

# MICRONESIA AND AMERICAN SAMOA STUDENT INTERNSHIP PROGRAM

## MASSIP

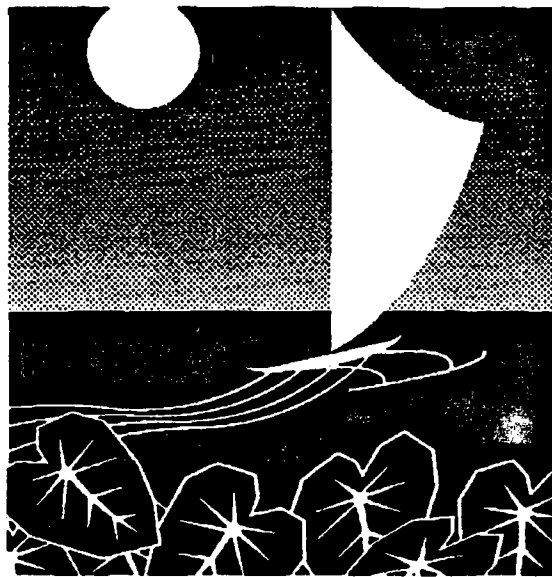


compiled by

**PACIFIC ISLAND NETWORK**  
**University of Hawai'i Sea Grant Extension Service**  
**School of Ocean and Earth Science and Technology**

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**University of Hawai'i Sea Grant Extension Service**  
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in partnership with

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**Coastal Management Program/Economic Development and Planning Office, American Samoa**

**Department of Marine and Wildlife Resources, American Samoa**

**Coral Reef Research Foundation, Palau**

**Yap Institute of Natural Science, Yap State, FSM**

**Institute of Pacific Islands Forestry, Hawaii**

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**The Nature Conservancy-Pohnpei Field Office, Pohnpei State, FSM**

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**Kosrae State Department of Forestry, Kosrae State, FSM**

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# **MANGROVE RESEARCH PROJECT**

by

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**Project Sponsors**

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**Kosrae, FSM**

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## **Introduction**

In my directed study course, I'm going to write about my internship program. In the past summer, I had an opportunity to go back to home island (Kosrae, Micronesia) and work as an intern student. I was selected to an internship program by MASSIP (Micronesian & American Samoa Student Internship Program) as one of the 10 members of their second year internship program. I was working in a mangrove project for the Division of Forestry of the Department Kosrae State Agriculture and Land. The project was funded and coordinated by IPIF (Institute of Pacific Island Forestry) which is located in Honolulu. I worked for eight weeks, eight hours a day and under supervision of John Bourgeois. I was paid for \$500 stipend with a roundtrip airline ticket.

The purpose of the project is to study the relationship between environmental characteristics and species distribution in Micronesian mangrove swamps. Our goal is to increase our knowledge to better protect, manage, and restore mangrove, and also be able to predict how natural and manmade changes will effect mangroves in the future. The project was executed by and participated with a very fine team. We had Dr. Katherine C. Ewel, researcher ecologist for IPIF who is responsible for the preparation of the study plan. John Bourgeois, an American ecologist temporarily hired by IPIF and in charge of fieldwork and collecting data; Eric Waguk, Kosrae State Forester; Zheng Songfa, a scientist from China; Zuleika Pinzon, a Panamanian and a graduate student at the University of Florida, and of course me.

## **Mangrove Project**

In the project, there were four different mangrove sites chosen to be the study area. At each site, there is a river. There are also three types of plots at each site.

There is a riverine plot which is closest to the channel, interior plot which is closest to the upland, and fringing plot which is closest to the ocean. In each plot, there are five points located and that's where we do our fieldwork and data collecting. Our day-to-day operations were mostly measuring the vegetation and recording the environmental conditions at each points of the study plot.

At every point, we selected trees to be measured by using a prism. We identified the species name, measured the diameter at breast height (dbh), bark thickness, height, volume, and counted the main branches of each tree. We also marked each tree by nailing a tag number to each tree and recording the azma direction and distance from a tree to the center point of the plot. That way when tree growth rates are remeasured after five years, it will be known what trees to work on. Tree growth rate will be based on remeasurement in the next five years.

We collected data about the soil, water, light, temperature, and examined the condition of gap formation in the mangroves. The gaps were assigned to Mr. Zeng and Mrs. Pinzon as their project. In all points and gaps in the plots, we set up two subplots (1-m<sup>2</sup>) and placed platinum electrodes for determination of redox potential. The subplot is randomly located from zero to five feet and zero to 360 degrees from the center of the point. After we allowed the electrodes to equilibrate for 30 minutes, we clipped a portable volt meter to the electrodes and took the reading. We recorded the pH and the temperature and counted the crab burrows in the subplot. At the same time, we recorded how much sunlight in each subplot, gap, and points by using a

densimeter and measured the salinity by using a refractometer. We also noted species of seedlings and seeds in the plots.

The other component done in the project was seedling transplant. At one of the study regions, we used the species *Bruguiera gymnorhiza* seedlings to recognize which type of sites (fringe, interior, riverine) were best suited to growth. The seedlings collected from fringing area were transplanted to the three types of sites.

Seedlings from the interior and riverine were treated the same. Data will be recorded quarterly on growth rate; survival will indicate whether seedlings from any one kind of an environment have an advantage over others.

My role is to assist my fellow workers in the project. In addition to helping my fellow employees, I was assigned by Dr. Ewel to examine the mangrove forest changes over time. My project was designed to observe and collect information based on these questions:

1. What propagules/seeds are available in each of the three kinds of mangrove swamps?
2. What are the predators in the propagules?
3. How important is seed predation in effecting the growth of these propagules?
4. Do seedlings of different species grow in shady or open areas?
5. Are all these seedlings likely to survive?

In previous study of Kosrae mangroves, there were seven species of mangrove trees found on the island. According to my survey, I was able to find only five species of seeds in the study plots. I noticed that among these species, *Bruguiera gymnorhiza* and *Rhizophora apiculata* are common and easily found in three types of mangroves. The other three species found but not very common are *Rhizophora mucronata*, *Sonneratia alba*, and *Nypa fruticans*. The only area I located *R. mucronata* was at the fringing plot as well as *S. alba*, and I also found some in the interior and riverine plots. The *N. fruticans* were located only in the interior and riverine plots. The other two seed species I was not able to find in the study plots are *Lumnitzera littorea* and *Xylocarpus granatum*. These species still exist and may be they happen not to be in the study area or I would say that these two species have smaller numbers of trees growing than the other species. I found seeds in the riverine and interior areas more easily than in the fringing area.

At every point, I randomly picked 10 propagules/seeds, identified and collected the ones that show evidence of predation. I cut them open and was able to find ants, isopods, worms (*oligochoetes*), and beetles (*Scolytidae*) inside the propagules.

On some occasions, I found snail (*Gastropod*) on the propagule. I realized that the scolytidae beetles appear on almost every propagules of *B. gymnorhiza* I collected. Scylotidae beetles in the *R. apiculata* were on less than 10 percent of the propagules examined. The other three seeds species I observed did not show any indication of predation. The scylotidae beetles bore holes in the propagules and laid its eggs there. When the eggs turn into larvae, they live in the propagules and make tunnels inside. When these beetles damage inside, the propagule dies. The other predators that do damage is the small crabs in the mangroves that consume propagules. Again, I discovered only on *Rhizophora apiculata* and *Bruguiera gymnorhiza*.

Seed predations were shown on most the propagules of *Bruguiera gymnorhiza* and *Rhizophora apiculata*. Again, I observed a great number of *B. gymnorhiza* (approximately more

than 90 percent) of seedlings. The seedlings showed predation of scolytidae beetle but did not effect the growth. In the long run, I'm not sure if the seedlings with predation will survive or die. The seedlings seem to grow well in the open areas where they get sunlight. I noticed that seedlings in the shady area have more leaves and nodes but are short in height.

Data collected will be analyzed by Dr. Ewel at the IPIF office in Honolulu. Kosrae State Division of Forestry will share the results of the project and use it to manage and restore their mangrove forest.

As a general agriculture major, the internship was very helpful. It was a good hands-on working experience for me. I learned much from it and it really encouraged me to continue my education after a pretty rough semester. It also gave me an opportunity to get to know and meet the head dudes of the Department of Agriculture. Hopefully when I finish school, I'll go back home and work with them.



# **SURVEY OF SEA GRASS BEDS**

**by**

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**Palau**

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This summer I had the opportunity to return to Palau and work as an intern with the Coral Reef Research Foundation. Before I proceed further, I would like to briefly explain the purpose of the Coral Reef Research Foundation (CRRF), as well as several other aspects related to the foundations operations.

CRRF is homebased in Chuuk, FSM. Patrick Collins, the president of CRRF, and his wife Lori, reside and oversee CRRF operations in Chuuk. In January of next year, the headquarters of the CRRF will be moved to Palau. Pat Collins and Charlie Arneson (vice-president of CRRF) were in Palau during the last week of my internship securing a lease for land and taking bids for the construction of a fully equipped laboratory.

Right now the Coral Reef Research Foundation is under contract to the National Cancer Institute. Under the agreement of the contract, CRRF collects marine invertebrate samples and sends them to the National Cancer Institute (NCI). At NCI, the samples are tested against the AIDS virus and cancer agents to see if they could be used as a cure or as a prevention agent.

When collecting samples there are several procedures instituted by the NCI which the CRRF must follow. First of all, in order for collected items to be considered full samples several steps have to be followed. First, a set of pictures must be taken of the sample within its natural environment. Next, one kilogram of the sample has to be procured. Finally, two vouchers of the sample must be made. One is to be kept by the CRRF as a reference, and the other voucher is to be sent to a taxonomist at a British museum. The bulk of the sample is frozen and preserved until it is ready to be sent to the NCI in Washington, D.C.

Another requirement by the NCI is that 1,000 samples must be collected each year. From what I have seen, this can be accomplished very easily for several years. All samples are preserved frozen and are all sent at one time to NCI, usually in September.

CRRF is not limited to the task set down by the NCI, even though the bulk of CRRF funding comes from NCI. CRRF also has other tasks. One task is to help visiting scientists and guests with research work or other related projects.

My supervisor in Palau was Larry Sharon. Larry is the field supervisor of the Palau CRRF station. Along with Larry, the CRRF has two other employees. They are Matthew Mesubed and Emilio Basilius. Larry, Matt, and Emilio were very helpful during my internship. They were interested in my project, and helped me whenever they could. They were also very helpful in teaching me the everyday operation procedures. They were so friendly that I started work two days after I arrived in Palau.

