

**COMMUNITY STRUCTURE OF MOLLUSKS IN THE MANGROVE
REFORESTATION, AQUASILVICULTURE, AND ECO-TOURISM
PROJECT IN KAPISPISAN, NEW WASHINGTON, AKLAN**

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SCIENCE RESEARCH I

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APPROVAL SHEET

This research proposal hereto entitled:

“Community Structure of mollusks in the Interated Mangrove Reforestation, Aquasilviculture and Eco-Tourism Project in Kapispisan, New Washington, Aklan”

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CHAPTER I

INTRODUCTION

A. Background of the Study

Mangrove swamps are among the dominant intertidal habitats of many tropical marine areas (Semeniuk, Keneally & Wilson, 1978, in Wells 1980). A dominant group of organisms that inhabit mangrove swamps are mollusks. Mollusks are invertebrates that belong to the phylum mollusca, typically having calcareous shell of one, two or more pieces that wholly or partly enclose the soft unsegmented body, including chitons, snails, bivalves, squids, octopuses, etc. (Webster's Encyclopedic Unabridged Dictionary of the English Language.)

There are so many mangrove swamps in the Philippines. One of these mangrove swamps is situated in Kapispisan, New Washington, Aklan. The mangrove swamp in Kapispisan, New Washington, Aklan, houses a variety of species of mollusks. The said mangrove swamp is situated near the Lagatik River. Because of its location, many people living near the area take advantage of the abundance of mollusks in the area. Some fishermen even sell them in the nearby market of New Washington. The fishermen are not the only ones who benefit from the mollusks but also the migratory birds which flock in the mangrove swamp and feed on mollusks.

The government saw the need to put the resources in cultivation. Thus they tied up with the Aklan State University Fisheries Department, to make a project that would help develop the area into more profitable resources. The researchers aim to help educate

the people about the community structure of mollusks in the area. By doing this the researchers believe that the area will be developed, and protected from destruction.

B. Objectives of the Study

This study will be conducted with the following objectives:

1. To describe and compare the community structure of mollusks in the three stations of the mangrove forest in Kapispisan, New Washington, Aklan, in terms of:
 - a.) species diversity
 - b.) density
 - c.) relative abundance
 - d.) biomass
 - e.) species composition
2. To describe the physico-chemical properties of the mangrove forest in Kapispisan, New Washington, Aklan, in terms of:
 - a.) soil temperature
 - b.) soil pH
 - c.) soil salinity

C. Significance of the Study

The researchers have found out that little is known about the community structure of mollusks in the mangrove forest in Kapispisan, New Washington, Aklan. This study will establish new knowledge about the community structure of mollusks in

the mangrove forest Kapispisan, New Washington, Aklan that will also help future studies about mollusks. This study will further educate the locals living near the mangrove forest in Kapispisan, New Washington, Aklan about the importance of the existence of mollusks and its role in the lives of the locals. Because of the rampant destruction of mangrove forests in the country the researchers will use this research as a tool to educate the importance of the mangrove forests and its role in preserving the wildlife.

D. Scope and Limitation of the study

This study is going to be conducted in the mangrove forest Kapispisan, New Washington, Aklan. The study site is near the river Lagatik and is surrounded by marshes. The study will be limited on the community structure of mollusks in terms of species composition, species diversity, relative abundance, relative frequency, population density and biomass in the mangrove forest in Kapispisan, New Washington, Aklan. This study will start at the month of April and will end at the month of December.

E. Definition of Terms

Biomass- that part of a given habitat consisting of living matter, expressed either as the fresh weight of organisms per unit area or as the volume of organisms per unit volume of habitat (Webster's Encyclopedic Unabridged Dictionary of the English Language)

Estuary - water passage where the tide meets a river current; *especially* : an arm of the sea at the lower end of a river (The American Heritage® Dictionary of the English Language: Fourth Edition. 2000.)

Intertidal - the region between the high tide mark and the low tide mark (The American Heritage® Dictionary of the English Language: Fourth Edition. 2000.)

