

Puerto Princesa Bay and Honda Bay, Palawan: An Ecological Profile

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Fisheries Resource Management Project (FRMP)
January 2004



Foreword

The Fisheries Resource Management Project (FRMP) is a project implemented by the Department of Agriculture (DA), through the Bureau of Fisheries and Aquatic Resources (BFAR) – Project Management Office (PMO), with loan funding from the Asian Development Bank (ADB) and the Japan Bank for International Cooperation (JBIC). Implemented in 18 out of 26 priority bays in the country, the Project aims to address the critical issues of fisheries resource depletion and persistent poverty among municipal fisherfolk through the establishment and implementation of a set of fisheries resource management systems, the promotion of income diversification for fishers and their families, and the strengthening of the institutional capacity of public agencies in charge of fisheries resource management, including those at the national, regional, and local levels.

This paper is the eighth in a series of technical monographs published by FRMP-PMO with the aim of providing technical information to guide Project partners and other stakeholders in their implementation of Project activities. The series is also intended to create awareness, among other interested parties and the general public, of the need for, and benefits from, resource management and environmental protection.

Technical Monograph No. 8 describes the present condition in Puerto Princesa and Honda Bays – their biophysical resources, the socioeconomic features of the coastal communities around the bays, the institutions working in the two bays, as well as the ongoing and completed programs and projects dealing with or having impacts on the coastal resources of the bays. The paper was prepared based on the findings of a series of field visits and interviews as well as the results of the resource and ecological assessment (REA) and participatory coastal resource appraisal (PCRA) conducted by study teams fielded by the SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA), the World Fish Center (formerly known as ICLARM, the International Center for Aquatic Resources Management), the Palawan Council for Sustainable Development (PCSD), and the State Polytechnic College of Palawan (SPCP).

Puerto Princesa Bay and Honda Bay, Palawan: An Ecological Profile

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Introduction



Puerto Princesa City (PPC) in Palawan province is the pilot site for the implementation of integrated coastal resource management (ICRM) under the DA-BFAR's Fisheries Resource Management Project. The waters of Palawan are among the most productive commercial fishing grounds in the country, contributing about 60% to the total annual fish catch. However, the integrity of Palawan's rich natural resources is under threat from various factors, including the influx of migrants and the strong demand for fish and fish products from local and national markets. This being the case, there is a need to rationalize fishing efforts, particularly in the municipal waters, and integrate fisheries management measures with land-based activities to conserve and manage the Province's coastal resources.

Puerto Princesa and Honda Bays are the two major bays in the province of Palawan which are covered under FRMP. Because of their central location, these bays have been subjected to increasing population pressure and intensifying resource use conflicts. The communities residing along the bays engage in various forms of livelihood activities to augment their meager income from fishing. In Honda Bay, *bangus* and *sugpo* fry gathering, fish trading, *almaciga* resin tapping, and honey collection are sources of additional income. Some residents are into making of nipa shingles, small-scale salt making, and charcoal making from mangroves.

Residents along Puerto Princesa Bay have more diverse activities considering its proximity to the city proper. Fish trading and processing are popular because of the growing demand for fish by the city's growing population, aside from the volume shipped outside the city. The tourism industry also provides employment to some residents of the area.

This paper describes the present condition in Puerto Princesa and Honda Bays - their biophysical resources, the socioeconomic features of the coastal communities around the bays, the institutions working in the two bays, as well as the ongoing and completed programs and projects dealing with or having impacts on the coastal resources of the bays. The paper was prepared based on the findings of a series of field visits and interviews as well as the results of the resource and ecological assessment (REA) and participatory coastal resource appraisal (PCRA) conducted by study teams fielded by the SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA), the World Fish Center (formerly known as ICLARM, the International Center for Aquatic Resources Management), the Palawan Council for Sustainable Development (PCSD), and the State Polytechnic College of Palawan (SPCP).

Honda Bay

Honda Bay is one of the major fishing grounds of Puerto Princesa City, with potential fishing grounds estimated at approximately 280 sq km. Its coastline starts about eight km from the city proper and stretches to about 100 km along its northeast section. Honda Bay has 12 islands with seagrass beds, coral reefs, and tidal flats which enrich the bay's ecosystem. Eight main rivers drain into the bay from the upland areas, some carrying water of good quality and others containing mine tailings and other industrial wastes. The coral reefs are mostly in fair condition; reefs in excellent condition are a thing of the past. Nevertheless, the number mangrove and reef fish species is higher than in Puerto Princesa Bay. Various species of fish, mollusks, crustaceans, and seaweeds are present in the bay, and milkfish and prawn fry can be caught in its shallow areas. The mangrove resources along the bay are estimated at 1,500 ha and are still relatively intact.

Nipa is interspersed with mangroves along the rivers. Talisay trees and pandan grow on sandy areas.

The landward portions of the bay are planted with permanent crops such as mango, cashew, and coconut. Seasonal crops include rice, peanut, corn, and various vegetables. In the upland areas are various forest trees such as ipil-ipil, mulawin, narra, kamagong, and apitong. Minor forest products like different species of rattan and honeybee are also obtained in the upland areas. Wild boars, wild cats, peacocks, squirrels, monkeys, and the Palawan bearcat, as well as several bird species (e.g., talking mynah, Philippine cockatoo, parrot, wild dove, "bato-bato," and "tabon") inhabit the uplands.

Coastal Resources

Coral Reefs. The coral reef of Honda Bay is classified as in fair condition. The live hard coral cover in Honda Bay ranged from 18.63 - 39.32%. The average percentage of live soft and hard coral cover of Honda Bay has been estimated at 36.50%. Massive non-*Acropora* and soft corals dominate the live coral cover. Abiotic components like benthos comprise about 20.08%; algae, 22.13%; sponges and other fauna, 8.01%; and dead corals, 9.40%. Coral reefs in Honda Bay are relatively better than those in Puerto Princesa Bay. The reefs in the eastern part of Fundeado and Arreciffe Islands and the reefs west of Cowrie and Meara Islands are recommended for fish sanctuary sites.

Mangroves. In 1996, four major mangrove species were found in Honda Bay: *Rhizophora apiculata*, *S. alba*, *Ceriops tagal*, and *Bruguiera sp.* The mangrove resources along the bay are estimated at 1,500 ha. Thick forests can be found in Barangays Manalo and Babuyan. In a survey conducted in 2000, 12 mangrove species were found along the coast of the mainland and the four islands, with *Sonneratia alba* present at all sites and usually the biggest trees in the mangrove stands. These species are: *Bruguiera gymnorrhiza*, *Ceriops tagal*, *Rhizophora apiculata*, *R. mucronata*, *R. stylosa*, *Xylocarpus granatum*, *Aegiceras floridum*, *Avicennia sp.*, *Lumnitzera sp.*, *Osbornia octodonta*, *Scyphipora hydrophyllacea*, and *Sonneratia alba*. Cut branches of mangroves were observed in the area, probably used as fuelwood or material for domestic construction. The most dominant species in the bay is *Rhizophora apiculata*, followed by *R. stylosa*, *Bruguiera gymnorrhiza*, *Ceriops tagal*, and *R. mucronata*.