My first four weeks at work were very exciting. I got to work with many different people. During my first two days we got to work with the Cousteau film crew. They wanted to film some marine lakes, so we took them. After we finished working with the Cousteau film crew, we got to work with Al Giddings. Matt, Emilio, and I didn't get to be in the film, only Larry did (lucky him). Even though, I didn't get to be in the film it was great fun working with Al Giddings. We collected marine animals for Al Giddings to film. We also took him to a marine lake (Gobi Lake) so he could film. The experience was great but hiking up the Rock Island with scuba tanks and gear, not to mention two 80 lb. cameras, was an experience I would sooner forget. We also took him to an underwater cave. I didn't go in with them because I have a mild case of claustrophobia.

During the third week of my internship we had some visitors from the Scripps Institute. Dr. Faulkner and a couple of his students came to Palau to collect sponges. They would be in Palau

for two weeks. So for the next two weeks we took the Scripps people to different sites to collect sponges. We went everywhere; we went to marine lakes, seagrass beds, and reefs. Dr. Faulkner specializes in marine animal and plant chemistry. He and his students collected these sponges for experiments concerning protein synthesis. This was fun work and also very educational. I learned about different species of sponges and their general chemistry. I was also able to talk to Dr. Faulkner about some chemical properties of seagrass. I asked him whether seagrass had any herbivoric defense systems, and according to him they don't really have any, except for a few species that have thistles, which act as a sort of "weapon" against animals that try to eat them. During the two weeks we did not do anything except help the Scripps people, but I was able to collect some seagrass samples since we had to go to some seagrass beds.

After the Scripps students left, Larry devoted the entire week to my project. They took me to different seagrass bed sights. He also lent me his camera so I could practice taking underwater pictures. The first several roles I took were not that great. The pictures I took either came out overexposed or underexposed. But by the end of the week I improved, and most of my pictures came out pretty good.

During the week another intern arrived. Andy attends the University of South Carolina and is a marine biology major. Andy's project was on fish odules, specifically white snapper odules. Andy and I quickly became friends. He would help me with my project and I would help him with his. Andy's project involved catching fish (white snapper), so this involved a great deal of fishing and, since I love fishing, I was very willing to help him.

For the next couple of weeks, we concentrated on collecting NCI samples since we had not collected anything for about three weeks. We snorkeled and scuba dived everyday. This also included night dives which were very exciting. At night you could see many creatures that do not come out during the day. There were so many creatures I had never seen before and never knew existed. The many sites we visited included several seagrass beds, so I was able to work on my project while we collected samples.

It was during the sixth week of my internship that I got stung by an urchin. The infection was so bad that I had to have minor surgery to take out infected tissues and pus. The doctor advised me that I should not get my hand wet for the next week or two. So for the next two weeks I did not go out. I stayed at the office and did some minor paperwork and other tasks that Larry asked me to do. I admit that staying in the office was boring but, I had no choice.

During the eighth week of my internship I decided to keep on working until I left. I really enjoyed this job, so I decided to stay on. We had some more visitors. A research vessel from Japan was visiting Palau for three weeks. We worked with the Japanese scientists for a couple of days. We got to tour their ship and use some of their equipment.

I did not collect all the seagrass samples I wanted. The main reason was the lack of transportation. The only seagrass beds I visited were within the Koror are. These sites basically consisted of the same types of seagrass. There was not that much variety. Another problem I had was the camera usage. Larry had only one underwater camera and he needed it most of the time.

Other than these, I had no other problems. I feel that my internship went very well. Patrick, Charlie and Larry said that they were very pleased with my work and guaranteed me a job when I graduate.

# **TUALAUTA BASELINE PROJECT**

by

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## Introduction

The territory of American Samoa consists of seven islands, totaling about 77 square miles, located 10 degree south of the equator in the mid-Pacific Ocean. The largest island, Tutuila, is approximately 54 square miles in area. The six other islands are Aunu'u, located just off Tutuila; Ofu, Olosega, and Ta'u known as the Manu'a Islands located about 80 miles from Tutuila. Rose Atoll, an uninhabited National Wildlife Refuge and Swains Island, is approximately 225 miles north of Tutuila.

The Government of American Samoa operated through a network of 51 villages, 14 countries, and three districts. The system is administered by the government's Office of Samoan Affairs. The officials representing the local units have limited authority but are delegated administrative tasks and serve as liaisons between the Territorial government and local residents.

The traditional Samoan lifestyle is known as *Fa'a Samoa* and places great importance on the dignity and achievements of the group rather than on individual achievements. The traditional lifestyle revolves around the *aiga*, or extended family. A *matai*, or a chief heads the *aiga*. He manages, protects and distributes family lands, is responsible for the welfare of all in his *aiga*, and represents his family in councils. However, American Samoa has been shifting slowly from traditional subsistence communal economy to a cash economy akin to that of the United States.

The 1990 population census in American Samoa found that there has been a 44 percent increase in the population over the past 10 years, from 33,000 people in 1980 to 46,600 people in 1990. The current population growth rate increases per year. This includes all new additions (babies and immigrants) minus all losses (deaths and any residents who left American Samoa to live elsewhere). American Samoa's population is still very young (Dept. Marine and Wildlife Resources, 1993).

The estimated mid-year population of the territory as of July 1, 1993 was 52,900; an increase of about 2,000 when compared to the mid-year 1992 estimated total of 50,900. It's population is ranked sixth compared to other countries in the South Pacific Region, and with only 200 square kilometers (77 square miles) of land area. There are about 234 persons per square kilometer or 607 per square mile (EDPO Research and Statistics Division, 1993).

## Background

Tualauta County includes: Vaitogi, Iliili, Pavaia'i, Faleniu, Mesepa, Tafuna, Malaeimi, and Mapusaga. According to the U.S. Census, Tualauta County contains approximately 5,500 acres of land. A large part of the County (approximately 1,750 acres) is not developable because it is (a) on the steep slopes, or (b) is in the 100-year flood plain, or (c) is in a hazardous area due to landslides or erosion. Present development occupies approximately 1,600 acres of the developable 3,700 acres.

Approximately 1,075 of those acres are in residential use. All other developable uses (e.g., commercial, industrial, government) occupy about 30 percent of the total developable acreage (EDPO Research and Statistics Division, 1993).

Land has always been a cherished commodity for man. Its uses range from agricultural production to housing foundations and industrial sites, from open space beauty to waste disposal

sites. Proper land use management is imperative to reaching environmental goals. In American Samoa, people value their land and they would do anything to hold on to that land.

The American Samoa Coastal Management Program (ASCMP) was developed with the Territorial goal of expanding development in mind. However, it is primarily intended to ensure that economic progress is not achieved at the expense of the longterm integrity of coastal resources. The American Samoa coastal zone includes the entire land mass of the territory, as well as territorial waters as submerged lands extending seaward three miles, with exception of excluded federal lands. Those lands include Rose Atoll, a National Wildlife Refuge, the American Samoa National Park lands of Tutuila, Ofu, and Ta'u, and Pago Pago International Airport.

The ASCMP is designed to accommodate and complement other planning efforts which will guide the socioeconomic development of the Territory. The initial legal authority for the American Samoa Coastal Management Program was contained in an executive order signed on May 29, 1980. This order identified the ASCMP coastal management policies and definitions applicable to the ASCMP and procedures for DPO/ASCMP, which reviews all permits issued to the American Samoa Government (ASG) agencies. The 1990 Coastal management Act provides that the general purpose of ASCMP is to provide effective resource management by protecting, maintaining, restoring, and enhancing the resources of the coastal zone.

The American Samoa Coastal Management Program is housed in the Environmental Division of DPO along with Fagatele Bay National Marine Sanctuary. In addition, the Economic Development Planning office also houses the Planning Division, responsible for local implementation of the National Flood Insurance Program (NFIP).

DPO/ASCMP has participated in specialized planning efforts, most notable the Tualauta Baseline Project. With the help of the American Samoa Power Authority (ASPA), ASCMP is working to come up with solutions to these Tualauta area problems.

## **Methodology**

There were two projects that I was involved with during my internship. Mapping flood plain areas in the Tualauta County was one. The latter part was helping help with the Coastal Week Program in the Manula Districts.

In the flood plain mapping part of the project, I had some time working in the field. Records of very intense rainfall on Tutuila date back to the early 1900s. The rainfall distribution for storms occurring in Tutuila varies almost annually. Flooding occurs in the project area because of this intense rainfall and because most of the stream in the lower area does not have well-defined channels. Flood problems in the area are caused by the insufficient flood-carrying capacities of the natural streams and in some watershed by the absence of defined stream channels. Thick vegetation, flat areas, and encroachments of residential dwellings into the flood plain have intensified flood problems.

There are many streams in the Tualauta County. However, none of the streams are considered perennial and the only main ones are Vaitele, Taumata and Leaveave Streams. They are clearly defined main streams within the upper watershed with characteristic pool systems. Vaitele Stream originates from Tuasivitasi Ridge along the northwest corner of the Tafuna Plain

before discharging into Pala Lagoon. Both Taumata and Leaveave Streams are tributaries to Vaitele. The Vaitele main stream system drains approximately 0.58 square miles and has about two miles of streambed along the main stem.

Taumata Stream is the largest tributary to Vaitele Stream and is normally dry except during the rainy season. Taumata Stream drains approximately 1.82 square miles, which includes another stream basin, and has approximately 2.27 miles of streambed. Leaveave Stream originates from the northwest portion of the Tafuna Plain, and drains 1.21 square miles. Flooding is exacerbated due to heavy vegetation in the overbanks, development encroachment and banana cultivation. In some feet downstream of the highway bridge, Leaveave Stream virtually disappears due to heavy vegetation and flat terrain. Residential encroachment into the lower alluvial plain in Tafuna occur frequently due to the lack of identified stream channel. Vaitele Stream's wide flood plain above the highway, typically demonstrates the effect of a combination of small stress cross sections and flat adjoining land contours which spread out the stream overflows. The upstream reach of Taumata Stream runs through Malaeimi Valley at a very flat gradient, producing a large flood plain. Taumata Stream's flood plain between the highway and the confluence with Vaitele, meanders through heavily vegetated residential areas. Partial overflows from the 100-year spills over into Leaveave Stream due to inadequate carrying capacity of the stream channel and overbanks.

The goal of flood plain management is to reduce a community's vulnerability to floods while integrating preservation and enhancement of the natural resources and functions of the flood plain. The basic idea is to avoid risks associated with development within established flood plains. Moving people out of harm's way or limiting development in the flood plain is one approach to lessen the risk. Unfortunately, the demands of economic growth and progress placed on this area, coupled with limited available land, subject people and their investments to potential flood risks.

