



SOCIO-ECONOMICS, HEALTH PROFILE, ENVIRONMENTAL PROBLEMS, AND PERCEPTION OF A FISHING COMMUNITY IN PANUKULAN, POLILLO ISLAND, QUEZON, PHILIPPINES

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ABSTRACT – The Municipality of Panukulan is a coconut-based farming and fishing island municipality in Polillo Island, Quezon. It is endowed with productive and interconnected upland and coastal ecosystems. This study described the socio-economic profile, health profile, existing environmental problems, and perception of the local people in Barangay Libo, a small barangay in the Municipality of Panukulan. Based on the socio-economic profile, the local people were highly dependent on their natural forest, coconut and rice farming system, and fisheries resources. Cash income is on a daily basis, and fishing and farming activities depend on season and favourable weather conditions. Majority of the people are permanent residents with no plans to migrate elsewhere and have acquired high school education suggesting a literate community. Based on key informant interviews, the major socio-economic problems in Barangay Libo are: lack of safe drinking water facility, lack of irrigation facilities for rice farmers, damaged roads, and lack of supplemental and alternative livelihood. Based on the personal observation of the author, the existing environmental problems are reclamation of coastal area, mangrove area degradation, sediment load deposition, and degradation of coral reefs due to dynamite fishing. The local people are heavily dependent on hand-dug wells, and natural spring and rainwater harvesting to supplement their drinking water needs. However, the water quality of traditional drinking wells is vulnerable to contamination. Household surveys revealed that the local people were supportive of plans and activities aimed at improving environmental condition indicative that a community-based coastal resources management project will become successful in this community.

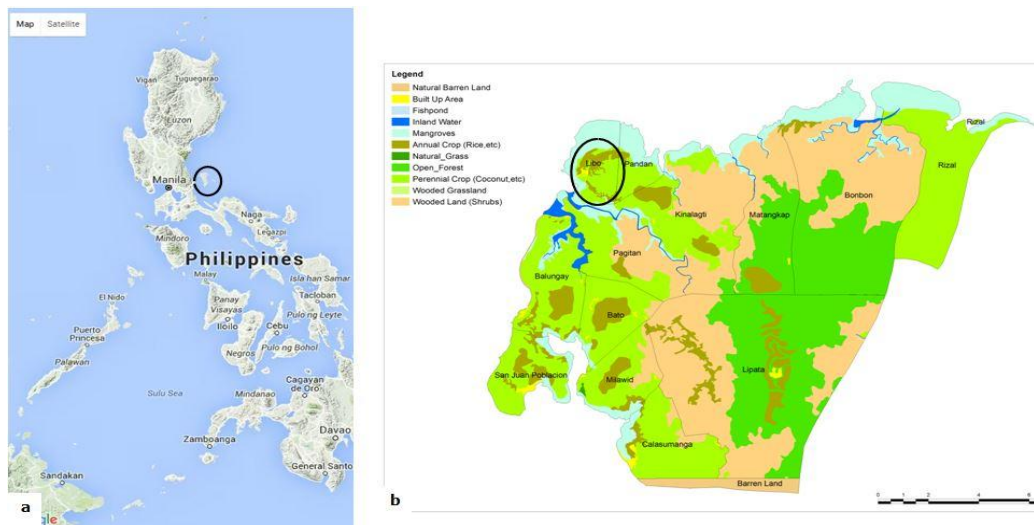
Key words: coconut-based and fishing community, socio-economic problems, environmental problems, Panukulan, Polillo Island

Introduction

In isolated island communities where cash income and livelihood opportunities are scarce, local people are heavily dependent on upland and fisheries resources. The high dependency on their natural resources often resulted to more frequent and repeated extraction, overutilization and overharvesting of environmental goods with consequent irreversible and permanent damage to fragile and vulnerable ecosystems. Unsustainable anthropogenic activities such as illegal logging, slash and burn agriculture, and illegal fishing practices, which only provide short term economic gains, are the major causes of negative externalities and social costs such as increased vulnerability to human-made and natural calamities, food insecurity, low productivity and public health threat. The decreasing fish catch, diminishing supply of environmental goods and raw materials, and deteriorating quality of the environment will drive more people to exploit pristine natural resources and degrade the environment. Mechanisms to reduce pressures on natural resources and to protect the remaining intact ecosystems calls for adoption of an integrated, sustainable, and community-based management of natural resources as a solution to improve resource health condition, to promote responsible and sustainable use of natural resources, and to reduce poverty incidents and associated rural problems such as low cash income and high cost of agricultural and fishing activities.

The Polillo archipelago is part of the political map of the province of Quezon. It is located in the eastern part of the municipalities of Infanta, General Nakar, and Real. Separated by Polillo Strait from Luzon Island, the Polillo archipelago is composed of 27 islands and five coastal municipalities. Polillo Island is the largest island in the Polillo archipelago and is divided into municipalities of Polillo, Burdeos, and Panukulan as seen in Figure 1.

Figure 1. a. Location of Polillo Island (in circle) in the Philippine map. b. Map of the Municipality of Panukulan in northern Polillo Island showing Barangay Libo (in circle).