Seagrasses. Eight seagrass species were observed in Honda Bay. Five belong to the Family Hydrocharitaceae, viz., *Cymnodocea rotundata*, *C. serrulata*, *Halodule pinifolia*, *H. uninervis*, and *Syringodium isoetifolium*. Three species belong to the Family Potamogetonaceae, viz., *Enhalus acoroides*, *Halophila ovalis*, and *Thalassia hemprichii*. High seagrass diversity and density can be found in Fundeado Island.

Seaweeds. Some 116 species of seaweeds were recorded at eight sites in Honda Bay, of which 53 were chlorophytes (green), 18 were phaeophytes (brown), and 45 were rhodophytes (red). *Halimeda opuntia*, *Laurencia papillosa*, and *Sargassum* species dominate the microbenthic algae, while *Caulerpa* and *Halimeda* have the most number of species. High seaweed diversity, frequency, and percentage cover were observed in Tagburos, Pandan, and Fundeado stations. Commercially important seaweeds are found on reef flats of Fundeado Island, Barangay Tagburos, and Buguias Island. These areas are recommended for seaweed farming and protection.

Reef Fishes. About 121 species belonging to 68 genera and 27 families of reef-associated fishes were observed in six sites in Honda Bay. Labridae and Pomacentridae had the highest number of genera at 15 and 12, respectively, and 22 and 31 species, respectively. Total fish biomass at the six sites was computed at 81.34 kg per 500 sq m. Estimated fish biomass and abundance suggest a moderately fished condition.

Fishery

Fishing Grounds. The common fishing grounds in Honda Bay are found in the (i) northern portion around Fundeado Island (Tadyo), (ii) central portion around Arreciffe Island (Mais-mais), and (iii) southern portion in the areas surrounding the islands of Meara (Nagusuan), Fraser (Nagusuan), and Makesi (Pandan).

Fishing Gears. Some 19 gear types were found operating in Honda Bay: three of the commercial type (daytime ringnet, nighttime ringnet, and bagnet) and 16 municipal or sustenance fishing gears, of which the hook-and-line was the most dominant, followed by bottom set gillnet and lift net. The estimated average catch per day from hook-and-line declined from 16.54 kg in 1990 to 7.7 kg in 1999. Other minor gears and methods are the longline, push net, crab pot, fish pot, and gleaning. The dominance of the hook-and-line and gillnet may be attributed to the characteristics and location of the fishing grounds in Honda Bay,

which have an abundance of fish habitats and are accessible to non-motorized bancas. The wide fishing area extending beyond the municipal waters **explains** the presence of commercial fishing gears in the bay area.

Fishing Effort. Records at the City Agriculture Office show that there were 437 fishers in 12 barangays along Honda Bay in 1996. Fish catch per fishing trip has declined from 36.5 kg in 1985 to 8.4 kg in 1989 and 5 kg in 1996. This downtrend has been attributed to several factors including the use of destructive fishing methods, encroachment of transient fishers using more efficient fishing gears within the City waters, and land-based activities which cause erosion and siltation of coastal waters.

Riverine Resources

Eight main rivers flow from the upland areas into Honda Bay, some with various organic and inorganic loads which adversely impact on the coastal resources of the bay. These rivers are: Babuyan, Ulanguan, Langogan, Tandayak, Tarabanan, Tanabag, Bacungan, and Magarwak.

Babuyan River. The Babuyan river system is said to be the largest (approx. 100 m wide) and longest river in Honda Bay. It originates at the foot of Mt. Cleopatra's Needle, which has a virgin forest and supports diverse flora and fauna, including a number of species endemic to Palawan. The river stretches along three barangays of Honda Bay: Babuyan, Lucbuan, and Mauyon. Its water depth is three ftm (right under the Babuyan Bridge), but varies at different locations and fluctuates during floods or heavy rains.

A cave is located at the inner portion of the river, which is said to be a potential tourism site. There is a pending application for a gravel and sand quarrying concession in the river. Kaingin activities used to be rampant in the river area, but have been reduced after the passage of an ordinance regulating such activities. There are no extensive farming activities in the down stream vicinity, except for backyard gardening. Agricultural activities can be observed at the upper stream of the river. *Almaciga* tapping and rattan gathering activities are carried out only by indigenous people. Very few houses are found along the riverbanks because of the local residents' fear of riverine floods. Around 27 degraded portions have been observed along the riverbank, and fallen and tilting coconut trees have been seen in the eroded areas. During heavy rains, silt/sediment load of the

river greatly influence the underwater visibility in several areas in Honda Bay, thus impeding tourism activities in the bay to some extent.

The Henry T.S.L. Foundation is supporting Barangay Mauyon in the conservation and development of the river systems of Babuyan. Hence, this section of the river is recommended to be one of the sites for water quality analysis and river rehabilitation.

Ulangan River. The entrance to the river is located in Barangay Binduyan, while the upper river source is located in the adjacent Barangay Concepcion. The Ulangan River is approximately 20 m wide and is known for its "ulang," the freshwater prawn (*Macrobrachium sp.*), after which the river was named. Only four families live along the riverbanks. A series of waterfalls can be found in the uppermost reaches of the river. Through a Barangay resolution, the waterfall area has been turned into the Ulangan Falls Nature Park, a barangay project supported by the Henry T.S.L. Foundation¹ and participated by another local NGO, Bandillo. The park gets 200 visitors a month, on average, since it started in January 2000. A donation in any amount is solicited at the entrance to the park.

Along the riverbanks are butterfly gardens, Palawan peacock, mouse deer, and different species of birds. Rattan gathering and *almaciga* tapping used to be common in the upland areas of the river, but have been prohibited since April 2000. Only a few members of the indigenous tribe still engage in these activities and practice *kaingin*. Haribon Foundation-Palawan, an NGO, has a project involving the upland indigenous tribes of Ulangan River. DENR is processing pertinent papers to declare Ulangan River a Protected Area. The CAO-FRMP has community-based riverbank rehabilitation interventions at the lower stream of the river.

Langogan River. This river stretches along eight sitios of Barangay Langogan, namely: Bukang Liwayway, Sentro, Pagkakaisa, Bagong Silang, Bulu-bulu, Macandre, Iraan, and Mangapin. The mouth of the river is about 90 m wide and water depth near the mouth of the river is four ftm (used to be 8 ftm). An islet located about 1.5 km landward from the mouth of the river is observed to have decreased in size (from 3.5 ha to 2.0 ha) after three major floods over the 1995-

¹ The Foundation ended its support to the park in September 2000.