National Flood Insurance Program (NFIP) is administered by the Federal Insurance Administration under the Federal Emergency Management Agency, offers flood insurance to communities that adopt and enforce flood plain management regulations that meet minimum NFIP requirements. This results from the fact that most people are putting their lives in danger by building on flood plain areas.

The latter part of my internship was helping out with the Coastal Discovery Program in the Manula Islands. This is under the Public Education and Outreach program of ASCMP. Public education is very important in American Samoa. These programs are very important especially given the lack of other influences such as environmental groups or public television that contribute to the awareness of environmental issues on the mainland. Each year, DPO/ASCMP submits cooperative agreement applications to fund various public outreach efforts, this includes the Coastal Discovery Program.

DPO/ASCMP sponsors a number of educational activities for students and teaches. For instance, a four-day workshop for sixth-grade teachers focused on the Coastal Management Program and its activities and on integration of environmental education into classrooms. The Summer Coastal Discoveries Program is a summer day camp with one week of half-day sessions that allow students to learn more about coastal management issues, their environment, and the Coastal Management Program. The program is conducted at four sites on Tutuila and at one in the Manula Islands. I was involved with the Manula program.

## **Conclusion**

Development within the Tualauta County is increasing due to the population growth. In addition, the amount of developable, relatively flat lands are limited on this island. Territorial laws and regulations tend to be western in concept and based on western notions of private property, government and more. Unaccustomed to the concept of external, territorial controls over land use and management, many elder matais have resisted the efforts and regulations of the ASCMP. Efforts to settle disputes and violations of territorial law through the judicial system rather than through the traditional village system is also new.

I feel that the success of coastal management in American Samoa depends largely on the program's ability to work within both the traditional and western systems.

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# **RESOURCE MANAGEMENT ISSUES OF ECOTOURISM**

by

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## **Background**

Ecotourism is a “nature-based tourism that involves education and interpretation of the natural environment and is managed to be ecologically sustainable” [Dowling 1994]. It is one of the fastest growing components of tourism. This definition recognizes that natural environment includes a cultural component, while ecological sustainability involves an appropriate return to the local community and long-term conservation of resources (Australian Department of Tourism 1994a:17).

## **Five Principles of Ecotourism**

There are five major characteristics or principles of ecotourism: nature-based, ecological sustainable, environmentally educative, locally beneficial, and tourist satisfaction.

**Nature-based:** Ecotourism is based on the natural environment with a special focus on biological, physical and cultural features. Ecotourism happens in, and relies on a natural setting and may include cultural factors where they happen in a natural setting.

**Ecological sustainable:** Ecotourism should be economically, socially, and environmentally sustainable. Natural resource sustainability has been identified by national and state governments in Australia as a key element in managing human activities. Ecotourism is an ecologically sustainable tourism engaged in a natural setting. The challenge of ecotourism that any country faces is developing its tourism capacity and quality without affecting the natural environment.

**Environmentally educative:** Environmental education and interpretation are essential tools in making an enjoyable and meaningful ecotourism experience. Ecotourism attracts people who are interested in interacting with the environment to develop their knowledge, awareness and appreciation of it. Education is a useful management tool for natural regions, while interpretation helps tourists see the whole picture. Both residents and visitors can become educated in developing awareness and appreciation of the natural environment and cultures, and what can be passed on to succeeding generations (Dowling 1995:4).

The word ecology in ecotourism suggests a mutual relationship between visitors and residents that involves cultural exchange, but also a shared respect and reciprocity. These factors should be present at a tourist destination as a welcoming purpose (Liu 1994:2).

**Locally beneficial:** Ecotourism creates benefits to community and environment. Local communities are involved in activities that range from ecotourism operations to provision of knowledge, services, facilities and products. These benefits should outweigh ecotourism’s cost to the local community and environment. Ecotourism also provides income for resource conservation management and also social and cultural benefits.

**Tourist satisfaction:** In the ecotourism industry, it is important that visitors are satisfied. Entailed in this notion is the essence of visitor safety considering political stability.

Information offered about ecotourism opportunities should precisely represent the opportunities provided at specific ecotourism destinations. The ecotourism experience should fit or surpass the realistic expectations of the visitors. Customer services and satisfaction should be second only to the conservation and protection of what they visit (Dowling 1995:5).

## **Three Broad Styles of Ecotourism**

**Frontier Ecotourism:** Frontier ecotourism consists of individuals or small groups (of ten or less people) who use non-motorized means of transportation (for example: walking or canoeing) to visit remote natural regions. Visitors are very self-reliant and have less demands for supporting services and infrastructure. They have a special and unique first-hand, experience that frequently needs a high degree of challenge and some background in outdoor survival skill. Such examples consist of trekking, rafting and kayaking.

**Small Group Ecotourism:** This type of ecotourism comprises of individuals or relatively small, groups (approximately 15 or less) who use motorized means of transportation (for example: 4WD vehicle or small boat) to visit regions of special interest which are generally 'off the beaten track'. This form of ecotourism does not require any special outdoor skill. Activities include: biking, rainforest tours and 4WD tours.

**Popular Ecotourism:** This type of ecotourism involves transporting of larger number of visitors to a region's most popular attractions. The means of transportation include bus and large boats. Just like small group ecotourism, popular ecotourism does not also require special skills. Such activities consist of: dive trips, canoe riding and natural trekking (Dowling 1995:5-6).

## **Ecotourism, A Desirable and Competitive Market**

There are more countries that are becoming interested in "green" tourism, cultural tourism and ecotours. Hence, they are considering ecotourism as part of their tourism planning. Many places are determined in marketing their natural and cultural attractions to ecotourists.

The advantages of ecotourism are recognized by governments in both developing and developed nations. For instance, Costa Rica, Ecuador and Kenya are noted as models of successful ecotourism. They provide unique environment and wildlife, and through ecotourism, they earn much needed foreign exchange. Belize has reevaluated its tourism development strategies, sponsored an ecotourism conference for the purpose of redirecting its tourism effort into more environmental protection and conservation. Other places like Australia, New Zealand, and Canada are aggressively investing, promoting and marketing ecotourism to broaden their tourism base (Liu 1994:2 & 5).

Within the Pacific region, the potential in tourism development falls in the range of ecotourism. Such examples are nature treks, homestays, bed and breakfast accommodations, and visit to nature parks, cultural and ancient ruins. Clearly, ecotourism is not a new concept to the Pacific. "What is new, however, is a growing ecotourism market and the strategies to capitalize on this new trend" (Liu 1994:31). When comparing ecotourism with other economic options, ecotourism can provide jobs, while preserving environment and culture.

## **Ecotourism and the American Affiliated Pacific**

Economies of the American Affiliated Pacific Islands (AAPI) are facing loss of resources due to population growth, natural disaster, and extractive industries like fisheries. Ecotourism can provide incentives to enhance management and preservation of the natural resources and to provide economic support to protect the environment.

Another major threat that the AAPI are encountering is the loss of federal monies. Since, these AAPI depend heavily on imports, ecotourism can provide a source of foreign exchange.

The other goals of ecotourism include benefit to local residents by assuring enough financial returns and a fair distribution of costs and benefits (Liu 1994:1).

## **Who the Ecotourists Are and Their Needs:**

Studies have shown that: ecotourists are more affluent, well-educated, more mature, more environmentally aware and focused in comparison with mass tourists.

They associate environmental goals and choices with adventurous activities to experience spiritual and cultural growth, and to learn, appreciate and interact with the environment. They are outdoor enthusiasts ecotourists.

They take longer trips and spend more money per day than travelers with less of an interest in nature.

They don't find interest in quality food or lodging, but they demand more especially when they are searching for needed information on their destination.

They have greater expectation of high quality environments and greater preference for complicated forests and spectacular, and endemic species (Wylie 1994).

## **Tourism Fees: Revenue Objectives and Demand Estimation**

Tourism fees are used by many natural area managers to recover costs of visitor management, traditional conservation management and community development program. In any case, the revenue generation options that ecotourism provides have yet to be fully implemented (Wells 1992; Lindberg 1992).

Countries like Peru, Ecuador, and Kenya raised fees for foreign visitors while keeping the fees low for local residents (Olindo 1991). This type of price differential is typical in the traditional tourism industry. For instance, airlines and travel agencies charge a higher price for tickets purchased close to date of departure. This is based on the assumption that travelers are willing to pay and are less price sensitive. Likewise, in response to the changes in the seasonal demand, hotels lower their rates during the off-season (Lindberg & Huber 1983).

Parks and other facilities should operate like businesses when servicing foreigners with tourism opportunities. Such action often needs bureaucratic and legal changes. At the same time, parks need to maintain and conserve attractions.

The level of fees will depend on national and local goals. The two feasible objectives are: (1) charging fees that would equal the cost of providing services (cost recovery); (2) charging fees that would make as much profit as possible (revenue to fund traditional conservation activities). There are other goals/objectives that may modify or replace these two. For instance, fees are maintained low to encourage more visitation and therefore increasing economic opportunities for any businesses relating to tourism. On the other hand, fees are increased to encourage the private sectors to develop facilities that are not profitable as long as fees for public destinations are kept low.

## **Cost Recovery**

This first objective is to set fees in order to create enough profit to pay for services provided. At the minimum, fees should equalize capital costs (development of visitor center) and

operating costs (maintenance of facilities, income for tour guides, etc.). Ideally, they should balance "indirect" costs (ecological damage) and cost of negative effect on local communities, though such costs are hard to quantify.

## **Profit Maximization**

This second objective is to set fees to create as much revenue as possible. More importantly, fees should balance the opportunity costs of resources used for tourism. The profits, revenues minus costs, can be utilized to fund traditional conservation activities, subsidize recreation opportunities for local residents, or other procedural goals. In practice, there is a deficiency of information to precisely find the financial, ecological and social costs of ecotourism (Lindberg & Huber 1984).

Maximizing profits is different than maximizing revenues. Attracting as many tourists as possible is the outcome of revenue maximization. On the other hand, profit maximization happens during low visitations. This occurs because financial, ecological or social costs of ecotourism can increase quicker than profits during high visitations (Lindberg & Huber 1985).

## **Other Management Objectives**

From the purely financial perspective of the site owner, ecotourism opportunities for visitors should be offered if the fees at least offset the costs. In any case, other goals can allow owners (governmental owners) to offer opportunities even when costs are not recovered. For instance, fees may be maintained low to keep high visitation, thereby creating economic opportunities to tourism businesses or fees charged to visitors may be insufficient to protect all costs, but they may create enough profit to subsidize local visitation.