The Municipality of Panukulan is a fifth class coastal municipality in northern Polillo Island. It was formerly a *barangay*, the smallest political unit in the Philippines, under

the political jurisdiction of the Municipality of Polillo but it was declared a separate municipality on July 18, 1967 through Executive Order No. 77 (Polillo Islands Biodiversity Conservation Foundation, Inc. and Philippine Biodiversity Conservation Foundation, Inc., n.d.). At present, the Municipality of Panukulan is composed of twelve *barangays* namely: Barangay Balungay, Barangay Bato, Barangay Bonbon, Barangay Calasumanga, Barangay Kinalagti, Barangay Libo, Barangay Lipata, Barangay Matangkap, Barangay Milawid, Barangay Pag-itan, Barangay Pandan, and Barangay San Juan (Barangay Libo Profile, 2014).

Barangay Libo is a fishing community located at the northern tip of Polillo Island and is bounded by Barangay Pag-itan, Barangay Kinalagti, and Barangay Pandan (see Figure 2). From Barangay Dinahican of the Municipality of Infanta, it can be reached by crossing Polillo Strait by a four to five hour boat ride. Folk stories said that the name *libo* originated from the word *lobo* or balloon, a favorite toy of the *Dumagat*, a group of people who were the first occupants of Polillo Island.

Polillo Island is endowed with outstanding biological (including several habitat restricted and endemic species), geological diversity, undisturbed forest, unspoiled coastal resources (mangrove belts, coral reefs, rocky shorelines, and sandy beaches) and agroecosystems (vast coconut and rice farming system) (Polillo Islands Biodiversity Conservation Foundation, Inc. and Philippine Biodiversity Conservation Foundation, Inc., n.d.). The highest peak in the island is Mount Malulod (peak height is 310 meters above sea level). However, these natural wealth are in danger of irreparable destruction and extinction due to illegal and clandestine harvesting of hardwoods, extraction and mining of mineral deposits, overharvesting of mangrove wood, reclamation of shoreline and wetlands for human settlements, overfishing, and use of destructive fishing techniques such as dynamite fishing, trawling and cyanide which damages coral reefs and seagrass beds.

At present, due to rapid sophistication of marine transportation technologies, the formerly inaccessible Polillo Island became a favorite destination of the people from mainland Quezon and nearby provinces. In this paper, the researcher hypothesized that population growth and continuous influx of migrants from the mainland exacerbated the already disturbed state of upland, coastal and fisheries resources of Polillo Island. As the population increases, the demand for food and raw materials needed to support a permanent community also increased. This lead to more frequent exploitation of fishery resources, more consumption of environmental goods, higher generation of domestic wastes, and faster rate of degradation of natural resources. Furthermore, the invasion of migrants resulted to the displacement of the local culture and dissolution of traditional resource practices of the *Dumagat*.

Polillo Island is an excellent study site for socio-economic, environmental, and health assessment where the socio-economic status of local people depends on the health of functional ecosystem and where economic activities impact the ecosystem structure. Similar to other tropical islands in the Philippines and in the Pacific region, human-environment interaction is evident in Polillo due to isolation and separation from the mainland. The islanders have developed deep knowledge of their biophysical environment as well as adaptive and survival strategies to natural perturbation. Their socio-economic activities evolved as a response to their environment (Cabili and Cuevas, 2016; Ravikumar et al, 2015; Sinfuego and Buot, 2014; Cabili and Cuevas, 2011; Cabili

and Cuevas, 2010; Rathakrishnan et al, 2009; Walters, 2004).

The general objective of this study is to assess the socio-economics, community health, and environmental condition of Barangay Libo. This study also aims to determine the perception and attitude of the local people on different local environmental issues. The data on this study were based on field work, key informant interviews, household interviews, and barangay local government. The result of this study can be used for developing strategies aimed for addressing socio-economic and environmental problems of poor and marginalized areas where people depend heavily on ecosystems for their livelihood and survival, and for achieving long-term and sustainable use of the natural resources of Polillo Island and similar island municipalities of the country.

Methodology

Barangay Libo, as seen in Figure 2, is one of the twelve barangays of the Municipality of Panukulan. This barangay is bounded by Barangay Pandan, Barangay Kinalagte, and Barangay Pag-itan. The municipality of Panukulan is a fifth class coastal municipality located in the northern part of Polillo Island, the largest island of Polillo archipelago. According to folk story, the name *libo* was derived from *lu'bo (lobo)* or balloon, a favourite playing object of the *Dumagat* who were the first settlers of Polillo Island. It has a total land area of 902 hectares. Four hundred eighty three hectares (483 ha) are used for agricultural purposes (rice and coconut plantation), 2.92 ha are industrial land, 29.26 ha are used human settlement, and 2.93 ha are for commercial land. The local population is composed of *Tagalog* (95%), Visayan (2%), Bicolano (2%), Ilocano (0.5%) and *Kapampangan* (0.5%). As of October 2013 the barangay has 774 registered voters (Barangay Libo Profile, 2014). Barangay Libo has one elementary school, Libo Elementary School (LES), and one high school facility, Libo National High School (LNHS). Elementary students from neighbor barangays (Barangay Kinalagti, Barangay Pag-itan and Barangay Pandan) continue their high school education in LNHS. Electricity is mainly provided by Quezon Electric Company; however, at the time of the study, electricity supply was only available from 2:00 p.m. to 7:00 a.m. on the next day. The existing churches in the barangay are Roman Catholic Church, Jesus Lord of the Island Church, and Blessed Christian Community Church.