1999 period. Different species of wild orchids abound along the riverbanks. Palawan peacocks, armadillos (anteater), squirrels, porcupines, flying squirrel, mouse deer, monkeys, wild doves, etc. are sighted in the forest along the river.

Agricultural land adjacent to riverbanks is estimated at one ha, while *kaingin* is still being practised in about 15 ha of land despite an ordinance to the contrary. There is a rattan concession in the upland area and gold mining used to be carried out until 1994, which some people believe to have caused soil erosion in the area. Erosion of a portion of the riverbank was observed in Sitio Bagong Silang. There are about 300 families living along the riverbank, with most houses equipped with septic tanks as required by the City Health Office.

The PCSD's Palawan Tropical Forest Protection Program (PTFPP) has a province-wide program involving water quality analysis of major rivers starting in the west coast of Palawan. Haribon Palawan has some initiatives for tribal communities in Langogan.

Tandayak River. The river originates in Conical Hill and flows through *Puroks* Riverside, Bagong Sikat, Kabairan, and Candis in Barangay Manalo. It is approximately 30 m wide under the Tandayak Bridge. Kingfishers, woodpeckers, and snakes have been seen in the area. Mangroves, nipa, and coconuts abound in the lower reaches of the river, while wide patches of agricultural lands are found in the upper reaches. There are few houses on the riverbanks and there are no concessions for quarrying, rattan gathering, or *almaciga* tapping.

The river has a watershed that is being maintained by the barangay, which provides not only drinking water to the community but also irrigation water to the farmlands in the barangay. The barangay observes its own annual *Pista e Kagueban* (Forest Festival), patterned after that of the City, held every last Saturday of July, at which numerous tree seedlings are planted to reforest the watershed.

The Barangay Captain believes that a portion of the river called Pudo (Mangrove Cave) could be developed for ecotourism, primarily through kayaking. The Southeast Asian Fisheries Development Council (SEAFDEC) had a project in the river mangrove area on crab fattening from 1996-1997. There are also projects for indigenous people near the river, which are supported by NATRIPAL, the City Government, and the private sector.

Tarabanan River. Located in Sitio Tagnaya, Barangay Conception, Tarabanan River is approximately 15 m wide under the Tarabanan Bridge, which is about 0.5-km from the river mouth. The river fauna and flora are said to be similar to those of Ulangan River. The river water is clear with no signs of siltation. There are three major eroded portions in the riverbank. During heavy rains and floods, river water reaches some of the houses near the river.

About 30 families inhabit the lower reaches of the river and another 20 families live along the upper reaches, with some households practising backyard vegetable gardening. There is minimal agriculture but gathering of minor forest products such as *almaciga* and rattan is practised by the indigenous people. On occasion, the insecticide Cymbus is said to be used to catch freshwater prawn (*Macrobrachium sp.*) from the river. There is an application for gravel and sand quarrying concession, but there is no quarrying operation in the area. Residents claim that at the foot of Mt. Cleopatra's Needle, where the river originates, is a natural pool with ecotourism potential.

There used to be a Community-based Forest Management Project, which aimed to reforest 5,000 ha of land in the area. The Project was carried out by the San Rafael, Tanabag, and Conception Multipurpose Cooperative with participation from DENR, the LGU, the PC, and the community.

Tanabag River. The river is located in Purok Pagkakaisa and is about 20 m wide under the Tanabag Bridge. River flora and fauna are similar to those of Ulangan River. There are about 15 families living along the riverbank but no major farming activities are observed. There is an existing gravel and sand quarrying concession in the river, which ended after the completion of the concrete road project. Silted river water was apparent during the quarrying activities. During flood periods, the houses near riverbanks are said to be submerged at a depth of about one m. Indigenous people deliver *almaciga* to the lowland areas. The people in the community claim that there is a waterfall (*puyos*) at the foot of the mountain where Tanabag River originates, but no expedition or survey has yet been done to verify the existence of this waterfall. DENR had a bamboo reforestation project in the upper riverbank area.

Bacungan River. The river originates at the foot of Mt. Candis and flows along Sitios San Carlos, Sta. Fe, Sentro, Malbog, and Kasikaan. The mangrove forest in the riverbank is intact, no deforested areas were observed. There were recent

sightings of crocodiles in the San Carlos and Sta. Fe portions of the river, and quarrying of gravel and sand was observed in the Sentro part of the river to support the road construction project. Patches of small agricultural land, ranging in area from 0.25-1.0 ha, are located in the slopes and upland portions of the river. A poultry farm used to operate in the area, with 6,000-6,500 heads of chicken. The population is concentrated only in sitio Sentro.

Ongoing ICRM-related activities in Bacungan are the following: (i) Bantay Gubat (since 1992), (ii) BFARMC (since 1998), (iii) Japanese Overseas Forest Consultation Association (JOFCAT) Agro-forest Reforestation and Nursery (since 1997), (iv) Candes II mpc Reforestation (since 1997), and (v) ELAC paralegal services (since 1999).

Magarwak and Esoy Watershed. Although Magarwak River is a small, narrow river, it has a watershed that has been identified by the City Environment and Natural Resources Office (CENRO) as the next watershed to be developed to supplement the water supply for the people of PPC. The watershed is located in Barangay Sta. Lourdes. Beginning in 2000, the City's annual forest festival (*Pista e Kagueban*) will be held yearly in this watershed until all the deforested areas are replanted. The watershed area is being protected by the CENRO. No one is allowed to construct a house along the Magarwak River vicinity.

Another watershed of the Esoy River area is found in the same barangay (Sta. Lourdes) but the CENRO is reluctant to develop it because the surrounding lands are privately owned.

Current Programs and Projects

Several government and non-government organizations have programs and projects in the Honda Bay area. These include the following:

- (i) BFARMCs organized by the City Agriculturist's Office;
- (ii) ELAC-VCP, an environmental group;
- (iii) Farfish Cooperative organized by farmers and fishers
- (iv) *Samahan ng mga Kababaihan sa Honda Bay* or SAKAHOBA, a women's group;
- (v) Honda Bay Boatmen Association, Inc. (HOBBAI), an organization of boatmen who service tourists and local island hoppers along the bay;

- (vi) Barangay Development Council composed of barangay officials and representatives from the different sectors;
- (vii) Barangay Health Workers who are actively involved in the provision of health services in coordination with the City Health Office;
- (viii) Other civic organizations such as the Rural Improvement Club, Charity Women's Association, organization of the Elderly, and the multipurpose cooperatives;
- (ix) *Bantay Dagat*, a program of the City Government tasked to man the city waters and monitor illegal activities;
- (x) City government offices providing the residents with services as mandated by their respective offices: Office of the City Mayor, Office of the City Agriculturist, City Health Office, City Social Welfare and Development Office, and the Office of the City Veterinarian;
- (xi) SUSIMO Project of DENR;
- (xii) Haribon Foundation-Palawan CRM Project;
- (xiii) Palawan Council for Sustainable Development; and
- (xiv) National Government agencies such as the Department of Agrarian Reform (DAR) and the Palawan Tropical Forestry Protection Program.