The establishment of employment or local recreation opportunities can be very beneficial. Tobias and Mendelsohn (1991), for example, approximated that the privately-operated Monteverde Reserve was worth between \$97,000 and \$116,200 per year as a recreation attraction for Costa Rican residents.

High fees can be utilized not only to increase profit but also to spread or limit visitors when particular attractions are crowded. Kenya, for instance, charges higher fees at crowded sites in order to spread visitors to less visited sites. This requires that similar site attractions to be readily available (Leakey 1990; EIU 1991). A similar model has been recommended for Nepal (Gurung 1990 as cited in Wells 1992). Additionally, experience in U.S. indicates that high fees will help reduce littering and vandalism in areas with natural settings and need to be protected (Aukerman 1990).

These models clearly rely on a balance between price and visitations: as price goes up, the number of visitors goes down, and vice versa. This is a fundamental economic notion, but previous fees are so low for most sites that even large increases will likely have small effects on demand (in terms of selecting a destination). Tourist surveys and actual tourist behavior indicate that price is not an important element when selecting an ecotour and when compared to other factors. Even when price is a concern, tourists are willing to pay high fees due to their awareness of the purpose of the fees. Fees are used to enhance their experience and are used to conserve the areas they are visiting. Many sites have increased their fees without noticeably impacting visitor levels and many more are able to do so. In certainty, if these profits are then utilized to enhance the sites, then demand would probably increase.

Price can play an essential role in terms of activity selection at destinations. That is, when fees are increased in Kenya, it may have little effect on the number of ecotourists visiting Kenya, but the same increase at crowded attractions may influence tourists to visit less crowded attractions within Kenya.

Accomplishing any of these management goals needs sufficient demand. Managers should keep in mind that ecotourism needs and desires can be very unpredictable and reliable on elements beyond their control. In any case, the following can be used to estimate this need and desire.

### **METHOD 1: Market evaluation**

The primary notion behind this method is that a given attraction can anticipate levels of visitation and a willingness to pay fees equal to existing attractions that are alike in consumer appeal, cost of travel, and other "demand factors."

This is a usual method for finding whether investments in the private sector will be profitable. In any case, care must be taken in consideration to measure how new facilities increase the supply of destination, thereby placing a downward pressure on prices for both existing and new facilities. Unfortunately, lodges and other ecotourism businesses normally do not share information on visitations and prices, making comparison hard.

Additionally, few national parks and other "public" facilities have traditionally imposed such fees; when fees are imposed, they have rarely been based on the cost of providing the service and the consumers willingness to pay for the service. Even private reserves that generally impose more than public parks frequently place low fees, due to the subsidy of costs by other programs (like scientific research and foundation grants) (Alderman 1990).

Even when statistical information is acquired from similar facilities, they must be modified to take into consideration the differences in demand component, like quality of attraction and travel cost. Ideally, it would be desirable to select an attraction that ranks roughly the same on all factors. Ranking may differ and decision may be used to approximate the optimal fee. For example, an approximation for the proper user fee for common parks in Central America is between \$5.00 and \$10.00 per day (Ashton and Haysmith 1992). This approximation is based on positioning Central American parks relative to parks in Africa or elsewhere. Central American parks would rank low with regards to quality of attraction (ease of wildlife) and better with regards to cost of travel. Weighing all components, \$5.00 to \$10.00 was considered a "reasonable" fee range.

Since there have been few analyses of demand components for ecotourism, the essence of each demand component must be heavily based on instinctive conclusion by those familiar with the industry. In the future, however, more research may assist in recognizing the significance of each component, hence facilitating expanded application of this model. Parks could then base their fees on those imposed at other attractions similar in terms of essential demand components; differences in less essential component would have little impact on setting fees. Initial results from a Costa Rican survey (Baldares and Laarmand 1990) imply that the following components impact the appropriate fee level: tourist income, quality of experience, tourists age and level of education, and the number of protected areas visited in Costa Rica.

## **METHOD 2: Survey of Tourist Demand**

The fundamental notion behind this method is that tourists approximate their own desire for the attraction in response to particular survey questions. This type of survey showed that Costa Ricans and foreign visitors agree that entrance fees to the three most known national parks should have an increase (Baldares and Laarman 1990). Moreover, both Costa Ricans and foreign visitors agreed that foreign visitors should pay more than the residents even though that was not a governmental policy.

Surveyors asked visitors, "For this type of visit you are making here ... how much should be the normal entrance fee for visitors who come from outside of Costa Rica?" Figure D1 (refer to Appendix D) illustrates the result of the survey. An analysis of the graph demonstrates that the majority of both residents and nonresidents felt that nonresidents should pay more than the 25 colones (\$.30) actually imposed. Many respondents expressed that the fee should be more than \$2.40. This information can be statistically analyzed to more precisely discover the revenue maximizing fee, but a visual evaluation of Fig. D1 (refer to Appendix D) implies that a fee of roughly \$1.20 should be imposed on nonresidents.

There is a weakness behind this method: the results likely underestimate real demand and hence the potential fee level.

Partially, this is due to the general complications in achieving precise responses to surveys (tourists frequently underestimate what they would actually be willing to pay). Additionally, the surveyors indicated that responses might have been higher if the survey had been conducted during the summer months instead of the winter months. Moreover, the responses might have varied if questions had been asked differently. For instance, a minority of the real respondent showed that they felt the proper fee should be \$2.4 or more. In any case, if the question had been asked differently like, "If the entrance fee was \$2.40, would you have canceled your trip to the parks?," it is likely that the majority of the respondents would have revealed a willingness to pay this higher fee (Lindberg and Huber 1988).

## **METHOD 3: Demand Curve Analysis**

Demand curve analysis is possibly the most precise technique to set fees. It measures how much tourists are willing to pay to visit sites, as well as the trade off between price and amount of visitors. Thereby, demand curve estimation enables managers to set the revenue-maximizing fees.

Demand curves have been approximated for developing country parks using hedonic pricing (Edwards 1987) and travel costs (Tobias and Mendelsohn 1991; Durojaiye and Ikpi 1988).

Nevertheless, a survey of this type addressed in Method 2, but intended and conducted to contingent valuation principles, will normally be simpler to use in an expanded range of settings. Researchers can extend the analysis addressed in Method 2 by using statistical analysis to approximate the revenue-maximizing fee. In the case for Costa Rica, the maximizing fee was approximated at \$1.20. As mentioned above, this approximation is considered low.

## **METHOD 4: Market-Based Reactive Management and Auctions**

The fundamental notion of this method is to respond to the tourism market as flexibly as possible by charging fees as demand charges. Due to the inaccuracy in approximating demand,

as well as the fickleness of the industry, this method is an essential element to the three already mentioned. That is, fees could be set at \$10.00 based on tourists surveys or evaluation of equal attractions. In any case, if the level of visitation keeps on increasing quickly, managers should consider increasing fees.

Likewise, if the level of visitation decreases quickly, managers should consider reducing fees. Additionally, if managers cannot apply one of the three methods to approximate demand, they can use reactive management to eventually raise fees until their objectives are achieved (cost recovery, profit maximization, etc.)

Auctioning permits or other tourism fees will usually adjust fees with demand since tour operators will propose as much as they are willing to pay for the permit. Nevertheless, auctions are typically suitable when the price of such permits are relatively high. This will normally be the situation with hunting and such high-value tourism opportunities as observing and enjoying mountain gorillas in Rwanda.

The complication with reactive administration within the context of government-run ecotourism sites is that agencies hardly have the needed flexibility to quickly respond to changes in the marketplace. Nevertheless, the advantages of such flexibility can be a strong power to decentralize the authority that sets fees.

The most suitable method in setting fees will rely on local conditions, availability of resources to address surveys and analysis, and other regards. Particularly, approximating demand for new facilities will generally comprise Methods 1 and 4 because they do not need a stream of present tourists (Lindberg and Huber 1989-90).

## **Tourism Fees: Financing Ecotourism and Conservation Programs**

Approximated revenues need to be compared with costs to find whether management goals will be achieved (cost recovery or profit maximization). This similar relationship will frequently take the form of financial analysis or benefit-cost analysis, especially if a loan is perceived to cover costs. This analysis is discussed in the first case study.

### **Case 1: Cost Recovery at the St. Lucia Sulphur Springs**

The St. Lucia Sulphur Springs are located on the Caribbean island/nation of St. Lucia. For the past eight years, tourism in St. Lucia has increased at roughly ten percent each year, with twenty four percent of all visitors spending time visiting the Sulphur Springs National Landmark (a region of boiling hot springs, volcanic promontories, and tropical vegetation). The St. Lucia Tourism Board, in association with the Organization of American States (OAS), examined whether tourism fee revenues would be adequate to recover costs of enhancing the attraction (Huber and Park 1991). The analysis consists of cost estimates for such projects: infrastructure, education, and environment. They are needed for the improvement of the natural landmark. Capital costs consist of the construction of such facilities as visitor center, restaurant, rest room, and an environmental education with exhibitions. Operating costs include maintenance and programming as well as tourist assistant and four maintenance staff (a manager and three tour guides).



The costs of enhancement are expected to be recovered through three paths. First, the enhanced quality of the attraction is expected to increase the level of visitation.

Second, entrance fees will increase, from EC \$3 (approximately \$1) to EC \$5.00. St. Lucian people will be admitted free by prior arrangement. Thirdly, revenues will be generated from restaurants, handicraft, and other concessions.

The authors of this feasible study employed a modified version of Method 1 and 2 to approximate reasonable tourism fees and find whether the revenues would offset the cost of the investment. They surveyed visitors to the area to find whether they were interested in the enhancements under consideration.

These surveys and historical visitation data illustrated that: the sulphur springs were already one of the most popular attractions; most tourists would extend their stay depending on availability of facilities; and many particular facilities like a visitor center, interpretive panels, and restaurant were desired.

Based on results of surveys, and knowledge of similar attractions, the authors approximated that there would be an increase in the level of visitation and visitors would be willing to pay a higher entrance fee for an enhanced attraction.

The authors used financial analysis to predict whether the project would be valuable once the costs and revenues associated with the project were approximated. (Only financial analysis methods will be discussed here; interested readers should refer to Brealey and Meyers (1988) or similar references for more information) (Lindberg and Huber:91-92). For more information on the cost-benefit analysis, refer to Appendix A.

The approximated costs are expected to outweigh the approximated benefits in the first two years of operation. Thereafter, the project will earn more revenue. The expected internal rate of return of this Sulphur Spring project is 19.3% and it is sufficiently high to verify financing.