Mollusk- any invertebrate of the Phylum Mollusca, typically having calcareous shell of one, two or more pieces that wholly or partly enclose the soft unsegmented body, including the chitons, snails, bivalves, squids, octopuses, etc (Webster's Encyclopedic Unabridged Dictionary of the English Language).

Mangrove- any of tropical evergreen trees or shrubs having stilt-like roots and stems and forming dense thickets along tidal shores (American Heritage Dictionary, 3rd Edition)

Propagule - a structure (as a cutting, a seed, or a spore) that propagates a plant (Merriam-Webster Dictionary)

Quadrat - a usually rectangular plot used for ecological or population studies (Merriam-Webster Dictionary)

Relative Abundance- system in large amounts or by numbers of a group of individuals of the same species occupying a given area at the same time (Miller, 1997)

Sampling Site- synonymous to place, location, station and locality (Webster's Thesaurus, 1993)

Species Composition- the general structural arrangement of style of particular species (Webster's Comprehensive Dictionary Encyclopedia Edition)

Species Diversity- number of different species and their relative abundance in a given area (Solomon, Breg, Martin & Vele, 1993)

Soil Salinity- the concentration of salt dissolved in water found in the soil (Webster's Comprehensive Dictionary Encyclopedia Edition).

CHAPTER II

REVIEW OF RELATED LITERATURE

A. Mangroves

Mangrove swamps are among the dominant intertidal habitats of many tropical marine areas. The trees form dense swamps in the mid to upper tide levels of protected bays and estuaries. Mollusks of mangrove areas were originally thought to be unique to the swamps, but more recent studies have shown that there are few species which live only in mangroves; most also occur on adjacent muddy or rocky shores (Coomans, 1969).

Mangroves are tropical trees and shrubs that grow in intertidal areas. They can also refer to the forest communities with their associated microorganisms (bacteria, fungi, algae) and fauna (mollusks, crabs, shrimps and fish). Rates of mangrove in the Philippines have been high, from 450,000 hectares in 1918 to only 120,500 hectares in 1994 (Southeast Asian Fisheries Development Center, 2000).

Mangroves are saltwater forests that grow on coastal mud flats in low latitude areas around the globe. They form a unique ecosystem in an environment that is in constant flux. In order to deal with salinities and water levels that can change on a daily basis, the variety of plants collectively known as mangroves has evolved many features that allow them to not only cope with this environment, but to thrive. Actually, the term mangrove describes a type of environment as well as the plants that thrive there. There are actually 54 species of trees that are classified as mangroves spread out across 20 genera and 16 families. Evolutionary convergence has resulted in many species of these

plants finding similar solutions to the problems of variable salinity, tidal ranges, and intense sunlight that come from living in the tropics (www.jhu.edu).

B. Importance of Mangroves

Listed are the reasons why mangroves are important to aquaculture: Protect perimeter dikes of fishponds and shrimp farms from strong wind and wave action; Act as natural biological filter by absorbing excess nutrients from pond discharges; Condition water for shrimp farms and fishponds; Act as nursery grounds for various species (Yap W.G., 2002).

C. Reproduction of Mangroves

Mangroves reproduce through the production of a propagule. Once a plant is pollinated, it will produce a propagule, which is neither a seed nor a fruit. A propagule grows on a parent plant, and although it can photosynthesize on its own, it requires water and carbon dioxide from its parent. Eventually it drops off the parent tree and falls into the water, where it can then be transported great distances. Propagules can survive desiccation and remain quiescent for weeks, months, or even over a year until they arrive in a suitable environment. Once a propagule is ready to root, it will change its density so that the elongated shape now floats vertically rather than horizontally. In this position, it is more likely to become lodged in the mud and root. If a propagule doesn't root, it can alter its density so that it floats off again in search of more favorable conditions (www.jhu.edu).

D. Mollusks

Marine animals appear and live so differently from those in muddy shores due to the vast, hard surface area of root in the mangrove. They either inhabit the hard substrate of numerous stilt root of mangrove or occupy the mud. The most dominant of them are the mollusks, crustaceans and fishes (Kit W.Y. 1999).