In the upland areas, the institutions supporting ICRM-related projects include the following:

- (i) DENR,
- (ii) *Bantay Gubat*,
- (iii) ELAC,
- (iv) NATRIPAL,
- (v) Haribon Foundation-Palawan Indigenous People Project,
- (vi) Samahan ng mga Tagbanua sa Sta. Lourdes,
- (vii) Henry T. S. L. Foundation,
- (viii) Bandillo, and
- (ix) PCSD, which has a province-wide program on water quality analysis of major rivers in the Province, starting in the West Coast of Palawan.

Puerto Princesa Bay

Due to its proximity to the city, Puerto Princesa Bay is subjected to even greater population pressure than Honda Bay. Its 22 barangays are more urbanized than those residing along Honda Bay, and the coastal communities are composed mostly of fishing families. Houses built on stilts are a common sight in the Seaplane, Quito, and Jacana areas, where most of the fisherfolk reside.

Mangroves are found in the inner cove up to the outer side of the bay, and practically envelop the peninsula, serving as spawning grounds for marine life present in the bay. More mangrove species are found in Puerto Princesa Bay than in Honda Bay, but the number of species of seagrass, seaweed, and reef fish is lesser than in Honda Bay. Coral reef cover in Puerto Princesa Bay is in fair condition, as in Honda Bay.

Coconut is a primary perennial crop in the lowland areas; other seasonal crops are corn, rice, vegetables, and fruits such as mango. In the upland areas, bamboo and forest trees abound.

Coastal Resources

Coral Reefs. The coral reefs of Puerto Princesa Bay are classified as fair. The live hard coral cover ranged from 18.42 - 28.57%. The average percent of live soft and hard coral cover of the bay has been estimated at 36.03%. The outer reefs have higher soft coral cover than reefs found in the inner portion of the bay. Abiotic components like benthos comprise about 23.64%; algae, 22.64%; sponges and other fauna, 8.31%; and dead corals, 10.22%. Coral reef sites at Nagolit Point, Twin Rock, and SS Channel are recommended as potential sites for fish sanctuary.

Mangroves. The PPC GIS Center (1990) estimated the total mangrove area in Honda Bay and Puerto Princesa Bay at 5,917 ha. In Puerto Princesa Bay, eight mangrove species were surveyed (viz., *Rhizophora apiculata*, *R. mucronata*, *C. tagal*, *S. alba*, *Xylocarpus granatum*, *Avicennia marina*, *Lumnitzera racemosa*, and *Scyphiphora hydrophyllacea*), mostly occurring along the fringes of the bay. In the 2000 survey, five species were recorded: *Ceriops tagal*, *Rhizophora apiculata*, *R. mucronata*, *Sonneratia alba*, *Xylocarpus granatum*. *R. apiculata* was widely

distributed and showed a recruitment rate of 20-31% within five months. *S. alba* was the biggest tree in the areas surveyed. Thick mangrove forests can be found in Barangay Iwahig.

Seagrasses. Initial work on Puerto Princesa Bay seagrasses revealed seven species of seagrasses in Canigaran and Putol na Ilog; *Cymodocea serrulata* was absent in both sites. Jacana and Iwahig had five species each, Nagolit Point had four, Roja Point had two, and Bush Point had only one. *Enhalus acoroides* was present in all sites surveyed. Canigaran showed the highest seagrass density of 2,463.33 shoots per sq m, followed by Putol na Ilog with 1,437.20 shoots per sq m. Raja Point has the lowest density at 31 shoots per sq m. The densities of *T. hemprichii*, *H. ova/is*, *E. acoroides*, and *S. isoetifolium* in Puerto Princesa Bay were higher (214.59, 161.98, 25.01, and 24.57 shoots per sq m, respectively) compared with Honda Bay; the rest had lower densities than Honda Bay. Recent reports showed eight seagrass species in the bay. *Enhalus acoroides* was most common, while *Thalasia hemprichii* had the highest shoot density. Roja Point had the highest seagrass diversity, while high mean seagrass density was found in Jacana area, WESCOM, and Roja Point.

Seaweeds. The number of seaweed species in Puerto Princesa Bay ranged from one (Iwahig and Nagolit) to 27 (Raja Point). Canigaran had the highest total relative frequency of 93.46% while Iwahig had the lowest at 0.38%. Roja Point showed the biggest cover at 56.83% and Iwahig had the least at 0.04%. The three species with high relative frequency are: *Sargassum* spp. (8.30%), *Padina minor* (4.57%), and *Dictyota divaricata* (3.99%). *Sargassum* spp. had the biggest cover at 6.16%, followed by *Halicoryne wrightii* at 2.67%, and *P. minor* at 2.10%. A total of 142 seaweed species was recorded in November 2000, composed of 52 green, 49 red, and 22 brown seaweeds. Coastal waters off Putol na Ilog, Barangay Mangingisda, Nagolit and Roja Point have high seaweed diversity. *Sargassum* spp. were most dominant in terms of frequency and percent cover.

Reef Fishes. The highest number of fish species was found in the southern outer part of the bay (50), followed closely by the southern channel (47), Saguit Point (37), the northern outer part of the bay (36), northern channel (30), and Nagolit Point (28). Some 105 fish species, belonging to 57 genera and 17 families were recorded in Puerto Princesa Bay. The total count of associated reef fishes in the bay was lower than in Honda Bay. *Plectroglyphidodon lacrymatus* is the species with the highest count (121), followed by *Ctenochaetus binotatus* (75),

Pomacentrus stigma (72), *Chromis ternatensis* (61), and *Pomacentrus vaiuli* (60). Overall, total abundance per 500 m is 1,272 individuals, far lower than the total abundance recorded in Honda Bay. Total fish biomass at the six sites was computed at 35.96 kg per 500 sq m.

In a 2001 report, fish census observations revealed that fish densities in Puerto Princesa Bay are low (i.e., 555 ± 285 individuals/ha). The fish biomass was estimated at 8 ± 5.4 tons per km², which is likewise considered under poor category. Fish biomass in Puerto Princesa Bay is lower than that of Honda Bay.

Fishery

Fishing Grounds. Puerto Princesa Bay fishers mostly fish in the nearshore areas in the long point. Other common fishing grounds are those along the coasts of Irawan, Iwahig, Abucayan Inlet, and Saguit Inlet.