It should be mentioned that this project involves expected, rather than actual costs and revenues. Attractions such as gorilla tourism in Rwanda illustrate ecotourism's potential to generate profit. The St. Lucia example a more "typical destination," demonstrates the expected potential to recover costs with fees.

Recovery of costs in providing the ecotourism experience will generally be the minimum criterion. Nevertheless when revenue surpasses costs, the resulting profits will be available for conservation programs, funding of other governmental programs, etc. The high fee for gorilla tourism in Rwanda and Galapagos tourism in Ecuador, for instance, are used in part to fund typical conservation activities within the park systems.

Table D1 and Figure D3 (refer to Appendix D) indicate that gorilla tourism has not only paid for management of park, but has also earned substantial profits for the treasury of government.

In Kenya, tourism revenues are expected to cover the total cost of administering the country's parks and reserves. Likewise, tourism at Kota Kinabalu Park in Sabah, Malaysia, earns enough funds to cover the whole Sabah Parks budget.

### **Case 2: Profit Maximization at Parks in Zambia and Rwanda**

Two projects from Africa employ Method 4 to maximize revenue from tourism fees. Since the level of visitation is controlled and relatively low in each case, these parks have also targeted maximizing profits.

As part of Zambia's Lupande Development Project, local safari hunting concessions for South Luangwa National Park are auctioned to tour operators. Presuming the auction is held competitively, this method of selling hunting rights maximizes revenues from fees. Proceeds from hunting concessions (profits from hippopotamus sales) are then directed through a "wildlife conservation revolving fund," with 60% being used for managing wildlife and 40% being given to Local chiefs for community projects.

Hunting concession fee revenues earmarked for managing the wildlife in 1987 were K146,000 (\$18,250), which was enough to cover the recurring costs of \$17,625 incurred by the village scout program construction and maintenance, supplies, and public relations. Other governmental agencies also benefitted through safari hunting licenses (that were imposed in addition to the concessions and that totaled \$36,130 in 1987), sales of elephant ivory, and fines collected from poachers that got arrested.

Rwanda's Parc National des Volcans has generally used market-based relative management in setting fees for level of visitation to the mountain gorillas. The popularity of visiting the gorillas resulted in demand far beyond the limit of visitation that has been set (at approximately twenty-four tourists per day). This over-capacity demand caused the government to raise fees to roughly \$200 per person for one hour visit, thereby earning revenues of almost \$10 million in 1989.

Due to the excess demand, which existed until civil war stopped gorilla tourism, the government could have raised fees higher. (They may have had to revise fees downward as gorillas tourism developed in neighboring Uganda and Zaire; such a revision has already happened in the process of exchanging from pricing in Rwandan francs to pricing in U.S. dollars.

Even with a limit on the level of visitation, gorilla tourism earned substantial profits. Official figures and informed approximations show that tourism has not only paid for the cost of guides but has also financed park guards and earned profits for the main government treasury (Table D1 and Figure D3) (refer to Appendix D). For instance, in 1989 tourism fees earned \$1 million in revenue while park expenses were less than \$20 thousand. In this sense, ecotourism has financed not only ecotourism but also conservation and general government projects.

### **Case 3: Incorporating Other Management Objectives in Pricing Trekking Tourism in Nepal**

Decisions to keep low fee levels for the purpose of achieving other management goals will lessen fee revenues.

Nevertheless, techniques like multi-tiered pricing structures can be established to lessen lost revenue. For instance, Nepal previously imposed fees of \$10,000 for climbing Mount Everest and \$8,000 for climbing other 8,000 meter peaks. Starting in the autumn of 1993, the fee for Everest rose to a range between \$50,000 and \$70,000 depending on size of group (Anonymous 1992; Noland 1992). At the same time, fees for the more casual treks undertaken by the majority of tourists were doubled, but still maintained relatively low at \$15 to \$25 per week. This combination of fees will probably sustain demand for small-scale tourism operations/businesses that rely on large numbers of trekkers while keeping governmental fee revenues at fairly high levels.

## **Tourism Fee: A Decision Making Process**

The previous sections outline common goals and methods, in combination with examples of how particular destinations have utilized tourism fees to generate revenues. This section outlines a decision making process for finding tourism fees. As demonstrated in Figure D4 (refer to Appendix D), the initial step is to find fee objectives (cost recovery, profit maximization, or alternative criterion). The next step is to approximate whether revenues will be enough to cover costs. If so, prices should be set properly. If not, decision makers must find whether objectives like provision of domestic employment or recreation opportunities will be sufficient to justify providing ecotourism opportunities at a financial loss. If this is the case, more funding must be developed to cover these losses. Regardless of goal being chosen, results should be controlled to find whether goals are being achieved (Lindberg & Huber: 97).

### **Incorporating Broader Economic and Social Impacts**

The prior section have focused only on the financial costs and benefits. In some instances, it will be proper to include expanded social costs and benefits. This is frequently the interest of governments (Lindberg & Huber: 97).

One method for doing so, the economic internal rate of return (EIRR), is based on the notion that market prices do not always reflect the true economic cost or benefit to society, partially due to public subsidies and taxes or monitored of prices and wage rates. As a consequence, EIRR utilizes "economic" prices rather than market prices. In practical terms, this means that: international (border) prices will be utilized for traded products (like imported food for tourists), with proper modifications for costs of transportation and handlement; shadow prices will be utilized for nontraded products (like labor); and transfer payments (like duties or taxes) are not included (Lindberg & Huber: 99).

The next method, "social benefit-cost analysis" (SBCA), expands EIRR by acknowledging that many advantages (and costs) are essential to society, but do not have "economic" value in the perception that they are bought and sold in the business sectors.

In certainty, public financing of parks and protected regions has depended basically on the fact that regions with natural settings contribute such advantages as watershed protection, species conservation, recreation, and others as well (Dixon & Sherman 1990; McNeely 1988).

These advantages are much more complicated to value than fee revenues, but much development has been accomplished in doing so. Once the benefits and costs are approximated into the future, the study case is evaluated by using the NPV or IRR criterion. Nevertheless, the social project discount rate is normally lower than the rate used for financial study cases. Hence, a social study case with an IRR of 10% may be considered valuable, but a financial study case with an IRR of 10% may not be.

As mentioned above, the existence of subsidized recreation benefits for local residents is one rationale for undertaking ecotourism programs even when the costs outweigh the financial gains from fees. Nevertheless, this rationale should be made clear and the actual benefits to residents should be quantified wherever feasible through methods like travel cost or contingent valuation analysis.

The fact that the natural areas offer both the financial ecotourism benefits and the nonfinancial traditional benefits has essential implications for decisions on how much land to

keep in natural setting. First, tourism supplements traditional conservation benefits and hence raises the economic justification for conservation. Next, conservation benefits supplement tourism benefits so that conservation can still be modified even where small or not tourism potential occurs. One instance of traditional benefits complementing tourists is the Korup study case in Cameroon. The social benefit cost evaluation of this study case resulted in information illustrated in Figure D5 (refer to Appendix D) (Ruitenbeek, 1989; c.f. Dixon & Sherman 1990). Tourism earned only \$1,360,000 (approximately \$2,720,000 at 1992 exchange rates) in present value. Given costs of \$15,239, tourism alone was not enough to modify the park study case. Nevertheless, when tourism benefits were associated with other benefits the park was worthwhile. Certainly, in this matter, tourism was vital in assuring that benefits are greater than costs.

Using Ecotourism to Support Economic Development Ecotourism has been adopted by many as an opportunity to earn income and create jobs in areas relatively untouched by typical development efforts. Such objectives have frequently been met partially, but there is an awareness that small amount of money spent by tourists stay at or near the destination itself (Lindberg 1991; Boo 1990).

There are at least three reasons for raising local benefits from, and participation in development of ecotourism. First, it is equitable (fair) insofar as conservation of the region for ecotourism lessens or eliminates traditional resource utilization. Second, when local residents get benefits they normally assist ecotourism, even to the extent of protecting the site against poaching or other encroachment. Contrarily, if residents bear the costs without getting benefits they frequently turn against ecotourism and might intentionally or unintentionally destroy the attraction. Third, the ecotourists, as consumers, frequently assist the essence of tourism benefitting residents (Eagles, Ballantine, and Fennel 1992).

The amount of money which actually enters the destination area, less the amount leaked out to pay for outside goods and services, has not been sufficiently quantified. A typical approximation is that less than lot of tourism spending stays in communities close to ecotourism destinations. To some point, this is simply because of the nature of tourism industry; substantial money is spent on marketing and transport prior to tourists arrive at their destination. Nevertheless, there are opportunities in developing ecotourism's domestic economic benefit. Many of these are currently being strived by privately or public funded programs/agencies. As these programs progress, we should be able to find which are most effective in reaching economic development objective.

Some of the techniques for raising local benefits from ecotourism include: local ownership and management of the ecotourism resource; leasing, partial ownership or profit sharing arrangement between tourism industry and domestic residents; direct payments to communities from tourism revenues; and domestic job opportunities in the tourism industry. Practically, the most proper technique or group technique, will rely on local traditional, cultural, political and economic circumstances. The following examples demonstrate some of what has been done (Lindberg & Huber: 105).

#### **Example 1: Local Ownership in Zimbabwe**

In 1980s, Zimbabwe developed the Communal Areas Management Programme For Indigenous Resources (CAMPFIRE) model, where district councils have been granted

“appropriate authority” to manage wildlife within their areas (Heath 1992; Murindagomo 1990). Importantly, the Ministry of Natural Resources and Tourism has requested that district councils illustrate endorsement by its membership and the ability to establish a wildlife management plan as a prerequisite to getting this authority.

Where this has happened, CAMPFIRE has enabled district councils to directly control, and profit from, hunting, photography tourism and other forms of wildlife usage. In the Gुरुve district, for instance, the 1989 hunting season earned Z\$61,340 (roughly \$24,536) in dividends to wards, with an additional \$195,315 available for equipment purchase, financial funding for the district council, and other uses. The Kanyurira ward generated \$18,924, of which the majority was designated for community projects and direct payments to households of \$80 each.

Comparably, the average household in the region received \$200 from cotton during the same duration (Murindagomo 1990).

### **Example 2: Direct Payment and Employment in Zambia**

The Lupande Development Project nearby the South Luangwa National Park contributes for hunting and other wildlife use benefits being directed into wildlife management and domestic communities through the Wildlife Conservation Revolving Fund (Lewis, Kaweche, and Mwenya 1990). Forty Percent of these funds are provided to local chiefs for community projects; in 1986 this came out to \$7,950.