Mollusks (Phylum Mollusca) are found in marine, brackish, and fresh waters. They include a diverse group of animals such as clams, oysters, scallops, abalone, conchs, shipworms, snails, nudibranchs, chitons, squid and octopuses (www.nas.er.usgs.gov.1988).

Life spans of mollusks range from two months to two hundred years. A short life span is correlated with lack of an external shell, or possession of an external shell that is semitransparent. The ubiquity of the correlation favors a non-adaptive explanation: shell and longevity covary, so that initial, adaptive changes in the shell engender a secondary, automatic change in the life span (Heller J.1983).

Freshwater mussels belong to the mollusks order Unionoida. Freshwater mussels are large bivalved creatures possessing a hinge which is most developed posterior of the beaks or umbos. The shells are typically covered by a thick skin or periostracum that is variously colored. Internally, the shell has a pearly appearance due to the nacreous lining of the inner shell surfaces (Smith D.1979).

E. Habitats of Mollusks

Mollusks can only survive in certain depth habitats, while others may move freely. There are 4 major habitat classification by depth: Freshwater, Terrestrial, Pelagic, Littorial.

Freshwater – (non-salt water bodies) Freshwater includes rivers, and lakes and just about any other body of water that does not include salt water.

Terrestrial – (land based) Terrestrial creatures are found in backyards. Many live in trees, some live in the ground or in stone walls or cliffs.

Pelagic – (near the surface of the ocean) About 100 species live in the pelagic areas. Some float, some are attached to weed, while still others hover in mid-water.

Littorial – Includes millions of miles of inter-tidal shoreline and shallow water depths. Littorial habitat extends down as far as algae can survive.

Deep-sea mollusks have four types of feeding habitats: scavenging, deposit-feeding, predation and parasitism. The number of species of scavengers, (mollusks feeding on carcasses of larger organisms such as fish bones), and of deposit-feeders, (feeding on the "snow" of particles falling from the water layers above to be deposited on the sea bottom), are higher at greater depths when compared to shallow water (Leal, J.H. 1987).

F. Classes of Mollusks

1. Chitons (Class: Polyplacophora)

Chitons have a dorsal shell composed of 8 plates. A ventral foot is used for locomotion and for attachment to rocks. It pulls itself close to rocks for protection. Chitons are marine animals. They use a radula to scrape algae for food.

2. Snails and relatives (Class: Gastropoda)

Gastropods have an elongated, flattened foot and usually a head and shell although nudibranchs (sea slugs) and terrestrial slugs lack a shell. Herbivorous gastropods use a radula to scrape food from surfaces. Carnivores may use a radula to bore a hole through surfaces such as bivalve (clam) shells. Some gastropods such as the slug do not have a shell. The larvae undergo torsion, a twisting that positions the visceral mass so that the anus is above the head. It is due to one side of the visceral mass growing faster than the other. The advantage (or function) of torsion is uncertain but it may be to balance the animal or it may be to allow the head to be withdrawn into the shell first when predators approach.

3. Clams and relatives (Class: Bivalvia)

Bivalves have two shells (valves) held closed by powerful muscles. The shell is produced by the underlying mantle; it grows along the outer margins. They use their foot for burrowing. Mussels use their foot for the production of threads for attachment. The gills are large because they are used for filter-feeding as well as respiration. Food is trapped by mucus on the gills and moved by cilia. Water enters and exits through siphons. Bivalves do not have a brain but have 3 pairs of ganglia.