Barangay Libo and Barangay Pandan are surrounded by a long stretch of rough, sharp, coralline rocks, fine sand, coral reefs, and mangrove forest. The land is flat to gently sloping with coconut plantation covering the largest part of the land. Barangay Kinalagti has undulating topography and is covered with coconut trees and vegetation.

Barangay Libo, Barangay Kinalagti, and Barangay Pandan were visited on the second week of April 2014 for a reconnaissance survey, followed by a second visit on the last week of May 2014.

Figure 2. The researcher's sketch of Barangay Libo and neighbor barangay. Shown also are location of schools (LNHS and LES), barangay health station, barangay pier, traditional wells, and its natural resources (rice farm, coconut farm, mangroves, coral reefs, coastal area)



A traditional shallow and rocky fishing ground locally called *gumatong* was visited on April 19, 2014. The coral reef fish sanctuaries were visited in Barangay Libo and Barangay Balungay (a municipal fish sanctuary) on May 28, 2014 and May 29, 2014, respectively. Similar to the fish sanctuary in Barangay Balungay, the coral reefs in the northern part of Barangay Libo is awaiting a municipal ordinance to be formally recognized as a municipal fish sanctuary (R. Pestañas, personal communication). The condition of coral reefs was observed. However, the percentage coral reef cover was not determined.

Key informant interviews, household semi-structured interview, and direct observation

were used to elicit information on the local people's perceived and observed socio-economic and environmental problems. The key informants in this study were composed of a senior resident (74 years old, male, married), a teacher of LNHS (40 years old, male, married, former municipal councilor), and a barangay local official (54 years old, male, married). The key informants were selected on the basis of their length of residence and knowledge on barangay local history and geography of Polillo Island. All key informants have vast knowledge on their local culture, history, natural resources of Barangay Libo and geography of Polillo Island. For the household interview, the senior member or head of the family were interviewed. The respondents were fishers and farmers and were limited to ages 18 years old and above on the assumption that older people can make more independent decisions. A total of 77 respondents were randomly selected in different areas of the barangay (coastal area, school and health station area, rice farm area, near traditional drinking well area, near coconut farm area). The respondents were interviewed and were asked to answer survey questionnaires (questions were in *Tagalog*) to elicit information on their socio-economic profile, perception, and attitude on local environmental and socio-economic issues and problems. Two key informant interviews were conducted in between April 18 to 20, 2014 (during the first visit) and on May 28, 2014 (second visit), while household surveys were conducted in between May 28 to May 30, 2014 with the help of five assistants. Field work, key informant interviews, and household interviews were approved by the barangay chairman.

Results and Discussions

Table 1 shows the socio-economic profile of the respondents. The average age of the respondents was 42.6 years old; the youngest and oldest respondents were 18 years old and 77 years old, respectively, and about 86% of the respondents were less than 60 years old. About half of the respondents declared that they attended high school or were high school graduates, while around 36% declared that they attended college or were college graduates. This is indicative that the community is composed of literate community members. The average year of residency is 33 years and around 75% of the respondents were residents for more than 20 years. Around 86% had no plans to migrate elsewhere and the common reasons for staying in the barangay are personal attachment to the island, loyalty to the community, existence of livelihood, and peace and social order. The main socio-economic activities in Barangay Libo are rice, vegetable, and coconut farming and open fishing. Other activities are selling of fish catch and making of fish nets.

Table 1. Socio-economic characteristics of the respondents in this study (n=77).

Variable	Frequency	Percentage
<i>Gender</i>		
Male	30	38.96
Female	47	61.04
Total	77	100
<i>Age</i>		
18-24	7	9.09

25-31	16	20.78
32-38	10	12.99
39-45	15	19.48
46-52	9	11.69
53-59	9	11.69
60-66	5	6.49
67-73	4	5.19
74-80	2	2.60
Total	77	100
<i>Educational attainment</i>		
College level	28	36.36
High School level	38	49.35
Elementary level	11	14.29
Total	77	100
<i>Marital status</i>		
Single	15	19.48
Married	62	80.52
Total	77	100
<i>Years of residency</i>		
2-10 years	12	15.58
11-19 years	7	9.09
20-28 years	15	19.48
29-37 years	11	14.29
38-46 years	13	16.88
47-55 years	7	9.09
56-64 years	7	9.09
65-73 years	3	3.90
74-82 years	2	2.60
Total	77	100
<i>Planning to migrate for the next five years?</i>		
Yes	7	9.09
No	66	85.71
No response	4	5.19
Total	77	100
<i>With or without electricity?</i>		
With electricity	68	88.31
Without electricity	9	11.70
Total	77	100
<i>Monthly electric bill</i>		
Less than 100 pesos	12	20.7
100 to 499 pesos	37	63.8
500 to 999 pesos	6	10.3
1000 to 1499 pesos	1	1.7
1500 to 2000 pesos	2	3.4
Total	58*	100
<i>Devices used in home</i>		
Bicycle	11	14.28
CD player	36	46.75

Cellphone	34	44.16
Computer	6	7.79
Electric fan	49	63.64
Motorcycle	12	15.58
Radio	29	37.66
Television	11	14.28
Gas stove	18	23.38

*only 58 of 77 respondents answered.