In addition to the direct financial benefits, 114 domestic residents were actively employed in the conservation programs hunting operations, and hippopotamus harvests. This contribution to local job opportunities illustrated how ecotourism can assist rural economic development. Local employment assistance also gives to conservation and protection. Certainly, poaching of elephants and black rhinos, which had been rising, reduced at least tenfold between 1965 and 1987.

### **Example 3: Direct Payment in Kenya**

Kenya has long been a leading money generator in the field of ecotourism, and revenues are expected to increase further as higher fees are established. Revenues from public parks and reserves is estimated to rise from \$23.6 million in 1990 to \$53.7 million in 1995 (constant 1990 dollars) (Kenya Wildlife Service 1990).

One of Kenya's priorities is to share 25% of entrance fee revenue with communities neighboring the protected regions. This program is clearly modeled to repay communities for the direct and indirect costs linked with developing the protected regions.

Allocation of funds will be based on costs incurred, such as loss of crops and cattle to wildlife. Although these instances include the relatively profitable activities like hunting and viewing of African games. The notion is acceptable elsewhere. For instance, the Annapurna Conservation Area Project (ACAP) in Nepal earns \$200,000 per year from trekking fees to fund ACAP activities and community projects. The \$3.50 entrance fee at Tavoro Forest Park and Reserve in Fiji earned \$8,000 in revenues between March and November in 1991. Of this aggregate amount, roughly half was utilized to pay salaries and expenses and half was utilized for community development projects (Young 1992).

### **Increasing Economic Development by Reducing Leakage and Improving Linkages**

Probably, the most explicit opportunity for providing benefits is hiring local residents in the tourism industry and the industries which support it. The money earned from tourist spending is circulated through the economy as the tourism sector and its workers buy products from other businesses. Hence, tourism might assist not only a local lodge manager but also a local farmer who raises the crops sold in the lodge. Contrarily, if the local lodge imports its crops, the money "leaks" out and creates less local benefits. To raise local development, tourism should be "linked" to the other sectors so that money helps develop the local economy rather than being leaked out (what makes up the "local" economy depends on the area of interest; it may be a village, a province, or some other unit). The following brief paragraphs demonstrate opportunities for lessening the leakages of tourism revenue.

Improve linkages within the tourism industry. Perhaps the most apparent opportunity for local community members to is acceptable elsewhere. For instance, the Annapurna Conservation Area Project (ACAP) in Nepal earns \$200,000 per year from trekking fees to fund ACAP activities and community projects. The \$3.50 entrance fee at Tavoro Forest Park and Reserve in Fiji earned \$8,000 in revenues between March and November in 1991. Of this aggregate amount, roughly half was utilized to pay salaries and expenses and half was utilized for community development projects (Young 1992).

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Improve linkages within the tourism industry Perhaps the most apparent opportunity for local community members to receive benefits from ecotourism is through employment and income in the industry itself. In the short run, this may focus on unskilled labor. Nevertheless, training sessions should be created so that locals are able to occupy skilled positions like guides and managers. Additionally, financing should be made obtainable for local entrepreneurs to develop and establish their own tourism businesses.

#### **Improve linkages to the local transportation industry.**

Ecotourists often require, and desire to use existing local means of transportation that range from traditional to modern. Whenever feasible, local boats, canoes, mules, taxis, and porters should be used. In some cases, cooperatives can be organized to buy more expensive and valuable equipment for transportation. For instance, a locally owned cooperative boat transports tourists from Puno to Taquile on Lake Titicaca in Peru. Improve linkages with agriculture and fishing. Significant amount of tourism expenditures go toward purchasing much imported food from areas far from actual tourism sites (Miller 1985). Ecotourists are most likely interested in

local cuisine, given that standards of quality are achieved and maintained. Lodges and restaurants often need to be more than willing to spend extra time making local food sources. In the meantime, local farmers and distributors often need to know the value of quality of reliability.

Improve linkages with construction, equipment, and maintenance. Local labor and materials are often employed in construction due to ecotourism's level (small scale and location (remote)). This linkage needs to be maintained and increased in size.

### **Develop local handicrafts and other souvenirs**

The sales of souvenirs are often the simplest way for local residents to receive benefit from tourists spending. Rather than selling souvenirs from other areas or even other places/countries, there should be making of local handicrafts.

How will local benefit from ecotourism be achieved and maximized? Using the simple case of a lodge, the objective would be to: make tourism that maximizes spending at the lodge (raise gross revenue); make programs that promote local ownership and administration of the lodge (raise direct benefits for each dollar of gross revenue); and make strong links between the lodge and local farmers, and finance programs/projects to assist farmers develop products which the lodge still gets from outside the region.

At some point, these linkages will develop naturally to achieve immediate needs. Nevertheless, active participation from community leaders, industry, government official, and nongovernmental organizations will be essential. For instance, the industry can work with local communities to find employment opportunities in the industry or to provide products like food and handicrafts. The government can often play an important role in contributing credit to entrepreneurs or training through extension programs. Nongovernmental organization can provide training and other important activities. These varied groups will require cooperation to identify training, credit, and other programs essential for meeting these opportunities; develop these programs; and evaluate program fulfillment and failure, trying new techniques where suitable (Lindberg & Huber: 108).

## **Employment and Training Approaches**

One great case of such cooperation to raise job opportunity is the guide training program made by the La Selva Biological Station with funding from World Wildlife Fund and in cooperation with Costa Rican National Parks Service and other organizations (Paaby, Clark and Gonzalez, 1991). A group of 26 local residents that went through a find and careful selection, joined a 42 hour of lectures and 103 hour of well-guided field walks/tours, which covered topics ranging from general ecology to bird-watching styles.

The results have been' positive, even though this training program was not intended to replace for a degree in interpretation (for example, most trainees do not have skills in foreign language). The trained guides formed a local cooperative (Natucoop) and were successful in finding jobs on both a part- and full-time basis.

Training sessions have also been established to make reliable and high quality of sources of food, improve standards of sanitation, and etc. In Bali, Indonesia, tentative farm was established to improve the quality and variety of fruits, vegetables, and poultry products for sale to tourist

hotels and restaurants. This program is concentrated on marketing, including arranging a reliable supply of products (Inskeep 1991). Kenya also lowered its imports on food from 77% to tourist food consumption in 1984 to 14% in 1988 (Dieke 1991).

Nepal's Annapurna Conservation Area Project (ACAP) not only directed entrance fees back into the local area but also involved training to enhance quality of service, standardize menus and prices, and improve standards of sanitation and waste disposal. Some training programs for staff may be established with public financing or funding, while others may be given by the private sector as component of a license agreement allowing development of tourism operations. A variety of training programs are described by Inskeep (1991).

Economic development programs like training and provision of rural credit have encountered different types of roadblocks, and several have not succeeded or partially succeeded. Some complications involve improper project model or establishment, lack of resident skills and experience with foreigners, and conflict over distribution of income. It is apparent that making programs which successfully train local residents, allocate credit, and achieve related economic development objectives are some of the most essential challenges currently facing ecotourism.

Additionally, decisions on which programs to attempt will often require prioritization in light of restricted human and financial resources. Should priority be offered to providing training for local guides or for establishing local agricultural inputs? Is it more significant to develop an "up-market" program, hence luring tourists who might spend more but need more imports, or to develop "backpacker" ecotourism which might create less gross revenue but be more easily linked to the local economy and feasible causing less ecological degradation or damage in the park.

These questions can be answered partially through multiplier analysis, a measurement of how tourism (or an industry) is linked to other economic sectors. Multipliers have often been miscomprehended and misapplied (Eadington and Redman 1991; Archer 1984). As they are employed multipliers are more useful in comparing industries than comparing various types of tourism development or finding ways to enhance linkages. Moreover, the data needed for calculating multipliers is often not available or of questionable accuracy.

Nevertheless, the fundamental multiplier notion is useful, and valuable information that can be acquired by undertaking a survey on the ecotourism's employment and purchasing patterns. That is, by showing their linkages with the local economy (Milne 1992; Borge et al. 1990). Responses from the analysis can assist planners find which types of development backpackers versus up-market would best achieve income or employment objectives. Additionally, it can be utilized to recognize those sectors - agricultural inputs, for instance - which can be produced to increase linkages and hence increase the money kept by the local economy.

When a full multiplier analysis is impossible, similar information can still be achieved by a less demanding analysis based on how money flows through the ecotourism sector.

Community leaders could formally or informally conduct interviews with tourism businesses to find where money leaks away from the local economy. This can help prioritize programs to lessen leakage and thus enhance local benefits. If tourism business surveys illustrate that most guides are hired in the city, but most food consumed by tourists is from the local region, the priority will be to establish program training for local residents to become professional guides.



If most food is imported from other areas/countries, then a decision may have to be reached between distributing financial funding for training guides or for production of agricultural goods for tourism. The business surveys could be used to find which option would create more jobs. Depending on priorities, the decisions on which projects to finance might be based on these criteria: cost of project and the degree it will meet its goals (will the agricultural goods truly be acceptable? Will the guides be sufficiently trained?); number of jobs created; which jobs are desirable; job stability (can the agricultural or handicraft goods be if tourism decreases?).

### **Increasing Tourist Spending in the Local Economy**

The opposite of reducing leakage is raising tourist spending. Studies in Latin America and Thailand show that additional revenues can be obtained by developing infrastructure and services nearby the ecotourism attractions (Boo 1990; Dixon and Sherman 1990). These may involve lodging, restaurants or snack bars, souvenir shops, visitor centers, cultural performances, and etc. Figure D6 (a branch of Figure D3) (refer to Appendix D) consist of sample questions for surveys that will assist in finding opportunities that can increase tourism spending and lessen leakage out of the local economy.

Questions pertaining to recent spending patterns are included in these surveys, recognizing recent direct economic effect on local communities (generally, tourists will be most able to recognize the effects of their own spending during travel as individuals rather than as prepaid tour groups).

Cautious planning is specifically essential when developing these additional facilities. It may be best to place the infrastructure outside the park, decreasing ecological effects and in the meantime increasing opportunities for local residents to take part in the tourism market. Nevertheless, placing facilities in the community regions may raise negative social and cultural effects, while reducing the park's ability to manage/control ecological effects.

Care should be taken to avoid indirectly damaging impacts to the local economy, culture, or environment. Handicrafts which consume flora or fauna would be managed when this consumption threatens the species or local traditional customs. Coral and bird feather souvenirs are examples of how production of handicraft can damage natural resources.

