

State of the Mangroves in

SUBIC BAY FREEPORT ZONE



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I. INTRODUCTION

Subic Bay Freeport Zone is a former US naval base surrounded by the Subic Bay, Zambales Mountain Range and the Bataan Peninsula. In 1992, the Subic Bay Metropolitan Authority (SBMA) was created to manage and develop this former US base into Subic Special Economic and Freeport Zone by virtue of Republic Act 7227 also known as the Bases and Conversion Act of 1992. Consequently, by virtue of Presidential Proclamation 532, the meets and bounds of the economic zone with total area of 67,452 ha were declared composed of the (1) former Naval Reserve, (2) part of Olongapo City, (3) Subic and (4) San Antonio in Zambales, and (5) Hermosa and (6) Morong in Bataan. The strict security provided by the US Navy in the area significantly preserved its natural resources such as old growth forest, mangroves and marine resources. Apparently, these rich nature reserves made the Subic Bay Freeport a popular tourism destination (Woodward-Clyde 2001).

The Subic Bay Freeport Zone has a shoreline length of 16.5 km with coastal area of 11,500 ha. Dwelling in these coastal regions are 84 locators from currently 1,234 registered business/locators in the Freeport. These locators along the coast are engaged in manufacturing, trading, tourism related activities such as hotel operations, diving operations, marine transportation industries such as port operations, ship building and repair facility, and oil and gas depot. The Subic Bay is bound by the Subic town in Zambales and Morong in Bataan. There are coastal communities along the Subic Bay coast, but these are under the jurisdiction of the respective LGUs.

The coastal communities that rely on coastal resources are unique to the Freeport because these communities are non-fisher folk or coastal households but industrial companies. However, it is also significant to discuss some

key characteristics of coastal communities outside the SBMA jurisdiction that directly affect the resource use in Subic Bay. Based from the study by Woodward-Clyde on Resource Inventory Summary Report in 2000, the coastal and/or lowland communities in Subic Bay were primarily engaged in municipal fishing while some are in deep-sea fishing and aquarium fish gathering. Others are involved in beach resort management, trading operations (market, buy and sell), or employed in one of the industries in the area. The study enumerated some key issues that the fishing sectors were facing, which include the following: (1) decreasing fish/marine resources, (2) inadequate fishing gears and equipment, (3) violation of marine regulations and laws, (4) the lack of sustainable financing and (5) the lack of marketing outlets.

As for the Subic Bay Freeport coastal communities, social issues experienced by the coastal locators include: (1) encroachment of neighbouring communities, (2) the lack of environmental awareness and ignorance to marine conservation guidelines, (3) conflict of interest and (4) social acceptability of the projects.

Several locators in the coastal areas have problems on encroachment despite the presence of SBMA Harbor Patrol in the Bay. Encroachers were composed of fisherfolks from adjacent towns that enter the Freeport's bay to fish and gather shellfish at rocky intertidal flats. However, the SBMA action was to increase the harbor patrol visibility in the area to abate the problems on poachers, looting and illegal fishing activities. The SBMA recently procured harbour patrol boats for this purpose.

The lack of public awareness on ecosystem dynamics and environmental rules and regulations leads to environmental degradation. In the case of Subic Bay Freeport, the SBMA Board approved the implementation of SBMA Marine Conservation Guidelines formulated in accordance with



the Subic Bay Protected Area Management Plan (SBPAMP). Ignorance to this law leads to non-compliance and consequently degradation of Freeport core ecological and habitat protection zones. Violation of the SBMA Marine Conservation Guidelines includes conduct of recreational fishing without permit and conduct of this activity in areas of no fishing zones and encroachment to marine protected areas.

Since Subic Bay is bound by several municipalities and the SBFZ, its coastal resources inevitably have multiple users, which result to conflicts in resource use. Contrasting interests and priorities of the LGUs, private institutions and the SBMA leads to ineffective coastal resource management. Hence, there is a great need to synchronize all coastal management initiatives and implement the Integrated Coastal Management Plan for Subic Bay.

Lastly, social problems arise when there are environmentally critical projects and/or projects that are proposed to be established in environmental critical areas that require social acceptability. In some cases, the SBMA mandate to provide employment opportunities lead to biases that are unfavorable to the environment and/or against the interest of the general public. For instance, a world class marine theme park was proposed few years ago, which required massive information dissemination activities and the acceptance of the community. Nevertheless, the SBMA ensures that each project operating inside the Freeport has undergone Environmental Impact Study (EIS) as required elsewhere in the Philippines and comply with the guidelines provided in the EIS.

