000.00 as capital loan. The third People's Organization as reported named Nagkahiusang Mananagat sa Barangay Mana (NAGMABMA). It composed by 30 members and led by Ronilo S. Labrador. The association legally registered in Department of Labor and employment last July 26, 2017. (NAGMABMA) SLPA was granted and allocated 380,000 from DSWD, DSLP Office of Region XI to be used in the procurement of stocks to be sold in the SLP store. Their programs include the construction of store that sells fisheries supply like fishing gears such as nylon, taga, sensor, tingga, saranggat, sikpaw, liha, paon sa undak, etc. and their reported recent profit for the business is 29,394.00. The association is active in seminars such as Fisheries and Aquatic Resources Managemrnt council (FARMC) this agency assists in the preparation of fisheries development plan and recommends enactment MANA fishing Ordinances to Sangguniang bayan, Sangguniang panglungsod, coordinated in DENR and follows guidelines from Fisheries

Administrative Orders (FAO). Above all, the primary goals Sustainable Livelihood programs is to reduce inclusive growth of poverty (The World Bank, 2018).

3.5 Coastal Environment Issues and Opportunities

Coastal environment of Brgy. Mana shares the same problem with the rest of Davao Gulf across Mindanao. The suggested management options were intended to ease the conflicts in each problem area and to relieve the pressures impinging on all resources in the coastal area of Brgy. Mana . Aside from the issues besetting the coastal resources of the profile area, the following presents crucial issues on the environment and economy that affect the coastal area of Brgy. Mana.

3.6 Air and Water Pollution SWOT Analysis

The present study conducted regarding management issues, air and water pollution, indicate that absence of a common strategy for coastal and maritime management, shortage of strategic plan for coastal environment conservation, lack of proper systems of coastal pollution will result to environmental degradation and increasing frequency of natural disaster. The coastal area of Brgy. Mana is a potentially productive natural ecosystem. However, the growing presence of human communities highlights the increasing need for considerate management of this area in order to yield substantial returns to the people.

Air pollution is caused mainly by the combustion of petroleum products by motor vehicles, combustion of woods and burning of plastics that are most common activity in the coastal area of Brgy. Mana. Urban air pollution is one of the environmental hazards that World Health Organization assessed as part of its burden-of-disease calculations for the World Health report 2002 (WHO, 2002).

3.7 Improper Sanitation (Lack of Toilet and Source of Water Facilities) SWOT Analysis

Sanitation issues such as lack of toilet facilities is common in the area mostly in Sitio Pagatpat wherein residents opted to go directly to riverside and seashore to defecate, and lack of water source that the residents are opted to use water

from unsanitary spring (Tubod/Balon) for households chores and drinking purposes. Poor maintenance of every individual settler sanitary complexes, cultural practices, lack of comprehensive coastal zoning are said to be one of the reasons why these issues arise that results in increasing frequency of unhealthy human, animals, and marine environment.

Moreover, the Local Government Unit of the Municipality should return the previous sanitary awareness such as providing each household a toilet bowl for them to have a toilet on their own. However, to some households who are living in an overcrowded place wherein toilet facilities cannot be constructed, a public toilet is applicable to cater and should be promoted by the Barangay. Increasing public awareness and crowd management were also some ways on helping eradicate improper sanitation in the locality. Given this, reduction of pressure on the marine resources and healthy lifestyle will arise Brgy. Mana.

3.8 Improper Waste Disposal SWOT Analysis

Improper waste disposal is the disposal of waste in a way that has negative sequences for the

environment. It also has far-reaching socioeconomic repercussions that governments should take into account today. Substitution of organic plates, etc. for plastic items, provision of health centers near coastal zones, increasing public awareness, crowd management and encouraging litter free zone along the coast are all required for the waste management agenda. Brgy. Mana council can develop a set of activities to limit the amount of waste that needs to be disposed of. They have the potential to encourage source reduction. Reuse and recycling as realistic waste management solutions that reduce waste and promote more resilient, diversified, and sustainable communities' economies that are self-sufficient and long-term. In other words, people should now see waste management not only as a social responsibility but also as a business opportunity. The government is unable to manage waste on its own. The goal of the public awareness campaign should be to mobilize widespread support for effective waste management. Given the said opportunities and implementation of the BLGU, good soil and climate, tourism potential, reduce pressure on marine resources, high level organizational facility, and coastal protection structure will be developed.