Throughout the process of planning, there should be consideration of both local cultural and economic traditions as well as tourists' preferences and wants. For instance, in some situations craft cooperatives will be culturally suitable and appealing to tourists while in others individual dealers will be suitable.

Tourism also places fresh demands on local economies, specifically those in isolated regions. Consumption of local goods can be a significant benefit toward ecotourism, but this particular demand should be stewarded so it does not shock local economies or environment. For instance, tourist need for firewood in Nepal has raised the cost of wood to the Nepalese as well as causing detrimental deforestation. There are often opportunities for diminishing these shocks; in the Annapurna Conservation Area Project (ACAP), trekkers use kerosene instead of firewood (Lindberg & Huber: 110-112).

### **APPENDIX A: Government Extraction on Economic Rent**

Financial analysis is based on the notion that projects should only be addressed if they are profitable. That is, if the benefits of those projects outweigh the costs. The alternative with the

highest net benefit should be selected when there are more alternatives with positive net benefits (Lindberg and Huber:92).

Project benefits and costs normally take place over a period of time (years). One of the central in economic analysis is that future benefits and costs are worth less than the same benefits and costs today. Discounting is the process whereby these future benefits and costs are decreased to a present-day value.

Projects can then be examined on the basis of their "internal rate of return," (IRR) "net present value (NPV) or similar criterion. The IRR is found by calculating the "rate of return" (discount rate) that just offsets the benefits and costs over the life of the project. That is, the present value of all benefits minus costs equal zero. For instance, when a business is considering a project: today it spends \$1 million on marketing and promotion and in a year generates a benefit of \$1.04 million.

If you were to find the marketing and promotion's "rate of return," your answer would be, 4 percent. This can be calculated by using the following equation:  $-\$1,000,000 + \$1,040,000 = 0$ . We could generalize this equation by the following criterion: if a project yields a stream of benefits (B), costs (C) over T that can solve this equation:  $B_0 - C_0 + \frac{B_1 - C_1}{1+P} + \frac{B_2 - C_2}{(1+P)^2} + \dots + \frac{B_T - C_T}{(1+P)^T}$

When the IRR is greater than the cost of borrowing (interest rate), the project is profitable and worthwhile to undertake.

An apparent admissibility criterion is to accept a project if p is greater than a business's opportunity cost of funds, r.

For instance, if a project generates 4 percent while the business can get 3 percent on other investments, the project is worthwhile. When two mutually exclusive projects are admissible, the chosen one is with higher value of p.

Nevertheless, selecting projects on the basis of internal rate of return can lead to bad decisions. Think about project X that needs \$100 today and yields a year later, the generating internal rate of return is 10 percent. On the other hand, project Y needs the expenditure of \$1,000 today, and in a year yields \$1,080, creating an internal rate of return of 8 percent.

According to internal rate of return, X is apparently preferred to Y. Nevertheless, a business generates only \$4 profit on X (\$10 minus \$6 in interest costs), while it generates profit \$20 on Y (\$80 minus \$60 in interest costs). Opposite to the conclusion suggested by the internal rate of return, the business should prefer Y, because it has greater profit. The internal rate of return provides poor guidance when projects are have different sizes.

In contrast, the present value rule provides correct answers even though the projects vary in scale. The present value of X is  $-100 + 110/1.06 = 3.77$ , while that of Y is  $-1,000 + 1080/1.06 = 18.87$ . According to the present value criterion, Y is preferable, as it should (Rosen 1992:246-47).

What is present value? The present value of a future amount of money "is the maximum amount you would be willing to pay today for the right to receive the money in the future" (Rosen 1992:241). An example would be: suppose you are offered a contract and you are guaranteed to get \$100 a year later. The person who offered you the contract is trustworthy, so you do not have any doubts. What is the maximum amount of money that you are willing to pay

today for this contract? It is inviting to say that a contract worth \$100. But this ignores the fact that the \$100 is not payable for a year, and meanwhile you are giving up the interest that could be generated on the money. Why should you pay \$100 today to get \$100 a year later, when you can get \$105 a year later by giving the \$100 to the bank today? Hence, the value today of \$100 payable one year later is less than \$100.

How do you determine the maximum present value? To determine the maximum, you would be willing to waive today in exchange for \$100 payable one year from now, you must determine that particular number, multiplied by  $(1 + .05)$ , which equals \$100. That is  $\$100/(1 + .05)$ , or roughly \$95.24. Hence, when the interest rate is 5 percent, the present value is  $\$100/(1 + .05)$ . To determine the value of money today one year from now, you multiply by one plus the interest rate.

Now consider a contract that pays you \$100 two years in the future. In this instance, the calculation has to include the fact that if you invested \$100 yourself for two years, later it would be worth  $\$100 \times (1.05)^2$ . The maximum you would be willing to pay today for \$100 within two years is the amount multiplied by  $(1 + .05)$ , and yields  $\$100 - \$100(i + .05)$ , or roughly \$90.70.

Generally, when the interest rate is  $r$ , the present value of a commitment to pay  $\$R$  in  $T$  years is  $\$R/(1 + r)^T$ . Hence, in the absence of inflation, a dollar in the future is less than a dollar today and is discounted by an amount that relies on the interest rate and when the money is obtainable. In effect,  $r$  is often considered as the discount rate. Similarly,  $(1 + r)^T$  is referred to as the discount factor for money  $T$  periods in the future. Keep in mind that later in the future the contract is payable (the larger is  $T$ ), the smaller is the present value. The longer you wait for the amount to pay, the less you are willing to pay for it now, other things being constant.

Lastly, consider a commitment to pay  $\$R_0$  today, and  $\$R_1$  one year in the future, and  $\$R_2$  two years in the future, and so on to  $T$  years. What is the value of the deal? It is clear that the answer ( $\$R_0 + \$R_1 + \dots + \$R_T$ ) is wrong due to its assumption that a dollar tomorrow is exactly the same as the dollar today.

To determine the what the Present Value(PV) of a dollar in the future, each yearly amount( $R_t$ ) is divided by the discount rate $(1+r)^t$  which gives the PV of each particular year. Each year should be accounted for its PV so that a summation of all the Present Values should yield the Present Value of the given time span. In other words  $PV = R_0 + R_1/(1+r)^1 + R_2/(1+r)^2 + \dots + R_t/(1+r)^t$  in which each year's present value is found and then added together to the number of years given (Rosen 1992: 241-43).

The NPV is the net value of a project (benefit minus costs) in current dollars (or other form of money) over the life of the project, given a particular interest rate or discount rate. A positive NPV is equivalent to an IRR greater than the cost of money borrowed. Although NPV is a more robust decision making tool than IRR, IRR is more intuitive (Lindberg & Huber: 92).

#### **APPENDIX B: Government Extraction of Economic Rent**

It should be feasible to determine what value each tourist puts on a destination or characteristic. A shadow demand schedule is drawn by adding all the values. The aggregate use-value is the total consumer's surplus below the demand schedule. This is depicted in figure B1 by OPIQI:

For an entirely free good like enjoying a breathtaking vista or watching a Mardi Gras carnival, the consumer's surplus is a value over a zero money price. The only change to the value

may occur from a shift in the shadow demand schedule and a new consumer's surplus is  $OP_2Q_2$ . This intrinsically cannot occur with pure public goods, whose consumption by one making the quality and quantity of goods remain the same for others. An example would be buoyage and coastal navigation. In the case of mixed public good, consumption by one can lessen the utility of others and their individual valuation (Burns 1988). A traffic jam in popular recreation sites lessens visitors, willingness-to-travel values.

Destination services are then distributed between consumers on the basis that those whose utility is most contrarily affected by traffic congestion will fall out of the market, the aggregate destination value is lessened, as no one avoids the congestion disadvantages while traveling.

To some extent, there may a policy option such as auctioning permits to internalize consumer, s surplus into market prices. This may occur whether tourism attractions are owned by private or public sectors. The reasons may as follows: "an ordinary commercial profit opportunity; the need to recoup costs of providing some aspects of the tourism attraction (maintenance, conservation and information in national parks); an attempt to regulate allocation to consumers of, for example a heavily congested attraction" (Bull 1991). Charging consumers at a publicly owned attraction is called "user-pays" principle. An example would be government auctioning permits to tourist operators or businesses for the purpose of maintenance or conservation of the resources.

Placing charges by implication, introduces a supply schedule for the tourism attraction which is relatively inelastic. For example, consider a marshalled carpark that has two fields. The parking space supply is fixed due to land capacity, whereas at low times of uses, marshals may be utilized and only one field available. This explains a simple, two-stepped supply curve, which at other than less utilization hold zero elasticity. A general version is illustrated below, figure B2.

If the operator or owner of the tourist attraction give a starting price at  $P_c$ , the revenue generated is the area  $OP_cEQ_c$ , which came from  $OPIQ_1$ , the consumer's surplus. In effect, this lessens consumer's surplus to the area above the price level, which is  $P_cPIE$ . Note that this has lessened the aggregate public valuation of the tourist attraction to  $OPIEQ_c$ , since those visitors that valued their trip at less than  $P_c$  are no longer in the market.

An attribute of many tourism attractions is the factor of "pure economic rent" included. Economic rent, as illustrated by Ricardo, happens when supply of a factor of production is inelastic, and the revenue-price obtained for the factor is needless to call forth further supplies (Samuelson 1989). From the above example,  $S_1EQ_c$  of revenue associates to increase supply of the attraction, and the rent is represented by the bigger portion  $OP_cES_1$ . A higher price could be imposed, which might raise the value of rent which is sometimes called producer's surplus.

Rent is maximized when alternative uses are not present for resources in the tourism sector. The appearance of alternative uses, in total rather than for a single attraction, would cause supply elastic and hence lessen the opportunity for pure rent.

Tourism prospers in many regions due to its ability to use land, water resources, historic buildings and which have small value to other areas/sectors. Their value to tourist understanding is often further strengthened by the absence of conflicting industrial activity. Economic rent on public tourism resources is consequently high when user charges are levied.

In the case of auction method of selling permits, it has similar notion with regards to consumer's surplus and producer's surplus. That is, the government policy on regulating

maintenance and conservation is represented by the supply curve, S or MC, while the private entrepreneurs demand of permits is represented by the demand curve, D or MB. The price ( $P_e$ ) of permits is determined by the equilibrium where marginal benefit (demand of permits) equal marginal cost (supply of permits). At this point,  $Q_e$  is determined and that is the quantity demand of permits. This  $Q_e$  determined the fixed supply of permits that the government should supply. This is illustrated in figure B3.