Of the 77 respondents, only 37 respondents declared their monthly income. Those who did not state their income were hesitant in declaring their true income. Estimating the average daily income of the local people was difficult because it depends on the volume of their fish catch and weather condition. According to fisher respondents, fishing activity is dangerous, difficult, and unproductive during rough sea times and typhoon season. Some respondents stated that they earn 50 to 200 pesos per day but this depends on the season, customer's demand, and abundance of goods. Eighty four percent (84%) of the respondents' monthly income is less than or equal to 5000 pesos per month while only 8% of the respondents earn 30,000 pesos to 40,000 pesos per month. Respondents with large income are owners of motorized fishing boats, coconut farms, rice farms, and concrete houses.

Despite the low income opportunity in the island, some houses are made up of galvanized iron sheet roofs while most houses in the barangay are made up of local materials such as bamboo, wood, and nipa palm. Around 50% of the respondents' houses are made of bamboo, wood, and nipa while 34% of the respondents' houses are made of wood and metals, as seen in Figure 3. Construction materials such as cement, concrete blocks, steel, and galvanized iron sheet are only sold at Infanta. Thus, only a few can afford the expensive construction materials to renovate their houses. Around 88% of the 77 respondents have electricity connections and approximately 64% of the 58 respondents are paying less than 500 pesos in their monthly electric bills.

Figure 3. Traditional (right) and modern houses (left) in Barangay Libo, Municipality of Panukulan, Polillo Island.



Polillo Island can be reached by large motorized boats from Infanta. It takes about 3 to 4 hours to reach Polillo Island, which includes loading and unloading of cargo and passengers. There is only one scheduled boat trip per day from Infanta to Barangay Libo at 2:00 p.m. While a trip back to Infanta will leave Barangay Libo at 7:30 a.m. The length of travel also depends on the weather condition. Owners of large or bulk goods such as sacks of rice, coconut, or heavy materials are charged with a cargo fee.

Income is reduced due to poor post-harvest handling of fish catch. Such condition lowers the market value of fish. Perishable goods such as fresh fishes cannot be transported for a long time and should be immediately consumed due to the absence of ice and freezers. Handling facilities such as ice plants and heavy duty freezers are not available in the barangay which further contributes in the dissipation of profit. In addition, the high transportation cost inflates the local price of commercial goods and materials.

Figure 4 shows the natural resources of Panukulan. Coconut trees are abundant and productive in Polillo Island due to its isolation from coconut pest from the mainland and possibly due to salt spray coming from the sea which served as additional nutrient to the crop (Cabili and Cuevas, 2010). The coconut farming system is a major source of “copra” or dried coconut meat which is the main ingredient for cooking oil processing. It is an important cash crop which is transported to mainland in Quezon. The coconut husks and shells are utilized as fuel for cooking. In terms of soil conservation, the root system of coconut trees has the ability to contain soil erosion, hold soil particles, and make the soil not prone to detachment (Cabili and Cuevas, 2011).

Figure 4. The natural resources of Panukulan, Polillo Island, Quezon.



The mangrove forest belt and rocky seashore are habitats of invertebrates and fishes. They provide protection to the coastal communities from large seawaves and storms. It

also helps to prevent coastal erosion. Mangrove woods are also used by the local people as fuel and construction material for houses and fences.

Natural rock formations like *mandadala* (human-like rock formations) and *kading* or *pulo* (rocks taller and bigger than human that is named after typhoon *Kading* which devastated the island in the 1970s) which can be seen in the coastal area of the barangay serves as buffer for seawaves. A key informant shared a story that in the past, there was a life-size human-like rock formation resembling a man with a spear in the seashore, but it was stolen by a Japanese tourist. Local legend says that this was an ancient man that was turned into a stone by a supernatural creature. Another story shared by a key informant was about the Yamashita treasure which was believed to be concealed by the Japanese army in Polillo Island and in the mountains of Infanta and Real during World War II. A key informant said that during his teenage years, a gold treasure was discovered in the waterfalls in Panukulan and up to this time, the search for Yamashita treasure still continues in Polillo Island.

The coral reefs surrounding the island are sanctuaries to many coral reef dependent species. The clear seawater, natural rock formations, and white sand beach provide recreational activities and can be a potential tourism asset.

At the time of the study, the ecological profile of Barangay Libo is unavailable and due to time and resource limitation, data such as coconut farm area, rice farm area, forest area, mangrove area, and coral reef area was not determined.

Table 2 presents the major socio-economic problems in Barangay Libo based on an interview with a senior key informant and a barangay official.

Table 2. Major problems in Barangay Libo, Municipality of Panukulan and socio-economic impact (listed not according to priority).