Importance of Mangroves

Mangrove forests are among the most important coastal resources in the Philippines. Mangroves are known to provide sources of food, timber, wood, and medicinal and agricultural products. They also provide aesthetic values and ecological services such as shoreline protection, nursery grounds for fishes, enhancement of biodiversity and maintainance of water quality. This wide range of benefits and functions of a mangal ecosystem sustains social, environmental and economic activities.

Mangroves in the Freeport provide important ecological functions and services. They support the fisheries by providing feeding, spawning and nursery grounds to fisheries benefitting the fishing communities of Subic and Bataan. They also serve as habitat and refuge for birds and home of endemic wild duck *Anas luzonica*. The mangal ecosystems in the Freeport also cater to researchers both from local and international academic and research institutions serving as their natural laboratory. Since it is situated in close proximity to Manila, the accessibility, safety and security to these mangrove sites are not problematic.

Moreover, the Freeport's mangroves, particularly in the Triboa Mangrove Park, provide recreational and aesthetic value as a natural park and ecotourism facility. Apparently, contingent valuation study (CVM) using willingness to pay survey estimated that the park has a total economic value of Php 5,052,618 (Pescador-Mallari 2012). The valuation method took into consideration the ecosystem goods and services that the mangrove ecosystem provides such as habitat, nursery grounds, and aesthetic, recreational and existence values, which are indirect goods that cannot be brought to market and hence have no direct monetary value.

Finally, the mangroves of the Subic Bay Freeport serve as sources of food and housing materials for the indigenous people, the Pastolan Ayta tribe. As part of the tribe's ancestral domain and cultural heritage, the mangrove forests in Binictican-Malawaan and Boton serve as areas for gathering mollusks, crustaceans and fishes for their consumption. The utilization of these resources by the Pastolan tribe is in accordance with the Memorandum of Agreement between SBMA and the Pastolan Tribal Council.

II. STATUS OF MANGROVES

Subic Bay Freeport Zone has a total of six mangrove forest patches with a total area of 61.63 ha (**Table 3**). These mangrove forests are in Binictican-Malawaan, Boton, Nabasan, Triboa A, Triboa B, and Ilanin with area coverage of 30, 12.2, 6.6, 7.8, 2.5 and 2.5 ha, respectively. **Appendix C** provides a breakdown of the mangrove distribution in the area. Situated inside the former US Naval Reserve, these mangrove areas were protected and conserved by the strict security provided by the Americans for decades until 1992. Hence, these mangrove stands are considered old growth mangrove forest.

Baseline study on these mangrove stands conducted in 1999 showed diverse species composition, with a total of 20 species belonging to 13 genera and 11 families. Out of these species, *Avicennia officinalis*, *Rhizophora apiculata* and *Sonneratia alba* are the most widely distributed species (Woodward-Clyde 2000). The baseline information indicated that the mangrove forest in Nabasan had the poorest stand in terms of total tree basal area per ha, species diversity indices and production density due to ashfalls from Mt. Pinatubo eruption in 1991. The study

Table 3: State of mangroves in Subic Bay Freeport Zone (in hectares)

Old Stand	Secondary Growth	Plantation
61.63	no data	3.94





recommended that enrichment planting of *A. marina*, *R. apiculata* and *S. alba* should be undertaken in areas with poor stocking and extensive open spaces like in Nabasan.

A follow-up study was done in 9–21 March 2000 after the rehabilitation of the mangrove areas covered by the baseline resource inventory. The follow-up study showed that a total of 28 mangrove species and associates were present. The top five most dominant and abundant species were *A. marina*, *A. officinalis*, *Bruguiera cylindrica*, *R. apiculata*, and *S. alba*. Mangroves in Binictican had the highest species diversity followed by Triboa B and Boton. However, it is significant to note that Nabasan and Triboa A demonstrate a more equitable mangrove ecosystem in the sense that it is more stable. Wildlife takes refuge in these relatively isolated areas, which are inaccessible, uninhabited and hence less exposed to human disturbances.

The mangrove area in Boton had the highest total mean reproduction with 116,321 per ha (mostly of seedling stage), followed by Binictican and Triboa A with 73,903 and 60,559 per ha, respectively. *Avicennia marina* had the highest mean regeneration density (63,588 per ha), followed by *B. cylindrica* (48,415 per ha), *R. apiculata* (36,153 per ha), *L. racemosa* (27,633 per ha) and *Nypa fruticans* (22,408 per ha).