Fishing Gears and Fishing Effort. Records from the City Agriculture Office show that there were 893 fishers in 14 barangays along Puerto Princesa Bay in 1996. Some 21 different types of fishing gear, both commercial and municipal, are in use in Puerto Princesa Bay. Gillnets were the most dominant at 32.6%, followed by hook-and-line (22.7%) and fish corral (14.0%). Gillnets gave the highest fishing effort (49 gear units), followed by hook-and-line (34), and fish corral (21). These three major fishing gears combined comprise about 65% of the approximate total fishing effort inside Puerto Princesa Bay.

Other minor gears are dipnet, spear fishing, push net, beach seine, and crab pot. Bagnets and nighttime ringnets used in Honda Bay are not found in Puerto Princesa Bay. In contrast, the dipnet, which is widely used in Puerto Princesa Bay, is not found in Honda Bay. Dipnets, which were not recorded by Rana in 1998, are now dominant in the bay, with 38 users representing 33% of the total number of fishers surveyed. This is perhaps the offshoot of the recent trawl ban in Puerto Princesa Bay, with the dipnet and push net (*sudsud*) now being used as substitutes for the trawl to gather such high-value species as shrimps, prawns, and crabs. It is important to note that gillnet fishers in Puerto Princesa Bay now use a modified trammel net to increase their catch efficiency. More environment-friendly gears to replace the trawl fishery could be introduced, provided proper regulatory measures (such as licensing and total allowable catch) and a prior assessment of shrimp stocks are implemented.

Species and Seasonality. Some 57 species of fish and invertebrates are recorded in Puerto Princesa Bay. The species caught vary with fishing gears and seasons, with gillnets, fish corrals, hooks-and-line showing the highest diversity of catch. Crab pot, dip net, jigger, octopus diving, and push net are limited to three target species only. About 87% of the 16 gear types operate throughout the year. In general, all gears in Puerto Princesa Bay show the highest fishing activity from March to December (*calmada*, *habagat*, and early part of *amihan*). The peak season is from May - October for three major gears (gillnet, hook-and-line, and fish corral); lean season is from November - April. Catch using longlines is limited by the area of the bay and its bottom characteristics which are not suited for bottom longlining. Specialized fishing gears in Puerto Princesa Bay (crab pot, gleaning, and dipnet) operate throughout the year.

Riverine Resources

Among several rivers draining into Puerto Princesa Bay are (i) Irawan River with its own watershed supplying potable water to about 60% of the City's population and (ii) Karamuran River, which is believed to have the greatest impact on the coastal resources of the bay.

Irawan River. This river, with an approximate width of 10 m near the Irawan Bridge, is located within the territorial boundaries of four barangays of PPC: Bacungan, Iwahig, Simpocan, and Irawan. Large trees are abundant along the slopes of the river, and its latest water quality classification was Class A, despite its use for quarrying of gravel and sand, car washing in the lower reach of the river, and recreation. The river was the site of a reforestation project of the City Government since 1993. The river has a watershed that supplies potable water to 60% of the population in Puerto Princesa City. In the watershed area is an 8,000-ha reservation site, also known as Palawan Flora and Fauna Watershed Reserve, which is home to an estimated 280 Tagbanuas holding Certificates of Ancestral Domain Claim. The indigenous people practice *almaciga* tapping and rattan gathering.

Organizations and agencies with projects in the river are DENR, PCSD, the LGU, NATRIPAL (an NGO), and the Australian Agency for International Development (AusAID). The CAO-FRMP has vetiver plantations along some portions of Irawan Riverbank as part of its Riverbank Rehabilitation Project.

Karamuran River. The Karamuran River runs along Barangay Sta. Monica, PPC and joins Sicsican River before draining into Puerto Princesa Bay. Its width is about 12 m at low tide at the Purok Maagap section. Residents in the area claim that the depth of the river has been reduced to about 50% since the 1980s. Most of the mangrove forests along the river had been converted into fishponds; cutting of mangrove trees is now strictly prohibited, however. Its water quality is threatened by domestic and industrial wastes resulting from the rapid industrialization and exponential population growth rate in the outskirts of the City. Siltation of the river has also become a problem as a result of the conversion of mangrove forests into fishponds.

Current Programs and Projects

National and local government and non-government organizations present in the Puerto Princesa Bay area include the following, among others:

- (i) DA-BFAR;
- (ii) DA Searanching Project;
- (iii) DSWD;
- (iv) DAR;
- (v) Cooperative Development Authority (CDA);
- (vi) Office of Congressman Abueg;
- (vii) PCSD;
- (viii) City Agriculturist's Office;
- (ix) CENRO;
- (x) *Bantay Dagat*;
- (xi) Holy Trinity College, a private institution implementing an outreach program
- (xii) ALAYKA, a program under the Provincial Health Office;
- (xiii) NATRIPAL; and
- (xiv) *Bantay Gubat*.



Institutions Present in the Area

City Government Departments/Offices and Programs

Office of the City Mayor. The City Mayor, as local Chief Executive, exercises general supervision and control over all programs, projects, services, and activities of the city. Among his various functions, he determines the guidelines of city policies and is responsible to the *Sangguniang Panlungsod* for the general program of government. He directs the formulation of the City Development Plan and initiates legislative measures for the approval of the *Sangguniang Panlungsod* and subsequently implements the plans and programs and enforces all laws and ordinances. The City Mayor is likewise tasked to initiate and maximize the generation of revenues and apply the same to the implementation of development plans and projects, particularly those programmed for agro-industrial development and countryside growth. He is also responsible for ensuring the delivery of basic services and the provision of adequate facilities.

Office of the City Agriculturist. The office is responsible for the (i) formulation of agricultural development programs in consultation with farmer leaders and other officials; (ii) supervision and coordination of agricultural extension activities, including identification of agricultural techniques and methods, particularly crop protection technologies, needed by rural families; (iii) provision of appropriate training programs and extension services; (iv) organization of farmers' associations or cooperatives and rural women and youth clubs; (v) supervision of farmers' classes; and (vi) dissemination of information on agriculture and specific subjects such as crop production, animal science, fisheries, and soil conservation to farming and fishing families. The office is the lead agency in the implementation of the coastal resource management program of the City Government in close coordination with DA-BFAR's FRMP in Puerto Princesa City.

Kaunlaran sa Pamamagitan ng Pabahay at Kabuhayan (KAPAKANAN). This program is implemented by the Office of the City Mayor in coordination with the Office of the City Agriculturist. It addresses the problems of poverty and social deprivation through the provision of low-cost housing units for squatters and landless families and implementation of an agricultural improvement project with marginal farmers and fishers as beneficiaries. Priority recipients of the housing project and relocation assistance are families whose houses were demolished

because of the expansion of the Port of Puerto Princesa and the construction of the Matahimik feeder road as well as the squatters along the coast of Puerto Princesa Bay. Livelihood assistance in the form of loans is provided to qualified farmers and fishers.