Problem	Socio-economic impact
1. Lack of safe drinking water facilities.	Health problems such as dehydration and diarrhea
2. Lack of irrigation facilities for rice farms.	Low rice production most especially during dry season
3. Damaged roads (most especially in mangrove area)	Delay travel and delay transport of local goods to barangay pier; higher cost of repair and maintenance of diesel run motorcycle
4. Lack of supplemental and alternative livelihood for fishers and farmers.	Insufficient and low cash income to feed the families of fishers and farmers; involved in illegal fishing activities and logging

The local people of Barangay Libo and other neighbor barangays are highly dependent on rainwater harvesting, natural springs, and hand dug wells, as seen in Figure 5, as their source of freshwater and drinking water. The two communal drinking wells in Barangay Libo are *libis* well and *lawis* well (E. Pestañas, personal communication). A water quality assessment of Lagbas and Habito (2016) revealed that the physico-chemical

characteristics of water samples from *libis* and *lawis* wells were within the limits of the Philippine National Standards for Drinking Water. However, coliform and fecal microorganisms were present at a level greater than the permissible level. Key informants said that several years ago, a waterborne disease called “El Toro” (due to cholera Ogawa contamination) caused severe vomiting, diarrhea, stomach pain, and dehydration that claimed the lives of several children and adults.

Figure 5. Traditional hand dug wells in Barangay Libo, Panukulan, Polillo Island for hygienic activity (left) and human consumption (right).



To irrigate their rice fields, the farmers depend on rainwater and groundwater extraction using diesel powered motor pumps. The use of diesel and motor pump means additional costs to farmers. The absence of freshwater irrigation facility makes rice farming difficult most especially during dry season.

It is worthwhile to note that in almost all areas in Barangay Libo and Barangay Pandan the roads are cemented, while the road in coastal areas near Barangay Libo pier have severe cracks that need immediate repair. This road construction project was initiated in 2012 by the Kapit-Bisig Laban sa Kahirapan – Comprehensive and Integrated Delivery of Social Services (KALAHI-CIDSS), a community-driven development project of the Department of Social Welfare and Development with funding assistance from the World Bank.

Open fishing, rice farming, and coconut farming are the main economic activity in Barangay Libo as seen in Figure 6. Other secondary livelihood activities are wine production (*lambanog*) from nipa and coconut, poultry, backyard piggery and selling of goods like softdrink, bread, and sweets. Fishes are usually sold in the barangay pier during early morning and late afternoon. Fish species such as blue marlin, yellow fin tuna, and other fish species such as *talakitok*, *tanigue*, *tambakol* (local name of fish species) are sold in the barangay pier in the late afternoon. The price ranges from 80 to 90 pesos per kilogram depending on the size and quality of fish. These fish species are caught in the deep sea using large motorized boats and are usually transported to Infanta or Metro Manila. Other fish species like grouper (*lapu lapu*), mullet (*banak*), and parrot fish (*loro*) are caught in near shore coral reefs in the morning using net and spear.

Species commonly caught during low tide in rocky shore and in mangrove area includes seashell, shrimp, and crab.

Figure 6. Socio-economic activities in Barangay Libo a. rice and coconut farming, b. small scale open fishing, c. vending of fish catch, d. making fish nets



a



b



c



d

Due to lack of supplemental livelihood and alternative livelihood options, seasonality of fishing and high cost of transportation fare, some local people are engaged in unlawful activities such as clandestine timber harvesting, mangrove wood harvesting, and dynamite fishing.

In 2013, the estimated total revenue of Barangay Libo was 1,151,000.00 pesos (Barangay Libo Profile, 2014). The major share came from the Internal Revenue Allotment (95.57% or 1,100,000 pesos) while the other income (4.4%) came from business tax, community tax, real property tax, fines and penalties, permit/license fee, clearance and certification fee, landing and parking fee, business income fines and penalties, subsidy from other local government units, and miscellaneous income. In the proposed 2014 barangay budget, 15,000 pesos will be allocated for gender and development (1.30%), 37,550 pesos for calamity (3.25%), 115,100 pesos for Sangguniang Kabataan (10%), and 220,000 pesos for development projects (19.11%). The utilization and purpose of the remaining fund was not described in the report.

There is only one Barangay Health Station located near LNHS that serves the people of Barangay Libo, Barangay Kinalagti, Barangay Pandan, and Barangay Pag-itan during Thursdays and Fridays only. Due to insufficient supply of medicines, unavailability of a resident medical doctor, poor medical facilities, and low cash income, the local people often consult their local traditional healer ("*albularyo* or *hilot*"). Survey showed that out of 77 respondents, 56.16% seek health advice from traditional healers, while the rest preferred medical advice of the health station personnel. Complicated and serious medical cases which cannot be treated by traditional healing methods are brought to hospitals in Infanta.

Regarding local people's obedience to traditional beliefs and practices, 79.45% respondents said that they observe traditional cultural beliefs and practices. The influence of oral tradition and folk Catholicism is strongest during Good Friday of the Holy Week. During this time local people postpone their farming and fishing activities, avoid taking a bath in the sea or river, and avoid going to wild environments. For the local people, adherence to oral tradition is a rational approach to minimize or prevent misfortunes such as accidents, illnesses, and bad luck. Culture, which is deeply embedded in the form of traditional beliefs, practices and rituals unite the community by relieving stress and giving them a sense of security.