True mangrove species present in the area are the following: *Aegiceras corniculatum*, *Avicennia marina*, *Avicennia officinalis*, *Bruguiera cylindrica*, *Bruguiera gymnorhiza*, *Bruguiera parviflora*, *Bruguiera sexangula*, *Ceriops decandra*, *Ceriops tagal*, *Excoecaria agallocha*, *Lumnitzera littorea*, *Lumnitzera racemosa*, *Nypa fruticans*, *Rhizophora apiculata*, *Rhizophora mucronata*, *Rhizophora stylosa*, *Sonneratia alba*, *Xylocarpus granatum* and *Xylocarpus molluccensis*. The mangal-associated species in the area are the following: *Acanthus ebracteatus*, *Barringtonia asiatica*, *Barringtonia racemosa*, *Heritiera littoralis*, *Hibiscus tiliaceus*, *Intsia retusa*, *Pandanus tectorius*, *Terminalia catappa* and *Thespesia populnea*.

Degradation of Mangrove Forests

- Mangrove Conversion

In SBF, approximately 74% or 30 ha of the former Binictican area and 43% or 12.23 ha of the former Boton area have previously been converted and developed into an industrial and commercial area (Woodward-Clyde 2000). These mangrove areas are still threatened by conversion to other uses due to economic pressures. With the degradation of mangrove areas, the ability of the mangroves to prevent upstream flooding, landslide and erosion has been reduced. The residents of Olongapo City consider the conversion of mangrove areas as a major factor for the frequent flooding they experience in the city.

- Encroachment

Encroachment in mangrove areas, particularly by the Ayta communities, leads to overharvesting of resources (particularly mollusks and crustaceans), improper solid waste disposal in the area, and the trampling of mangrove sediments that affect mangrove ecosystem processes such as reproduction and nutrient cycling.

- Natural Disaster

Deposition of pyroclastic materials from the eruption of Mt. Pinatubo in 1991 led to the suffocation of mangroves and land buildup that altered the hydrobiological process of mangrove ecosystems. A survey indicated that this natural disaster created natural openings or cleared areas with an aggregate area of 3.1 ha, and also caused sporadic deaths of matured trees.

III. MANGROVE PROTECTION AND MANAGEMENT

As stated in the Implementing Rules and Regulation of RA 7227, the Subic Bay Metropolitan Authority was given two important mandates. First is to promote the economic and special development of the country and particularly Central Luzon. Second is to recognize the importance of maintaining a high degree of environmental quality as a precursor to sustainable economic development. The Ecology Center was created to take charge in managing the natural environment of the Freeport. In this regard, the SBMA commissioned consultants to develop the Subic Bay Protected Area Management Plan (SBPAMP) through a loan from JBIC.

Under SBPAMP, all mangrove areas within SBMA jurisdiction are categorized as Habitat Protection Zones defined as “areas with significant habitat and species values where management practices are required periodically to maintain specific non-climax habitat types or conditions required by rare, threatened or endangered species” (SBPAMP 2001). This zoning category has the following management prescriptions as shown in **Table 4**.

Mangrove Rehabilitation

Following the recommendation from the initial mangrove survey, the Woodward-Clyde Philippines, Inc. (WCPI) commissioned by the SBMA, conducted a one year Mangrove Reforestation Project in 2000. This project reforested 3.94 ha of open areas with *R. stylosa* species. This species was used because of the off-seasonal and meager production of the recommended propagules. Reforestation areas are located at Nabasan, Triboa, Silangin and Ilanin. Approximately 2.25 ha were used for direct planting of propagules and 1.69 ha were planted with nursery-raised





Table 4: Habitat Protection Zone Management Prescription

Permitted Activities	Prohibited Activities
<ul style="list-style-type: none"> • Scientific research and monitoring • Active habitat management • Swimming and snorkeling (human immersion) • Traditional indigenous peoples activities • Supervised scuba diving • Non-powered (engine or sail) small boats activity (dinghy, kayak, canoe, row boat) in open water zones only 	<ul style="list-style-type: none"> • All extractive activities • Water sports involving motor powered craft (speed boats, jet skis, launches) • Sports fishing • Spearfishing • Turtle eggs collecting • Harvesting of ducks and other shore birds • Mining • Dumping of wastes (garbage, sewage, etc.) • Drop anchorage

Note: Prescriptions applicable to mangroves are in bold letters

seedlings (Fig. 4). Seedling survival was recorded with 92% and 90% survival rate of direct planted propagules and nursery-raised seedlings, respectively (Woodward-Clyde 2000).

Furthermore, during the implementation of the Second Subic Bay Freeport Project under the Roads, Bridges component, the Malawaan, Boton and Binictican bridges were retrofitted affecting 8,811 mangrove trees within 0.33 ha of the forested area. Nevertheless, the SBMA through the Ecology Center facilitated the replanting of 1.33 ha with a total of 26,000 propagules of *R. stylosa* species.

Currently, the Ecology Center encourages Subic Bay Freeport stakeholders to participate in mangrove conservation activities including mangrove seed collection and planting, monitoring, awareness campaign, cleanup drives, and research and development. At the same time, the Center continually surveys the mangrove forests to identify cleared areas needing reforestation and rehabilitation.