Table 4. Existing people's organization and cooperative in the study area

Name of People's Organization	Members	Programs and Activities
Mana Water System Cooperative (MAWASCO)	417 members	Water supply Offers livelihood assistance such as chicken laying eggs Facilitate agri-pinay project for women Coordinates with the DTI in conducting cooking lessons that sustain income for women.
Pagatpat Fisherman Association (PAFIA)	24 members	Funded by BFAR to provide a capital for fisherman.
Mana Fermented Fish Processing Women Association (MFFPWA)	58 women	They productively produced ginamos also known as salted fish paste in Classique and hot and spicy flavor, Vinegar, salted peanut, dayok, dried squid and fish.
Nagkahiusang Mananagat sa Barangay Mana (NAGMABMA)	Composed by 30 members	Their programs include the construction of store that sells fisheries supply like fishing gears such as nylon, taga, sensor, tingga, saranggat, sikpaw, liha, paon sa undak, sapyaw, pulunan, plywood, bulb, timon, tubo, gasoline, kerosene, dry cell battery, pamu, ice box, plasher, epoxy, flashlight, grease, spark plug and other fishing gears and equipment involve in fishing.

3.9 Fish Scarcity SWOT Analysis

Degradation and destruction of coastal and marine habitats, changes in marine community composition and trophic interactions, and the employment of harmful fishing methods or gear types are all factors that contribute to the loss of marine biodiversity.

Untreated waste water discharge, inefficient in implementing legal framework, lack of comprehensive coastal zoning, population crowded are said to be the reason of the depletion of fishes in the Barangay that results to disappearance of marine resource, increasing frequency of food scarcity, threatening of natural sites by over commercialization, damages of important marine species and habitat destruction. Brgy. Council of Mana and the Local Government Unit of the Municipality of Malita should manage and govern for a resilient social-ecological system, preventing the fishery from failing to deliver benefits by nurturing and preserving ecological, social, economic, and institutional attributes that allow it to endure, renew, and reorganize. The challenge is to build and strengthen coastal nations' and communities' social-ecological resilience to the many effects of fisheries resource scarcity, increase of coastal revenue, increasing coastal guards, possibility of endangered species culture, crowd management as well to break the destructive cycle of "fish wars." Given this opportunities, marine resources and food availability will gradually have developed.

3.10 Economic Issues and Opportunities

The coastal area of Brgy. Mana is endowed with diverse fisheries, agricultural and natural resources and has the potential to produce more. But diverse fisheries, agricultural and natural resources cannot sustain the growth and development of the economy as it is constantly hampered by product seasonality, vulnerability to natural calamities, and product inelasticity to income and price change.

3.11 Unemployment SWOT Analysis

The cost of unemployment to the individual is not hard to imagine. When a person loses their job, there is often an immediate impact on that person's standard of living. In Barangay Mana, there were individuals who happen to be lack of education, lack of creativity, bias/pabor2 system because of low profile are said to be some of the

reason why unemployment occurs and because of this poverty arises and some families were suffering financial problems due to no income. The Local Government unit, in response to the growing unemployment affecting economy of the residents, continues to reach up poor families as vulnerable population who are greatly affected by the catastrophe through supporting Sustainable Livelihood Programs (SLP) distributed to different sitio in forms of small scale business such as sari-sari store and selling fishing gears, tools and equipment. Housewives in Brgy. Mana, particularly those who are residing along coastal areas that are not a beneficiary of 4'Ps and other Government Funding program, were provided technical support and livelihood trainings sponsored by the Province of Davao Occidental. The main goal of the sponsored Sustainable Livelihood Programs is to eradicate poverty, give opportunity to the unemployed individuals, and to help them sustain their essential needs.