The Barangay Health Station record (April 18, 2012 to May 20, 2014) showed that acute upper respiratory infection (AURI) is the most frequently encountered health problem with 81 cases or 31% of 229 recorded cases. AURI was most common in children with ages less than 9 years old, comprising 72% of 81 cases encountered. Illnesses suspected to be related or associated with consumption of contaminated water were acute gastritis, acute gastroenteritis, and urinary tract infection comprising 3%, 5%, and 6% of recorded cases, respectively (Lagbas and Habito, 2016).

Water quality characteristics such as clarity, absence of unpleasant smell, and reports related to consumption of contaminated water are rapid and reliable indicators for rapid assessment of water safety and quality. Table 3 presents the perception of respondents on the water quality characteristics of their traditional drinking wells. In general, the respondents agree that well water physical characteristics such as clarity, color, and absence of unpleasant odor are good, but they do not agree on its microbiological quality. Respondents perceived that microorganisms that can cause diarrhea and dehydration are present in the groundwater. Furthermore, household interviews revealed that 71% (55) of the respondents perceive that water from the communal traditional drinking well is safe for human consumption. While many of the respondents perceived that their traditional well is a source of clean and safe drinking water, some respondents doubt that it is only good for adults but not for children and infants who are more susceptible to diseases.

Table 3. Perception on well water quality (n=77)

Water quality characteristics	Mean	Remarks
The water is clean and clear.	1.24	Agree
The water has no unpleasant taste and odor.	1.16	Agree
The water does not need to be boiled before consumption.	1.53	Disagree
The water is safe for children and infant.	1.87	Disagree
The water has no microorganisms that can cause disease.	1.75	Disagree

Note: 1=Agree, 2=Disagree, 3=Not sure

Based on the field observation and key informant interviews, the unsustainable anthropogenic activities that are directly linked to environmental problems in Barangay Libo are presented in Table 4.

Table 4. Anthropogenic activities related to environmental problems in Barangay Libo, Panukulan, Polillo Island and its socio-economic impacts

Anthropogenic activity	Socio-economic impact
1. Illegal cutting of hardwood trees and mangroves	Increased vulnerability to soil and coastal erosion, and natural calamities, increased turbidity of seawater
2. Reclamation of wetlands and former mangrove areas	Loss of coastal protection against powerful seawaves and storm surge
3. Illegal fishing such as dynamite and cyanide fishing	Coral reef destruction; low catch per unit effort

The densely populated area of the barangay is concentrated near the barangay pier, mangrove area, and in a relatively flat area. At the time of the study, it was observed that wetlands where mangrove and nipa grow were reclaimed for human settlement and also serves as a dumping area for household wastes and human wastes as seen in Figure 7. It was also observed that some coastal residents (near mangrove area and pier) do not have toilets with septic tanks. It is possible that these residents dispose their wastes in the mangrove and nipa area. Another cause of mangrove destruction in the community is the overharvesting of mangrove woods for fuel wood and construction materials.

Figure 7. a. Reclamation of mangrove area. b. Indiscriminate solid wastes disposal in nipa area.



Large scale logging is rampant in Polillo Island in the 1970s (E. Pestañas, personal communication). At present, there are still reports of clandestine wood harvesting and small scale tree cutting. Illegal logging resulted to loss of upland vegetation which resulted to soil erosion and rapid runoff during heavy rainfall. Field observation revealed that the impact of sediment deposition was obvious in the seashore of Barangay Libo and in nearshore coral reefs.

Damage to coral reefs and critical fisheries habitat was caused by boating activities, blast fishing, cyanide fishing, and trawl fishing. As seen in Figure 8, the impact of dynamite fishing and cyanide fishing was observed in *gumatong*, a traditional fishing ground of the fishers of Panukulan. It is interesting to note that according to a senior key informant, *gumatong* protects Barangay Libo by neutralizing sea waves and storm surge during typhoon season and earthquake. When the seawaves reach *gumatong*, it produces a sound which can be heard in Barangay Libo. Depending on the characteristics of the sound, this serves as an early warning to islanders and fishers of the forthcoming typhoon. Thus, in the absence of a storm advisory in television or radio, this traditional knowledge helps them to predict the weather condition and to postpone or advance their coastal and fishing activities.

Figure 8. *Gumatong* during low tide (left). Rocks and white sand of *gumatong* are visible in clear seawater surrounding Polillo Island (right).



In an interview, a local fisherman claimed that before the introduction of dynamite fishing, large fish were abundant and the average fish catch was about 20 kg per day but due to the increasing number of fishers and poor coral cover, the fish catch was

reduced to around 5 kg per day. Many islanders perceived that the degradation of coral reefs due to blast fishing reduced their fish catch that also lead to increased cost of fishing and dissipation of income.

Table 5. Coral reefs condition in *gumatong*, Barangay Libo, and Barangay Balungay.