Monitoring and Evaluation

The Ecology Center, through the Protected Area Division, conducts regular monitoring of mangrove areas within the SBMA jurisdiction. The monitoring activity is conducted at least annually and at most quarterly to assess the mangrove area cover, identify areas for rehabilitation, describe habitat boundaries, ensure that the area is protected from encroachment and illegal collection of wildlife and mangrove resources, and ensure prompt abatement of environmental degradation of economically, aesthetically and ecologically important coastal resources. Currently, the Ecology Center is establishing permanent transects and monitoring plots for long term ecological assessment.

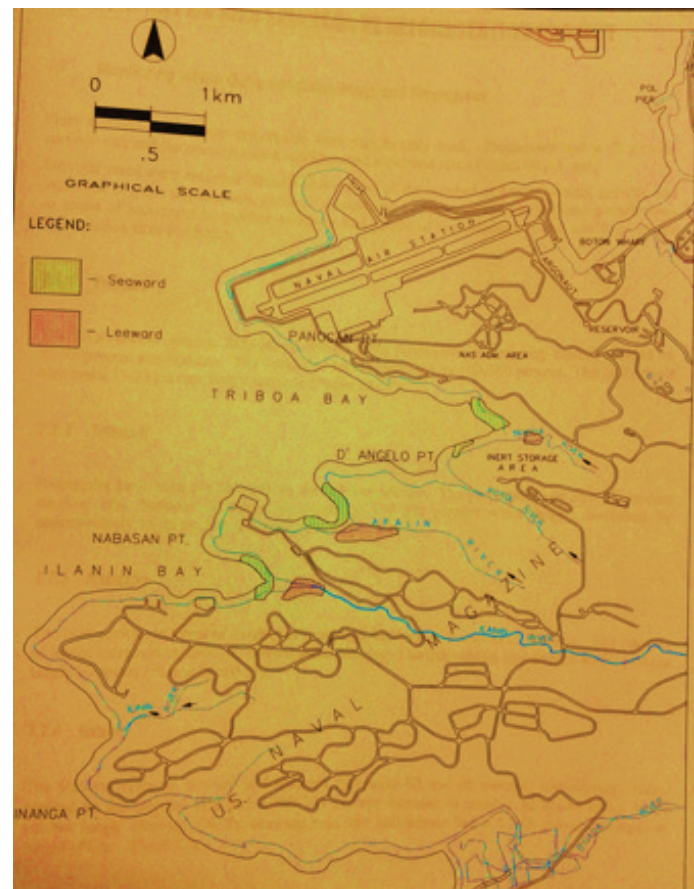


Figure 4: Areas reforested with *Rhizophora stylosa* species

A special monitoring team was created to conduct a more scientific monitoring and evaluation of mangroves. This monitoring team is composed of members from the Forest Ranger Branch and Harbor Patrol Branch of the Law Enforcement Department, Monitoring Support Group from the Pastolan community, and environmental specialists from the Ecology Center. Members of the team





Figure 5: SBMA Biodiversity Monitoring Team in action: (A) training and capability building, (B) laying of quadrat plots for epifaunal survey, and (C-D) actual monitoring of mangrove areas.

undergo capability building processes and receive trainings on mangrove identification, monitoring protocols and other skills/knowledge related to environmental management. At the end of each year, the team aims to collate all the data gathered, publish the results for public awareness and submit a report to the SBMA management to provide bases for crafting mangrove policies and management actions (Fig. 5).

IV. SUMMARY AND RECOMMENDATIONS

The 60 ha of mangrove areas in Subic Bay Freeport remain intact. Because of the strict enforcement of SBMA environmental rules and regulation, the mangrove forest ecosystem services have been enhanced. Preservation of these resources provides benefits not only to the present stakeholders but, more importantly, also to the future generations. The SBMA's mandate to protect and conserve the environment is geared towards sustainable development of the Subic Bay Freeport Zone. These can

only be achieved by addressing the present threats to mangroves (and pre-empting those already foreseen) by conducting massive IEC utilizing all possible channels of information dissemination such as internet media, radio, posters and flyers, newspaper ads, forums and workshops.

We recommend strict enforcement of environmental laws and increasing harbor patrol and forest ranger presence in the area to discourage encroachers and poachers. Obsolete guidelines should be updated or amended, and new polices for mangrove management should also be developed.

The Ecology Center aims to conduct monitoring programs that are more detailed and include the status of mangrove planted, survival and growth rates and other ecologically important parameters. In line with this, we intend to attract more researchers to focus their study on the mangroves of the Subic Bay Freeport by strengthening our network and collaboration with academic and research institutions.





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