4. Squid, Octopus, Nautilus, and Relatives (Class: Cephalopoda)

Cephalopods are predators and live in a marine environment. A closed circulatory system allows them to move rapidly in pursuit of prey. They move by jet propulsion; water in the mantle cavity is squirted rapidly through a siphon. The foot has evolved into tentacles around head. Cephalopods have a powerful parrotlike beak to tear apart prey. The sense organs of cephalopods are well developed. Mollusks are the simplest animals with eyes. Some mollusks have *lenses* and therefore are capable of forming clear images. Cephalopods are fast-moving predators and need to catch prey. The camera-type eyes of some cephalopods (squid, octopus) are capable of focusing and forming clear images. Well-developed brains (especially in octopuses) give them a high learning capacity. Ink sacs function for protection by releasing a dark-colored fluid that enables the animal to hide (www.faculty.clintoncc.suny.edu).

G. Some Mollusks found in Asia

1. Imbao(*Anodontia edentulla*), a mangrove clam that harbors sulfur-oxidizing symbiotic bacteria in the gills, making it a potential sediment cleaner (Southeast Asian Fisheries Development Center, 1999).

2. Asian clam(*Corbicula fluminea*)

Kingdom: Animalia Division/Phylum: Mollusca Class: Bivalvia

The Asian clam has a small, yellow-brown to black shell with concentric, regularly spaced ridges. Its shell is rounded to triangular. The inside of the shell is white or purple. The Asian clam may grow to 1 1/2 inches long.

The Asian clam lives in the silt, mud, sand, or gravel bottom of lakes and streams. It has a free-swimming larva. It filters small organisms from the water for its food. The Asian clam is exotic to Iowa. It was introduced into western North America in the 1920s and 1930s and has spread throughout much of the United States. Its habitats are: Mississippi River, Missouri River, interior rivers and streams; constructed lakes, ponds, and reservoirs (Iowa Department of Natural Resources. 2001).

H. Behaviour of Mollusks

Cephalopods such as squid have eyes with lenses, retinas, and other features remarkably like those of vertebrates. Some gastropods have a well-developed sense of smell and can locate food in the water at a considerable distance. Predators may similarly be detected by the chemical senses and are sometimes evaded by leaping or swimming. Some mollusks exhibit complicated courtship behavior. Advanced cephalopods possess considerable ability to learn from experience.(www.encarta.msn.com).

CHAPTER III

METHODOLOGY

A. Materials and Equipments

72 one - meter bamboo pegs

500 - g weighing scale

plastic bags

pH paper

clean empty bottles

laboratory thermometer

disposable syringe

push – pull rule

refractometer

nylon string/straw lace (rope)

B. Description of Study Site

The Integrated Mangrove Reforestation, Aquasilviculture and Eco-Tourism Project in Kapisipan, New Washington, Aklan is one of the few remaining estuaries in the province of Aklan. It is an artificial mangrove and is a collaborative property of Aklan State University-School of Fisheries and Marine Sciences and the Local Government Unit. It is a 20-minute boat ride from the main coast. The study site is near the Lagatik River and is surrounded by marshes. The place houses only a few residents.

Mollusks can be seen on wet ground and some clinging on plants. The mangrove provides habitat for recreationally and commercially important fishes, mollusks, and other living organisms.



Sketch of the project site showing the location of the various existing and proposed projects.