Location	Date visited	Observation
<i>gumatong</i>	April 19, 2014	many coral rubbles
Barangay Libo (near barangay pier)	May 28, 2014	corals were covered with fine silt
Barangay Libo (proposed fish sanctuary)	May 28, 2014	coral reefs were abundant
Barangay Balungay (near barangay pier)	May 29, 2014	coral reefs were covered with silt; new corals are growing
Barangay Balungay (municipal fish sanctuary)	May 29, 2014	coral reefs were abundant

Table 6 presents the level of participation of the respondents on various activities affecting the quality of their local environment. In general, respondents expressed strong support on the following activities: public education, environmental awareness campaign and promotion of environmental stewardship (4.79), prohibition of creating garbage pit near a source of water such as well or spring (4.77), prohibition of dumping any kind of solid and liquid wastes in the river and sea (4.77), prohibition of illegal fishing methods and practices (4.66), strict implementation of environmental laws and ordinance (4.66), and prohibition of dumping human and animal fecal matter in the sea, river, mangrove area, open land and in the forest (4.65). Evidences of environmental consciousness among local people are supported by the existence of *Bantay Kalikasan*, whose members were deputized by the barangay local government, and annual mangrove planting participated by the high school students of LNHS. In a study of Lagbas and Habito (2016), the high school students of LNHS possess considerably high knowledge and good understanding of the ecosystem functions and socio-economic importance of mangroves, sea grasses, and coral reefs. The students are well familiar in the habitat and coastal protection functions of coastal ecosystems. However, in the study, the students were not able to reflect on the negative impact of upland anthropogenic activities such as mining, illegal logging, and unsustainable mangrove wood harvesting to sea grasses, coral reefs, and seawater quality. The students have not been aware of the interconnectedness of upland and coastal ecosystem.

Table 6. Perception of local people on various activities affecting local environmental quality.

Activity	Rating
Public education, environmental awareness campaign and promotion of environmental stewardship	4.79
Prohibition on creating garbage pit near a source of water such as well or spring	4.77
Prohibition on dumping any kind of solid and liquid wastes in the river and sea	4.77
Prohibition on illegal fishing methods and practices	4.66
Strict implementation of environmental laws and ordinance	4.66
prohibition of dumping human and animal fecal matter in the sea, river, mangrove area, open land and in the forest	4.65
Prohibition on slash and burn agriculture, logging of trees, cutting of mangroves and mining	4.56
Prohibition on frequent and over-application of chemical fertilizer and pesticides on plants (4.17)	4.17
Prohibition on construction of new well	4.01
Prohibition on entry of resort businesses owned by foreign nationals	3.94
Prohibition on encroachment of the seashore for human settlement	3.73

Note: 5=strongly agree, 4=moderately agree, 3=agree, 2=disagree, 1=strongly disagree

Mangrove planting has been the project of the barangay and the municipal local government for the past several years. The local people are aware that mangrove planting is important for sustaining the population of crabs and shell fisheries, and for increasing coastal protection against wave and wind damage. Mangrove planting is a solution to rehabilitate degraded mangrove areas; however, monospecies planting of mangroves does not meet biodiversity conservation goal. For example, in Banacon Island, Bohol, the old growth mangrove forest, which is composed of different mangrove species, has been replaced by locally managed plantation of *Rhizophora stylosa* to supply the local people's demand for fuel and construction materials (Walters, 2004). The negative impact of monospecies mangrove plantation to the ecosystem should be studied to encourage the local people to plant different mangrove species.

On the other hand, the coral reefs in Barangay Libo that are less affected by siltation are being proposed to be declared as a fish sanctuary through a municipal ordinance. The establishment of a fish sanctuary aims to conserve and protect the remaining coral reefs and to increase fish population. At the time of the study, a formal legislation of the marine protected area framework which will be integrated in the municipal ordinance is pending due to lack of financial resources (R. Pestañas, personal communication).

Concerning proper solid wastes disposal as a way to protect surface water and groundwater resources, respondents expressed concern that each household should reduce their waste generation by minimizing consumption of non-biodegradable materials, reducing and recycling recyclable wastes and disposing wastes only in the proper disposal area and not anywhere in the island (in mangrove areas and nipa).

Meanwhile, respondents gave moderate support on the following activities: prohibition of slash and burn agriculture, logging of trees, cutting of mangroves and mining (4.56) and prohibition of frequent and over-application of chemical fertilizer and pesticides on plants (4.17). For activities that prohibit the frequent application of synthetic fertilizers and pesticides, some farmer respondents expressed that chemical fertilizers and pesticides ensure their harvest and income; hence, if this activity will be prohibited, their crops will become more vulnerable to pest attacks and plant pathogens. Prohibition of construction of new well appears to be moderately accepted by the respondents with a 4.01 average response. According to them, well construction within their backyard should not be prohibited due to the absence of local water facilities and scarcity of freshwater in the island. Prohibition on encroachment of the seashore for human settlement also earned moderate support with an average response of 3.73, because majority of local people cannot afford to own a parcel of land, thus a few build their houses near the seashore or in former mangrove areas. Likewise, some reclaimed the rocky seashore for human settlement. At the time of study, the land use and coastal zoning ordinance, including regulation of unsustainable coastal development such as reclamation and construction of permanent structures is not yet implemented by the local government.