Office of the City Veterinarian. This office provides veterinary extension service, meat inspection, hygiene, and sanitation. It supervises and controls all matters pertaining to the inspection of animals intended to be slaughtered and sold for public consumption in any public or private slaughterhouse and poultry dressing plant. It develops and implements plans and programs to increase the number and improve the quality of livestock, poultry and other domestic animals used for work or human consumption. Among its regular activities are:

- (i) ante-mortem and post-mortem inspections of all animals to be slaughtered;
- (ii) post-abattoir and post-inspection in markets, cold storages, and other establishments that sell or keep meat and its by-products;
- (iii) issuance of licenses to meat handlers, vendors and processors, hide dealers, poultry dressers and butchers;
- (iv) examination and checks of poultry and livestock diseases in the barangays to determine if there are cases of spreading disease;
- (v) vaccination;
- (vi) veterinary extension service and training programs to meat vendors, butchers and animal raisers; and
- (vii) impounding of stray dogs and cats.

City Environment and Natural Resources Office. The **City-ENRO** is mandated to manage communal forest areas and small watershed areas, which are sources of local water supply. It implements community-based forestry projects, such as the following: (i) Integrated Social Forestry Project, (ii) reforestation projects, (iii) Forest Land Management Agreement, and (iv) Community Forestry Projects. It establishes and maintains tree parks and other tourist attractions in areas identified and delineated by DENR, except those covered by the National Integrated Protected Areas System (NIPAS). It also implements activities under the Rehabilitation on Conservation Hotspots (RICH) and the Conservation of Rare and Endangered Species (CARE) in areas designated by DENR. It likewise enforces forest laws as well as pollution control and environmental protection laws, rules, and regulations. It deals with solid waste disposal and other environmental man-

agement system and services related to general hygiene and sanitation (i.e., sewage and household waste disposal). Likewise, it issues permits for guano collection and extraction of sand, gravel, and quarry resources and conducts cadastral and lot surveys as well as isolated and special surveys provided that DENR issues the survey authority, verifies the survey returns and issues the patents, and undertakes other post-survey activities. The CENRO Officer chairs the ENR Sectoral Committee of the City Government, which meets quarterly to discuss accomplishments, plans, and issues among multi-agencies.

Bantay Puerto Program. The *Bantay Puerto* Program was launched by the Office of the City Mayor to implement measures for the protection, conservation, and sustainable development of Puerto Princesa's natural resources. Its two major components are *Bantay Gubat* and *Bantay Dagat*, which address illegal and destructive activities in the forests and the marine areas, respectively. The program also organized a Special Task Force and Monitoring and Civil Security, which carries out activities designed to counter other illegal and criminal elements in the City. Forest and coast guards are hired to man outposts; conduct information, education, and communication (IEC) campaigns; and apprehend and prosecute violators of environmental laws. A 24-hour surveillance of suspected individuals/groups is conducted with the assistance of the military, including the Coast Guard. The support of PNP is also sought in the enforcement of laws. The Department of Education, Culture and Sports (DECS) is tapped for the IEC drive, and Haribon Foundation assists in environmental protection activities. Marginal fishers and farmers who are adversely affected by the program are provided with material and technical assistance in coordination with the City Agriculturist's Office, BFAR, and the City DSWD.

Office of the City Health Officer. The City Health Department is the guardian of the health and physical well-being of every individual through the implementation of preventive, curative, and rehabilitative health activities with the active participation of the community. It conducts regular medical, dental, laboratory, and environmental health visits to the communities. The department likewise undertakes sanitation activities aimed at strengthening environmental health, thereby maintaining a pollution-free community. It promotes family planning methods that take the couple's choice into consideration. It also has a nutrition program directed at infants and pre-school children so that those with normal weight do not become malnourished while underweight children are rehabilitated. The City Health Plan includes blood typing for all residents and the

maintenance of a master list containing information on blood types, and provides support to indigents through the provision of free quality medicines.

City Satellite Hospitals. The City Government operates six satellite hospitals in the barangays of Napisan, San Rafael, Cabayugan, Salvacion, Mangingisda, and Inagawan and a satellite clinic in Sitio Nasuduan, Barangay Tagabinet. A satellite hospital has four beds and is equipped with an ambulance, radio, and medicines. It provides basic over-the-counter drugs and temporary shelter for emergency cases awaiting transport to the city proper. A medical team provides 24-hour services and conducts lectures on proper health care, with focus on preventive measures, from time to time. The project is implemented by the City Mayor's Office in coordination with the City Health Office and other government and private agencies.

Office of Social Welfare and Development. This office is concerned with the provision of interventions and opportunities that will uplift the living conditions of distressed and disadvantaged individuals, families, and communities and enable them to become self-reliant and actively participate in community development. It coordinates the services and facilities required from government and non-government agencies to provide an integrated welfare package to the constituents on the basis of their needs. Socially disabled individuals and those who are physically and mentally handicapped are cared for and protected or rehabilitated. The projects/activities of this office include:

- (i) child and youth welfare program (day care and peer group service, child care and placement, community-based services for street children delinquent youth);
- (ii) family welfare program (responsible parenthood service, marriage and family counseling, skills development, job placement, and livelihood assistance);
- (iii) community organizing;
- (iv) women welfare program (maternal and child care program, self-enhancement service, social communication skills, and counseling);
- (v) disabled persons' welfare (disability prevention services, assistance for physical restoration, practical skills development, substitute family care and livelihood assistance); and
- (vi) emergency assistance program (disaster relief, emergency shelter assistance, and emergency supplemental feeding).

Anti-Squatting Program. The Program is designed to look into the problem of squatters and squatting syndicates. It monitors squatting activities and arrests and prosecutes violators. A mechanism has been established to ensure compliance with the provisions of the *Urban Development and Housing Act* and its Implementing Rules and Regulations relative to demolition and eviction of squatters.

City Tourism Development Program. In support of the City's tourism development objectives, the program undertakes promotional activities, conducts research on the tourist market, and monitors tourist facilities and related services to serve as input into marketing operations and regulation of the industry. The implementation of the program is spearheaded by the City Tourism Division, which participates in international and national events to promote the City as a tourist destination and conducts local seminars and training in collaboration with the private sector.

Community Development Enhancement Program. The Office of the *Liga ng mga Barangay* is implementing this program designed to strengthen information flow to the barangays with regard to local and national development efforts and issues, thereby encouraging their active participation in these endeavors. The program also provides training on local governance, livelihood enhancement projects, education, financial, medical, and material aid and services to barangay officials and provides financial support to poor but deserving students. It is hoped that the program will eventually transform the officers and members of the Liga into dynamic community leaders. Through the provision of income generating projects, the Program aims to contribute to the economic upliftment of the members.