MUNICIPALITY
OF
NEW WASHINGTON
PROVINCE OF AKLAN
REGION VI

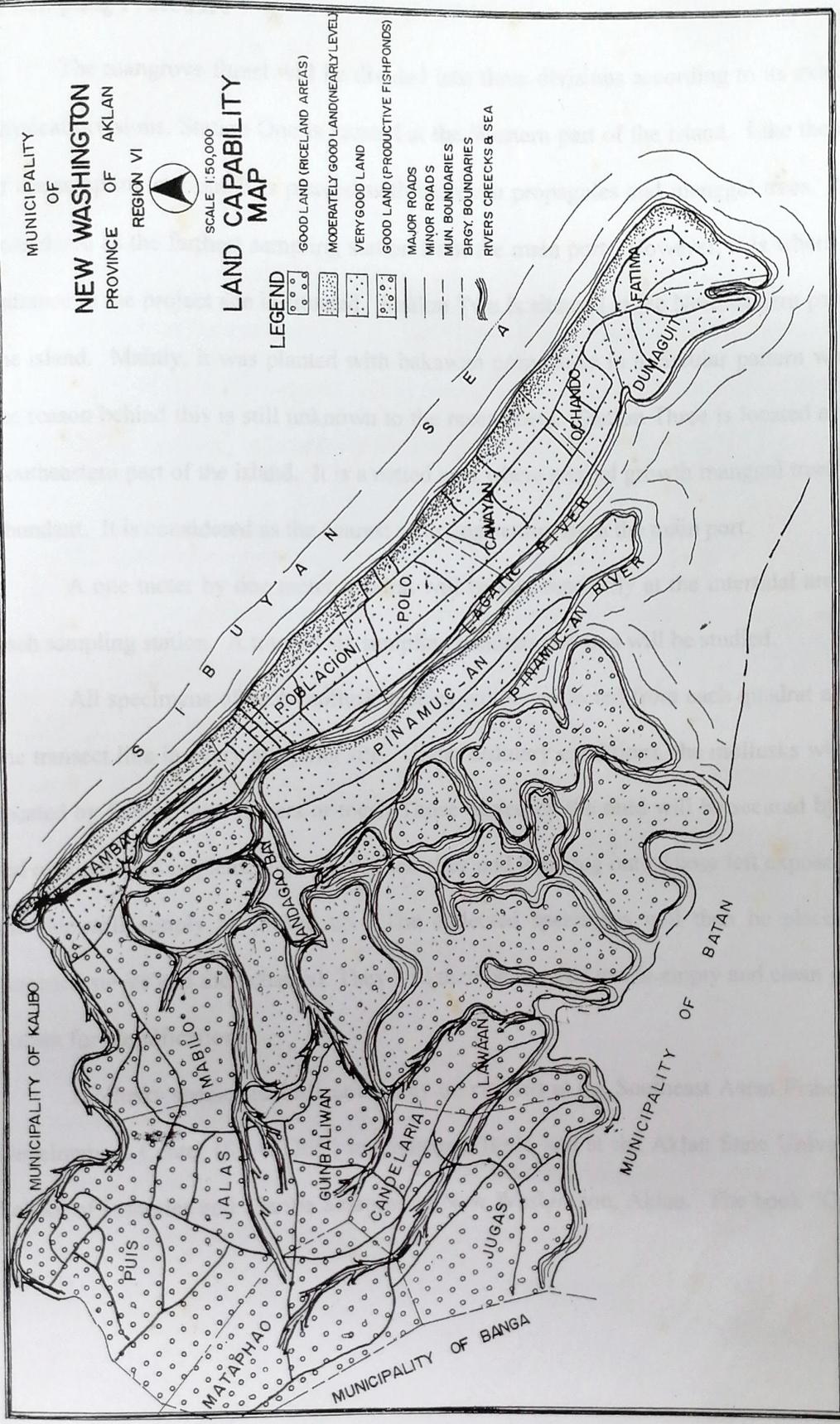


SCALE 1:50,000

**LAND CAPABILITY
MAP**

LEGEND

- GOOD LAND (RICELAND AREAS)
- MODERATELY GOOD LAND (NEARLY LEVEL)
- VERY GOOD LAND
- GOOD LAND (PRODUCTIVE FISHPONDS)
- MAJOR ROADS
- MINOR ROADS
- MUN. BOUNDARIES
- BRGY. BOUNDARIES
- RIVERS, CREEKS & SEA



C. Sampling Procedure

The mangrove forest will be divided into three divisions according to its existing physical divisions. Station One is located at the Western part of the island. Like the rest of the sampling stations it is planted with bakawan propagules and manggal trees. It is considered as the farthest sampling station from the main port. However, it is where the entrance to the project site is situated. Station Two is situated at the Northeastern part of the island. Mainly, it was planted with bakawan propagules in a circular pattern which the reason behind this is still unknown to the researchers. Station Three is located at the Southeastern part of the island. It is a netted area where second growth manggal trees are abundant. It is considered as the nearest sampling station from the main port.