Lastly, respondents moderately support policies that will prohibit entry of resorts owned by foreign nationals with a mean rating of 3.94. Some respondents (16 or 20.77%) believed that tourism will help improve the local economy by creating local employment and tax revenue, hence it should not be prohibited by the barangay and municipal government. On the other hand, many of the respondents (64 or 83.12%) fear that tourism activities will damage their pristine coastal environment and local culture, thus the selling and privatization of land should be limited to the local people.

Overall, based on this study, a community-based coastal resources management project (CBCRMP) could be successfully implemented in Barangay Libo.

Conclusion

This study looked into the socio-economic profile, health profile, environmental problems, health problems, and environmental attitude of the local people in Barangay Libo, Municipality of Panukulan. This study generates the following findings and conclusions:

1. The local economic activities in Barangay Libo and neighbor barangays are highly dependent on the ecosystem goods and services of forest, upland, coastal, and fisheries resources of Polillo Island. Thus, these natural resources should be sustainably utilized; otherwise, their ecosystem will fail to sustain their basic needs.
2. The anthropogenic activities endangering the functional integrity of coastal ecosystem and fisheries resources of Barangay Libo are: a. illegal logging (which is a major cause of soil erosion and sediment load deposition on near shore coral reefs), b. dynamite fishing and cyanide fishing (which are still performed by a few local fishers at the time of study, and are the major cause of coral reef destruction), c. indiscriminate cutting of mangrove woods for domestic purposes such as firewood and construction materials, d. reclamation of degraded mangrove areas and wetland filling to become suitable for human settlements, particularly near the barangay pier, and e. indiscriminate dumping of solid wastes in mangrove and nipa area.

3. The lack of alternative livelihood opportunities, absence of market, low market price, deteriorated fishery habitat, and unfair competition with commercial fishers and poachers who have modern fishing technology often pushed some people to engage in unsustainable and destructive fishing methods such as dynamite fishing to increase their fish catch.
4. Majority of the local people are reliant on the traditional drinking well as source of potable water due to the scarcity of clean drinking water in the island. On the other hand, some people perceived that well water is not safe for human consumption (most especially children) and may contain microorganisms that can cause diarrhea and dehydration.
5. Socio-cultural norms in the form of traditional beliefs, practices and spirit of cooperation are still intact in the community. In many situations, this reduces social friction and gives the community stronger social ties and economic network.
6. This study showed that the community possess positive characteristics favourable for successful establishment and implementation of a CBCRMP. Among the positive characteristics are homogeneous culture, religious affiliation and ethnic origin, young population, high literacy, good level of education, and high level of environmental consciousness. The homogeneous culture and religious affiliation would help reduce social friction. The presence of a young and permanent community will ensure perpetual existence of CBCRMP and awareness to current state of environmental problems would serve as motivation to achieve the goals and objectives of CBCRMP (Israel et al 2004). Likewise, the peoples' organization (Bantay Kalikasan and Libo Fishers and Farmers Association) can be recruited as volunteers to replicate CBCRMP best practices in Panukulan with assistance from KALAHI-CIDSS and Institute of Social Order.

Recommendations

This study recommends the following:

1. To conserve the remaining healthy coral reefs, the coral reefs unaffected by siltation (located in northern part of Barangay Libo) should be declared as a no-take fish sanctuary through a municipal ordinance. A detailed assessment of coral reefs is necessary to be able to identify which area should be protected.
2. Environmental laws and ordinances should be strictly implemented by the local authorities. At every household waste reduction and waste segregation should be practiced. Coastal reclamation and building of human settlements near the barangay pier and in former mangrove areas should be forbidden by the local government.
3. Create land-based alternative livelihood options to diversify the local livelihood and source of cash income. This mechanism will provide options to reduce dependence of families on marine resources and will encourage temporary fishery exit (Slater et al 2013; Aldon et al 2011).
4. To increase chances of lower fishing effort, new fishers and younger fishers especially those with growing kids, should be the primary targets of livelihood programs because they are the ones associated with higher fishing effort and are

more open into shifting to non-fishing jobs (Muallil et al 2013).

5. Encourage people most especially the young members of the community to participate as volunteer members of *Bantay Kalikasan* to sustain monitoring and patrolling activities.
6. To emphasize the interconnectedness of upland, coastal and marine ecosystems and the various ecosystem goods and services from it, the teachers at the elementary and high school level should educate students on the socio-economic benefits of intact and healthy ecosystems, socio-economic impact of degraded ecosystem, and sustainable use and development of natural resources (Lagbas and Habito, 2016). Topics such as climate change impact, climate change mitigation, climate change adaptation, and sustainable development should be also integrated in the lesson.
7. The local government may request assistance of KALAHI-CIDSS, ISO, and academe to conduct an economic valuation study of their forest and fisheries resources that will serve as a basis for crafting and implementing appropriate economic instruments and management intervention for the sustainable use of Polillo Island's upland and fisheries resources and for executing informed choices between various land-use and sea use options (Ahmed et al 2007; Samonte-Tan et al. 2007).

Statement of Authorship

This study was part of the special problem of the author for the Master of Environment and Natural Resources Management at the University of the Philippines Open University. Data collection and analysis, key informant interviews, and final paper were done by the author.

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