Barangay Fisheries and Aquatic Resource Management Council. As provided in *Executive Order 240*, a BFARMC was created in each barangay, composed of the two representatives each from the *Sangguniang Barangay* (preferably the chairpersons of the committees on agriculture and fisheries), accredited NGOs, the private sector, chairman of the *Sangguniang Kabataan*, eight fisherfolk representatives (preferably the President of the fishermen's cooperative or association), and the representative of the women's sector. The BFARMC is tasked to prepare and recommend fisheries and aquatic resources management policies and formulate plans. It also formulates rules and regulations regarding the issuance of licenses to ensure the appropriate use of fisheries and aquatic re-

sources and the imposition of resource use limits and controls. These guidelines or recommendations may include the evaluation of all projects and applications within their area of coverage, which serve as the basis for the evaluation of the environmental impact of a project.

Provincial Government

The *Kilusan Ligtas Malaria* (KLM) is a community-based malaria elimination project of the Provincial Government of Palawan, which is supported by Shell Philippines Exploration J.V. The program is basically a province-wide IEC campaign conducted throughout the municipalities to coordinate the people's participation in the efforts towards malaria control. The Program develops and disseminates IEC materials via radio and television and in schools, and monitors the impact of the campaign. Community organizers facilitate community-based activities and organized barangays set a malaria-free day for the conduct of mass blood smearing, prepare and update data boards, conduct bed net impregnation every six months, stream clearing and seeding, bio-pond construction, and health education. KLM is working with indigenous people in the uplands of Honda Bay (San Rafael, Mauyon, Conception, Binduyan, and Langogan). The Provincial Government has a project called *Sagip Kalikasan*, which complements the PENRO on the environmental concerns of the Province.

National Government Agencies

Department of Agrarian Reform. The major responsibility of DAR is the implementation of the Comprehensive Agrarian Reform Program (CARP). DAR is mandated to: (i) acquire, determine the value of, subdivide into family-size farms or organize into collective or cooperative farms, and develop private agricultural lands for distribution to qualified tillers, actual occupants, and displaced urban poor; (ii) administer and dispose all cultivable portions of the public domain declared as alienable and disposable for agricultural purposes transferred to it by DENR; (iii) acquire, by purchase or grant, real estate property suited for agriculture that have been foreclosed by the national government; (iv) undertake land consolidation, land reclamation, land forming, and conservation in areas subject to agrarian reform; (v) facilitate the compensation of landowners covered by agrarian reform; (vi) issue emancipation patents to farmers and farm workers who have been given lands under the agrarian reform program as may be provided for by law; (vii) provide free legal services to agrarian reform beneficiaries

and resolve agrarian conflicts and land tenure problems; (ix) develop and implement alternative land tenure systems such as cooperative farming and agro-industrial estates, among others; (x) undertake land use management and land development studies and projects in agrarian reform areas; (xi) approve or disapprove the conversion, restructuring, or readjustment of agricultural lands into non-agricultural uses; (xii) monitor and evaluate the progress of agrarian reform implementation; and (xiii) assist the Office of the Solicitor General (OSG) in providing evidence for reversion proceedings to be filed with respect to lands of the public domain, occupied by private individuals and their tenants or farmworkers, which are subject to land reform and real rights, connected therewith which have been acquired in violation of the Constitution or the public land laws or through corrupt practices.

Department of Environment and Natural Resources. DENR is responsible for the conservation, management, development, and proper use of the country's environment and natural resources, specifically forest and grazing lands, mineral resources, including those in reservation and watershed areas, and lands of public domain, as well as the licensing and regulation of all natural resources. It promulgates rules and regulations in accordance with law governing the exploration, development, conservation, extraction, disposition, use and such other related commercial activities. At the provincial level, DENR operates through the Provincial Environment and Natural Resources Office (PENRO) and under this office are the CENROs which cover up to four municipalities. DENR had a bamboo reforestation project located in the slope of Tanabag River and is developing the Magarwak Watershed in Honda Bay. It also has projects in the Irawan River and Watershed.

Philippine Coconut Authority. The mandate of PCA is to promote the integrated development and growth of the coconut industry to ensure that coconut farmers become direct participants in, and beneficiaries of, such growth. It envisions that growth and equity are achieved through the existence of organized productive and self-reliant rural communities involved in viable coconut farming, processing, and marketing with the dynamic complementation among sectors of the industry. Because of the growing demand for the expansion of coconut areas in the province, especially the northern municipalities, replanting is a major thrust of PCA. Technology transfer of the concept of model farms under the project, "*Maunlad na Niyugan Tugon sa Kahirapan*," will be implemented.

National Irrigation Administration. NIA is responsible for the construction, repair, or improvement of communal irrigation projects. It conducts field engineering, investigation, survey, and other data gathering for all proposed projects. The engineering section is tasked to design the specifications, survey proposed projects, prepare feasibility studies, prepare plans, and implement the actual construction of projects. It is also mandated to implement institutional development of irrigators' associations (IAs), water users, and farmer leaders through training and similar programs to enhance their participation in project implementation and develop their capability in managing irrigation systems. NIA likewise collects payments for the amortization of communal and pump irrigation systems and provides technical assistance to IAs and water users in the operation and maintenance of irrigation systems.

State Polytechnic College of Palawan. The SPCP's Aquatic Science and Technology Institute conducted a Resource Ecological Assessment in some parts of Puerto Princesa Bay under DENR's Sulu-Celebes Sea Conservation and Management Project through the Philippine Council for Aquatic and Marine Research and Development (PCAMRD). It conducts several other DOST/PCAMRD-funded research projects on fish, seagrass, and seaweeds in both Puerto and Honda Bays. The students of SPCP also carry out fishery-related theses in Puerto Princesa Bay and Honda Bay.

International Organizations

In 1996, ICLARM and SEARCA jointly conducted initial resource, socioeconomic, and institutional assessment activities in two barangays (Manalo and Tagbuos) in Honda Bay, Palawan for the purpose of developing a resource management plan for the Bay.

Non-Government Organizations

Environmental Legal Assistance Center. ELAC provides legal assistance and counseling in defense of environmental rights, including legal representation. It pursues advocacy and outreach efforts, lobbies for responsive environmental laws and policies, and conducts training and seminars on environmental laws, ecological awareness, leadership, environmental monitoring, and resource assessment. It holds consultation meetings on environmental issues and forges linkages with allied organizations and local and international personalities to

carry out its mandate. ELAC also strongly advocates the empowerment of fishers and farmers for environmental management activities.

Haribon-Palawan Foundation. The activities of Haribon-Palawan are focused towards environmental conservation, sustainable development, and social equity. It conducts training and education campaigns to increase public awareness on the necessity to protect the environment. As part of its advocacy work, the organization conducts public fora and lobbying in government agencies and councils and provides legal assistance in the prosecution of violations of environmental laws.