A one meter by one meter quadrat will be laid randomly at the intertidal area of each sampling station. A total of six sampling quadrats per area will be studied.

All specimens of each mollusk species will be collected from each quadrat along the transect line in every sampling site. Under ordinary conditions, the mollusks will be located by feeling with fingers or toes. Those buried by the mud will be secured by the aid of some hard implement like a wooden stick and then dug out. Those left exposed by the tide will simply be picked up. The collected specimens will then be placed in screened sieves and then cleaned. They will then be secured inside empty and clean glass bottles for identification.

Mollusks species identification may be verified at the Southeast Asian Fisheries Development Center (SEAFDEC) in Tigbauan, Iloilo and at the Aklan State University School of Fisheries and Marine Sciences in New Washington, Aklan. The book "Guide

to Philippine Flora and Fauna, Volume Six" by Rolando Garcia 1986 will be used to help in the taxonomy of the mollusk species.

D. Community Structure Analysis

D.1 Species Composition

Species composition will be determined by identifying the mollusk species comprising the mollusk community in the mangrove site.

D.2 Species Diversity

The species diversity will be calculated by using Simpson's Index formula:

$$D = N(N-1) / (n_1(n_1 - 1))$$

Where:

D is the diversity index

N is the total number of individuals of all species

n_1 is the number of individuals of the i th species

D.3 Relative Abundance

The relative abundance will be calculated by using the formula:

$$\text{Relative abundance} = \frac{\text{No. of a particular species}}{\text{Total no. of organisms}} \times 100$$

D.4 Relative Frequency

The relative frequency will be determined by finding the probability the species in any one plot can be compared between plots of equal sizes. The relative frequency will be calculated using the formula:

$$\text{Relative frequency} = \frac{\text{Frequency of a species}}{\sum \text{Frequency of all species}} \times 100$$

D.5 Population Density

The population density will be determined by accounting for the concentration of each species per quadrat by counting the number of individuals per quadrat. The population density will be calculated using the formula:

$$\text{Population density} = \frac{\text{Total no. of organisms}}{1 \text{ m}^2}$$

D.6 Biomass

The mean wet weight of representative sample per species will be measured using a 500 – g weighing scale.

$$\text{Biomass} = \text{mean weight} \times \text{density}$$

E. Physico-Chemical Parameters

E.1 Soil Temperature

Soil temperature will be obtained by using a laboratory thermometer and inserting it into the soil to a depth of 10 cm below the soil surface. Three trials for soil temperature will be done for each quadrat.

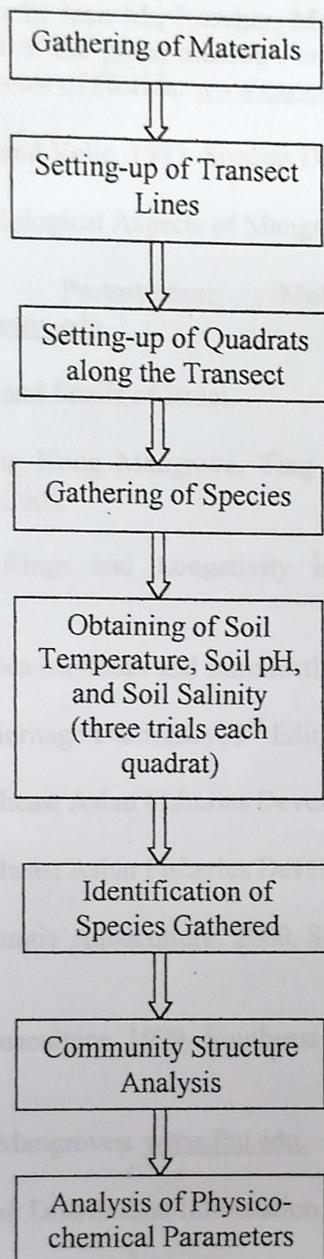
E.2 Soil Salinity

Soil salinity will be obtained by using a Refractometer. Soil samples will be obtained from the soil surface and will be placed in a 20-milliliter disposable syringe. The water from the soil samples will then be squeezed out and tested. Three trials for the soil salinity will be done for each quadrat.