3.12 Pandemic Covid-19 Crisis SWOT Analysis

The onset of Covid-19 pandemic brought the country's economy into recession breaking almost three decades of uninterrupted growth. High risk of pandemic occurrence in Brgy. Mana and throughout the nation are said to be the result of inefficiency in implementing legal frameworks, lack of awareness, underdeveloped health emergency discipline, lack of relief materials and human resources and the spreading misinformation rumor that set an alarming issues not just on economic but on mental and physical aspect as well that results to negative impact on a daily life, works, on economic status and increase poverty. Low prices of Crops and Fishes SWOT Analysis.

Low prices of crops such as the coconuts, manga, and cardava in the market were the problem face by the farmers in the Barangay. Meanwhile, low prices of fish caught were also the problem of the fishermen in the locality. This happens because of the fishermen and farmers lack of knowledge on the industry, in economic diversity and the poor organizations supporting farmers and fishermen in the study area. Increasing frequency of poverty, unhealthy competition and increasing number of unemployment were the threats given by the disadvantage of low prices of crops and fishes [1,2,11-26].

Table 5. Analysis of coastal environment and economic issues, problems and opportunities

Particulars	Strengths	Weaknesses
Coastal Environment Issues		
➤ Air and Water Pollution	<ul style="list-style-type: none"> ▪ Aesthetics of beach environment. ▪ Strong coastal protection structures. 	<ul style="list-style-type: none"> ▪ Absence of a common strategy for coastal and maritime management. ▪ lack of proper systems of coastal pollution treatment.
	Opportunities	Threats
	<ul style="list-style-type: none"> ▪ Possibility to research about the coastal environment. ▪ Increasing public awareness 	<ul style="list-style-type: none"> ▪ Environmental degradation ▪ Increasing frequency of natural disaster.
➤ Improper Sanitation	Strengths	Weaknesses
	<ul style="list-style-type: none"> ▪ Reduce of pressure on the marine resources and healthy lifestyle. 	<ul style="list-style-type: none"> ▪ Poor maintenance of every local settler's sanitary complexes. ▪ Lack of comprehensive coastal zoning. ▪ Cultural practices
	Opportunities	Threats
	<ul style="list-style-type: none"> ▪ Crowd management ▪ Increasing public awareness ▪ BLGU should develop back-up strategic plan like placing public toilets and water refilling station in the Brgy. 	<ul style="list-style-type: none"> ▪ Increasing frequency of unhealthy human, animals, and marine environment. ▪ Environmental degradation
➤ Improper waste disposal	Strengths	Weaknesses
	<ul style="list-style-type: none"> ▪ Tourism potential ▪ Good soil and climate. ▪ Coastal protection structure. 	<ul style="list-style-type: none"> ▪ Inefficiency in implementing legal frameworks. ▪ Crowded population ▪ Lack of education
	<ul style="list-style-type: none"> ▪ High level organizational facility. 	<ul style="list-style-type: none"> ▪ Poor management system and implementation.
	Opportunities	Threats
	<ul style="list-style-type: none"> ▪ Substitution of organic plates, etc. for plastic items ▪ Provision of health centers near coastal zones. ▪ Crowd management ▪ Encouraging litter free zone along the coast. 	<ul style="list-style-type: none"> ▪ Loss of aesthetic values ▪ Environmental degradation ▪ Damages to marine inhabitants ▪ Increasing frequency of natural disaster.
➤ Fish Scarcity	Strengths	Weaknesses
	<ul style="list-style-type: none"> ▪ The presence of water 	<ul style="list-style-type: none"> ▪ Untreated waste