Palawan Center for Appropriate Rural Technology. PCART aims to promote socioeconomic development through projects that address the need for alternative technologies because of the alarming problem of ecological imbalance brought about by the massive use of destructive inputs. Its goal is to arouse, organize, and mobilize the peasants of Palawan through socioeconomic projects that strengthen their collective will and develop self-reliance towards the upliftment of their welfare. The organization focuses on the development of participatory organizing skills among farmers and the practical application of appropriate technology for agriculture. It conducts training on alternative technologies, health, and enterprise development and is involved in the establishment of experimental farms and site-specific livelihood projects as well as the provision of loans for cooperatives.

San Rafael, Tanabag, Conception Multipurpose Cooperative. The Cooperative had a Community-based Forest Management Project involving the reforestation of a 5,000-ha upland area in the northern barangays of Honda Bay. The Project, which was supported by DENR, the LGU, and PCSD, ended in 1995.

Other Programs

Palawan Tropical Forestry Protection Program. The Program aims to assist the Province in the protection of its forest area within the framework of sustainable environmental protection and the NIPAS Law. As a community-based project, it focuses on working with communities and LGUs within the target catchments surrounding the Mt. Mantalingahan mountain range, St. Paul's Subterranean River National Park, and the Irawan and Iwahig areas. The following components are implemented within the catchment areas: agriculture

and livelihood, forest management, institutional strengthening, and environmental awareness supported by boundary demarcation, research, and geographic information system (GIS). It also supports the PCSD's establishment of the Environmentally Critical Areas Network (ECAN). The Program is a special project of PCSD (4.1 million Euro) supported with a grant from the European Union amounting to 17 million Euro. It started in mid-1995 and ended in mid-2002. The Program is operating in at least one catchment in the mainland's city/municipalities, except Taytay and El Nido. The Project ended in 2002.

Second Palawan Integrated Area Development Project. SPIADP was launched in 1991 as the second phase of the Asian Development Bank (ADB) loan-funded Palawan Integrated Area Development Project. The Project included an agricultural development component, which focused on crops, livestock and poultry, irrigation, and fishery services. An infrastructure (roads and bridges) component supports the agricultural interventions. Cadastral surveys and issuance of land titles likewise support it. Following the concept of an integrated area development project, SPIADP includes a Women in Development component and an integrated health program (nutrition, malaria, and tuberculosis control).



Issues and Concerns

Several issues and concerns have been identified in the course of the field surveys, studies, and local consultations. Grouped under three categories: (i) coastal land, (ii) coastal sea and fisheries, and (iii) socioeconomics, these issues and concerns include the following:

(i) Coastal Land

- Although there are conservation and development initiatives in some of the rivers, there are few existing management plans for rivers in two bays.



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(i) Coastal Land

- Although there are conservation and development initiatives in some of the rivers, there are few existing management plans for rivers in two bays.

- River conservation and development initiatives are still limited.
- Community awareness of the importance of river management as a critical component of integrated coastal management is at a low level.
- Few training courses are available on proper river management for LGUs and communities.
- Almaciga and rattan concessions are still operating in most upland areas of Honda Bay, while kaingin is still being practised in Honda Bay, although limited to indigenous people only.
- Most past activities were mainly focused on CRM and not on ICRM.
- There is a need for more studies on the effects of previous mining activities in river and municipal waters.
- No inventory of species diversity in coastal lands has been conducted.
- Siltation and pollution from industrial and domestic wastes endanger rivers in urban and industrialized areas of PPC.

(ii) Coastal Sea and Fisheries

- Resource use conflicts exist among tourism, municipal fishers, and commercial fishers.
- Threats to fisheries include compressor fishing, blast fishing, use of sodium cyanide, and pesticides.
- Motorized nearshore pushnets (sudsud) destroy seagrass beds and young mangrove trees.
- Push nets have been identified as heavy competitors of sustenance crab and shrimp fishers (dipnet fishers) in main fishing areas in Puerto Princesa Bay.
- Some sustenance fishers are forced to fish in areas farther from the shore or outside the bay due to apparent decrease in their catch per unit effort.
- A decline in catch volume has been observed in many areas using the same gear in the same fishing area over the last five years.
- BFARMCs need assistance in capability building.
- Communication between the city LGU and among barangays must be improved.
- Prohibition of cutting of mangroves for fuelwood and charcoal still needs to be strictly enforced.

(iii) Socioeconomics

- Small fishers have meager incomes from fishing and are in need of capital assistance and livelihood opportunities.
- The influx of migrants from other areas increase pressure on the coastal resources.
- Some coastal communities have no security of land tenure.
- Solid waste management plans have to be adopted and implemented.
- Some people claim mangrove areas as private property.
- There are still communities suffering from malnutrition and lack of potable drinking water.
- Tailings from the abandoned mine site in Sta. Lourdes are believed to have caused mercury poisoning in its immediate vicinity. However, for fear of possible relocation, the residents in the area refuse to recognize mercury as threat to their health.

The following recommendations are proposed to address the foregoing issues and concerns:

(i) Coastal Land

- Review existing pollution laws and standards regarding water use and river pollution, and enforce these laws strictly on existing and proposed establishments.
- Conduct IEC on the ill effects of pollution on the rivers and their aquatic life.
- Conduct IEC on the need for ICRM, rather than solely CRM.
- Conduct surveys to obtain baseline data on the relationship between upland activities (almaciga tapping, rattan gathering, kaingin, intensive farming, etc.) practices and river water quality.
- Include rivers with previous mining activities as sites for water quality analysis.
- Conduct coastal land biodiversity survey in identified pilot rivers.
- Conduct community-based river management training for LGUs and other concerned local agencies.
- Regulate gravel and sand quarrying activities and require the conduct of surveys of quarry sites to ensure that important species and habitats are not affected.

(ii) Coastal Sea and Fisheries

- Introduce an environment-friendly gear as substitute for push net (sudsud) shrimp fishery.
- Undertake measures to decrease fishing pressure in the bay such as licensing and monitoring, control, and surveillance (MCS).
- Resolve resource use conflicts by analyzing various stakeholders' needs and implementing a zonation of coastal waters.
- Declare marine protected areas (MPAs) to serve as resource production units in the bay.
- Reforest riverbanks and coastal shores.
- Strengthen the capabilities of LGUs and BFARMCs.
- Establish effective communication among barangays and with the city LGUs.
- Review and strictly enforce the Fisheries Code and other local fisheries ordinances.
- Conduct IEC on why coastal land and coastal sea should be jointly managed.

(iii) Socioeconomics

- Strengthen community organizing, form cooperatives, and introduce livelihood opportunities to the community.
- Strengthen the capability of fishers' POs and cooperatives in terms of business plan development and management of livelihood projects.
- Assistance should be extended to the City Government in terms of resources to effectively monitor, assist, and evaluate POs, fishermen's associations, and cooperatives.
- Review land use or zoning and development plans for security of tenure.
- Assess the potential and mandate of tenurial instruments.



Republic of the Philippines
Department of Agriculture
Bureau of Fisheries and Aquatic Resources

Fisheries Resource Management Project

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