E.3 Soil pH

Soil pH will be obtained by using a pH paper. Soil samples will be obtained from the soil surface and will be placed in a 20-milliliter disposable syringe. The water from the soil samples will then be squeezed out and tested. Three trials for soil pH will be done for each quadrat.

FLOWCHART



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Table 2. Community structure of mollusks in the Mangrove Rehabilitation, Aquaculture and Eco-tourism Project in Kapingtan, New Washington, Aklan. Values are derived from six quadrats per station.

Parameters	Station 1	Station 2	Station 3
Species Diversity (no.)			
Relative Abundance (percent)			
Relative Frequency (percent)			
Density (no/m ²)			
Biomass (weight/m ²)			

Table 3. Physico-chemical conditions of the sampling site in the Mangrove Rehabilitation, Aquaculture and Eco-tourism Project in Kapingtan, New Washington, Aklan. Values are mean standard deviation of 10 determinations per station.

Parameters	Station 1	Station 2	Station 3	Mean Standard Deviation (range)
Soil temperature (°C)				
Soil salinity (ppt)				
Soil pH (unit)				

C. Budget

APPENDIX

A. Tables

Table 1. Species composition of mollusks in the Mangrove Reforestation, Aquasilviculture and Eco-tourism Project in Kapispisan, New Washington, Aklan

Station 1	Station 2	Station 3

Table 2. Community structure of mollusks in the Mangrove Reforestation, Aquasilviculture and Eco-tourism Project in Kapispisan, New Washington, Aklan. Values are derived from six quadrats per station.

Parameters	Station 1	Station 2	Station 3
Species Diversity (no.)			
Relative Abundance (percent)			
Relative Frequency (percent)			
Density (no/m ²)			
Biomass(weight/m ²)			

Table 3. Physico-chemical conditions of the sampling site in the Mangrove Reforestation, Aquasilviculture and Eco-tourism Project in Kapispisan, New Washington, Aklan. Values are mean standard deviation of 18 determinations per station.

Parameters	Station 1	Station 2	Station 3	Mean Standard Deviation (range)
Soil temperature (°C)				
Soil salinity (ppt)				
Soil pH (units)				

C. Budget

1.) Materials

QTY.	UNIT	DESCRIPTION	UNIT PRICE	TOTAL COST
72	Pieces	One-meter bamboo pegs	P 1.00	P 72.00
72	Meter	Straw lace	P 30.00 per roll	P 60.00
3	Pieces	Disposable syringe	P 25.00	P 75.00
18	Pieces	Clean empty bottles	P 30.00	P 540.00
1	Piece	Push-pull rule	P 180.00	P 180.00
12	Pieces	Plastic bags	P 1.00	P 12.00

TOTAL MATERIAL COST: P 939.00

2.) Transportation

FROM	TO	NO. OF PERSONS	FARE	NO. OF TIMES	TOTAL COST
Kalibo	New Washington	2	P 10.00	25	P 250.00
New Washington Port	Kapispisan	3	P 50.00 per trip	25	P 1250.00
Kapispisan	New Washington Port	3	P 50.00 per trip	25	P 1250.00
New Washington	Kalibo	2	P 10.00	25	P 250.00

TOTAL FARE: P 3000.00

3.) Documentation

Printing (drafts and final paper)

- Printer Ink P600.00

- One Ream of Short Bond Paper P250.00

Photocopying (final paper) P 300.00

Binding (three bound copies)	P750.00
Pictures	
- Film	P 196.00
- developing	P 250.00
CD (final paper may include video footages)	P 200.00

TOTAL COST: P 2546.00

4.) OTHERS

Miscellaneous ----- P 5000.00

GENERAL TOTAL COST: P 11485.00

CONTINGENCY FUND

General Total Cost
x 20%
Contingency Fund

P 11485.00
x 20%
P 2297.00