Particulars	Strengths	Weaknesses
	<ul style="list-style-type: none"> resources near coastal zone ▪ Marine resources availability ▪ Food facilities 	<ul style="list-style-type: none"> water discharge ▪ Inefficient in implementing legal framework. ▪ Lack of comprehensive coastal zoning ▪ Crowded population
	<p>Opportunities</p> <ul style="list-style-type: none"> ▪ Increase of coastal revenue ▪ Increasing coastal guards ▪ Possibility of endangered species culture ▪ Crowd management 	<p>Threats</p> <ul style="list-style-type: none"> ▪ Disappearance of marine resources ▪ Increasing frequency of food scarcity ▪ Natural sites may threaten by over commercialization. ▪ Damages of important marine species and habitat destruction.
Economic Issues	Strengths	Weaknesses
➤ Unemployment	<ul style="list-style-type: none"> ▪ Eradicate poverty ▪ Sustain essential needs ▪ more opportunity 	<ul style="list-style-type: none"> ▪ Lack of education ▪ Lack of creativity ▪ bias/pabor2 system
	<p>Opportunities</p> <ul style="list-style-type: none"> ▪ BLGU should invite private/public sector on conducting Sustainable Livelihood Programs. 	<p>Threats</p> <ul style="list-style-type: none"> ▪ Poverty ▪ No income
➤ Pandemic Covid-19 crisis	<p>Xtrengths</p> <ul style="list-style-type: none"> ▪ Covid-19 pandemic quick and effective cooperation of departmental joint prevention and control ▪ The medical and health system is gradually improving both online and physical are gradually safe and convenient <p>rk opportunities</p>	<p>Weaknesses</p> <ul style="list-style-type: none"> ▪ Inefficiency in implementing legal frameworks. ▪ Lack of awareness ▪ Health emergency discipline is underdeveloped ▪ Lack of relief materials and human resources. ▪ Rumors spreading misinformation
	<p>Opportunities</p> <ul style="list-style-type: none"> ▪ Promotes virtual works and opportunities ▪ Further improvement and inspection on the health emergency system 	<p>Threats</p> <ul style="list-style-type: none"> ▪ Negative impact on a daily life, works. ▪ Negative impact on the economic status ▪ Poverty
➤ Low prices of crops, fishes	<p>Strengths</p> <ul style="list-style-type: none"> ▪ Opportunities for the residents to earn income to sustain daily living. 	<p>Weaknesses</p> <ul style="list-style-type: none"> ▪ Lack of knowledge on the industry ▪ Lack of economic diversity

Particulars	Strengths	Weaknesses
	<ul style="list-style-type: none"> ▪ Reduce pressure on economic sector ▪ Food facilities 	<ul style="list-style-type: none"> ▪ Poor of organizations of producers
	Opportunities	Threats
	<ul style="list-style-type: none"> ▪ Crowd management BLGU should implement strategic plan on marketing 	<ul style="list-style-type: none"> ▪ Increasing frequency of poverty ▪ Unhealthy competition ▪ Increasing number of unemployment

4. CONCLUSION

In socio-political setting; Out of the purposely taken 639 households, there were majority numbers of male's age between 31-40 years old and mostly were secondary students as their highest education attainment. Most of the respondents were born Catholic and Bisaya as their language. The sources of income of the respondents were small-scale manufacturing and business earning Php 1.00-Php 3,000.00 monthly. Majority also of the household settle in their own house but of free rented lot, owned motorcycles and used Globe Telecommunication as means of communication and practices proper sanitation as there was high rating for sanitized sources of water and toilet facilities and majority of the household benefited in health programs and facilities offered by the Barangay Local Government unit. There were also present of infrastructures in the coastal Brgy. of Mana such as churches, schools, fish processing building and gasoline station.

In Natural Resources; there were identified aquatic resources and ecology in the study area that composes of mangrove species and other shrubs such Bakhaw lake (*Rhizophora apiculata*), Pagatpat (*Sonneratia caseolaris*), Bakhaw baye (*Rhizophora mucronata*) and *Nypa frutican*. Along beaches were seaweeds identified as peacock's tail (*Padina pavonica*), turner (*Sargassum aquifolium*) and *Sargassum polycystum*. The results of economic sector in the study area led to a conclusion that small-scale business and manufacturing dominates the coastal area of Brgy. of Mana. In people's organization, there are three existing people's organization and one cooperative in costal sitios of Barangay Mana. These are, Mana Water System Cooperative (MAWASCO), Mana Fermented Fish Processing Women Association (MFFPWA), Nagkahiusang Mananagat sa Barangay Mana (NAGMABMA). In managing

coastal environment issues, problem and opportunities, the major strength found in the Brgy. Mana are the esthetics of beach environment, the good climate, its tourism potential and the marine resources availability that aid and help reduce coastal environment and economic problems.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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