The government's purpose of auctioning permits is to try and extract the consumer's surplus which is the triangle above  $P_eQ$  to add to its surplus (producer's) the triangle below  $P_eQ$ . In addition, the government can only auction permits to the point at  $Q_c$ . Figure B4 demonstrates what has been briefly discussed.

### **APPENDIX C: An Assessment on the Survey of Ecotourism Sites on Pohnpei**

This past summer, I performed my internship project with the Nature Conservancy, the Tourist Commission and the Division of Forestry in Pohnpei, Micronesia under the supervision of Bill Raynor, Youser Anson, and Herson Anson, respectively. I worked primarily with the Watershed Management Project (WMP), funded by the Asian Development Bank and the Head Field Representative for the WMP, Bill Raynor. Raynor's main objective for the WMP employees is to "work with the rural communities to identify compatible development issues and ways to improve standards of living while maintaining the cultural and natural environment (Raynor and Van't Slot 1995: iv).

There are many questions but few answers related to Pohnpei's future. What would Pohnpeians do if the Compact money (financial aid given by the U.S. government) is cut in the year 2001? What would happen to the economy, the labor market, the local businesses? At this point, Pohnpei is desperate, inviting almost any economic opportunity that enters the door. Critical decisions have to be made on the use and management of its scarce resources. One of Pohnpei's best opportunities is ecotourism. Why ecotourism? Why doesn't Pohnpei promote and invest in casinos, golf courses, or mass tourism? Ecotourism has unique and positive aspects: ecotourism is a type of tourism that has low impact; it provides job and income opportunities; it provides incentives to protect and conserve natural resources; generated profit does not leak out of the local economy; and it is a community-based development.

Tourism is considered an infant industry in the Federated States of Micronesia (FSM). In addition, tourism is a significant contribution to the economy in terms of employment, export, and income. The visitor industry on Pohnpei is the single largest earner of foreign exchange among the four states of FSM (Chunk, Kosrae and Yap).

Tourism is the fastest growing industry in the whole world. The fastest component of tourism is ecotourism. Studies conducted in other countries like Australia, Thailand, and Kenya show that ecotourism is a significant contributor to their wealth, economic growth, and sustainable economic development. Australia, for example, is a highly rated ecotourism destination for the Japanese. They are attracted to rainforest walks, boat tours, and the barrier reefs of Queensland. Kenya, with its big game parks, earns \$350 million per year from tourists who visit to see the elephants, tigers, and spectacular scenery. Ecotourism is expanding in Thailand as well. Twenty percent of the five million tourists that visited Thailand in 1990 primarily went to experience its nature tourism sites. Pohnpei's ecological attractions would allow it to exploit this growing ecotourism sector of the international tourism market.

My internship was spent primarily developing a database on the potential ecotourism sites of Pohnpei. During my fieldwork, I went to communities and evaluated the ecotourism sites using a survey questionnaire. Additionally, I took pictures of the sites, conducted interviews with the site owners or operators, and inquired about any legends or history behind the sites. After my fieldwork, the collected information was entered into a database.

These factors and components made my project genuinely interesting. As a Pohnpeian, I learned new things about my own island.

## **Major Findings**

### **Ownership**

During my internship, I visited a total of 21 sites. Seventeen (roughly 80 percent) are privately owned while four (about 20 percent) belong to the public.

### **Site Facility and Tourist Accessibility**

Based on the data collected, the sites facility range from paved to unpaved road, through trail, graded to ungraded road, and to boat. Four sites are accessible by paved road, five by unpaved road, eight by trail, two by boat, one by graded road, and one by ungraded road.

With tourist accessibility, ten sites are currently accessible, three are accessible upon request (visitors have to request through the Tourist Commission to get permission from owners of the sites for visits), and the rest are currently not accessible, but the owners are interested in developing the sites.

## **Site Attributes and Attractions**

There are different types of sites and attractions. The result on the types of sites and attractions do not correspond to the total number on sites (21), because each site possesses more than one type of site and attractions.

## **Site Quality**

### **Neatness**

The quality is based on the sites, neatness. Neatness is defined as to whether the site is being kept very neat and clean or is being littered and unmaintained. The scale that is being utilized in measuring the site's neatness ranks from one to five.

A site is considered neat and clean when its scale rank 1 or 2, and with the scale of 4 or 5 showing a littered or unmaintained site. I was only able to evaluate the developed sites. The result came out with seven sites being clean and neat, while four were being littered and unmaintained.

### **Current Development Fit with Theme**

With the development of the sites, a site is evaluated based on how its current development fits ecotourism's theme. In other words, a site's development can be well-fitted with ecotourism's theme or be very inappropriate. Development of a site is constructing a trail using local materials rather than unnatural materials like metals or cement blocks.

The result of the evaluation came out with eight sites have well-fitted development with the ecotourism's theme, while three have inappropriate development.

## **Fee**

All developed and privately owned sites charge fees to visitors and all public sites are free. Fees are charged to maintain trails and to pay tour guides and cultural performers. Fees are imposed on visitors using trails which cost \$1.50 to \$10.00. The cost of tour guides starts at \$3.00 and it can increase to \$10.00. The prices varied due to the unique attractions or activities that visitors may experience or interpretation that tour guides presented to visitors. At some trails, visitors may not need any guide which makes it reasonably cheap. With presentation, the prices range from \$10.00 to \$25.00.

Again, the price varied because, a cultural center charges \$10.00 if they only perform cultural dances, but if they add more cultural performances like the kava ceremony and preparation of local food, then the price increases.

## **Niches and Potential Growth Areas**

The discussion on niches and growth are in the summary section.

## **Discussion**

My project has revealed some interesting findings which highlight ecotourism's 'potential and some of the problems that need to be addressed. Ecotourism is one of Pohnpei's best options under its current economic situation. Moreover, Pohnpei has unique natural resources suitable for ecotourism, and it has the products tourists desire. The ecotourism sector in Pohnpei is considered small scale. That is, the ecotourism businesses are being operated or owned by small groups of people and the size of the ecotourism sites are small in size (carrying capacity is limited), which leads to low quantity of visitors.

There are three important reasons why ecotourism is a potential business for Pohnpei. First, Pohnpei is unique for its rich and luscious natural resources, cultural pride and interesting historical background. Pohnpei is the only island among the four states of the Federated States of Micronesia that has rich upland and mangrove forests. Nahna Laud (Big Mountain) is a good example of an upland forest. This mountain is one of the few cloud forests in Micronesia. Endangered species and plants are found only there.

The Enipein Marine Park has some activities that include tours on canoes through the extensive mangrove forests, an opportunity to enjoy the wild mangrove birds and a chance to learn about the mangrove forest's ecosystem. Other attractions include waterfalls like Kepirohi. Visitors can enjoy a swim after visiting the Venice of Micronesia, Nan Madol. Nan Madol is a great example of an historical site where visitors can appreciate listening to how the first people of Pohnpei arrived and lived. Nan Madol consists of one hundred plus artificial islands that each serve different ritual or ceremonial purposes. With regard to culture, the Nett Cultural Center provides cultural dances, a "sakau" or kava ceremony and local style food preparation. This center can have visitors taste the culture and dances of Pohnpei.

Next, ecotourism has positive benefits for WMP because it educates people about the value of preserving and protecting the island's natural resources. It also encourages people to plan in

ways to limit damage to the ecosystem's integrity. Moreover, it is a way to identify the tourist attractions in the communities.

Lastly, the development of the database on the ecotourism sites is a key element to promoting and advertising the unknown and known sites. This is the final product of my internship project. This guidebook will also fulfill a Directed Study class at the University of Hawaii at Hilo. I would like to have this guidebook published some day. This tour guidebook would offer information on site location, accessibility, contact names as well as cultural guidelines and environmental insights for foreign visitors. In this sense, it is intended to be both informational and educational.

The problems that need to be addressed were identified during my site visits. Such issues include: lack of familiarity with ecotourism, lack of skilled tour guides and interpreters, and littering. What can be done about these problems? The lack of familiarity with ecotourism has resulted in the development of sites with colliding themes. The Tourist Commission is now developing the sites and ensuring that the overall development fits ecotourism's theme. To address the lack of skilled tour guides and interpreters, the College of Micronesia in Pohnpei is initiating the first step by offering a tour guide training course in 1995. I will include a complete list of these certified tour guides in the tour guidebook. Lastly, with littering, residents living above a natural site (waterfall) often throw rubbish into the river, which is not attractive for visitors. The WMP and Tourist Commission are strongly encouraging residents to avoid littering due to its detrimental impact on the environment.

Overall, these are some of the findings that I discovered during my internship. The internship helped me realize that Pohnpei has potential in ecotourism. There are niches in the ecotourism market for Pohnpei. Such niches include marketing homestay visits and targeting Japanese young single working ladies with adventurous spirits. In addition, Pohnpei can provide and promote more activities and develop sites with WWII ruins. This would lengthen visitor stays, increase visitor spending, and influence repeat customers. Pohnpei can substantially benefit

## **Major Findings**

### **I. OWNERSHIP**

\* Private - 17 sites

\* Public - 4 sites

### **II. SITE FACILITY**

\* Paved - 4

\* Unpaved - 5

\* Trail - 8

\* Boat - 2

\* Graded - 1

\* Ungraded - 1



### **III. TOURIST ACCESSIBILITY**

- \* Currently Accessible to Tourists - 10
- \* Accessible upon Request - 3
- \* Currently not Accessible, but owner is interested and site is developing - 8

### **IV. SITE ATTRIBUTES**

#### **A. TYPE OF SITE**

- \* Trail - 14
- \* Natural - 12
- \* Recreation - 12
- \* Historical - 10
- \* Archaeological - 6
- \* Cultural - 5
- \* Marine - 1

#### **B. ATTRACTIONS**

- \* Hildng Trail - 13
- \* Archaeological - 10
- \* Vista - 8
- \* Waterfall - 7
- \* Swimming - 8
- \* Historical Structure - 6
- \* Upland Forest - 5
- \* Mangrove Canal - 4
- \* Cultural Display - 3
- \* Birds/Wildlife 2
- \* Traditional Handicrafts - 1

### **VI. FEE**

- \* All Developed & Private Sites: CHARGE Fee
- \* All Public Sites : FREE
  - Trail: Price - \$1.50 - 10.00
  - Guide: \$3.00 - \$10.00
  - Presentation: \$10.00 - \$25.00

### **VII. NICHE & POTENTIAL GROWTH AREAS**

#### **A. NICHE**

- \* Homestays
- \* Young Japanese Single Working Ladies

## B. POTENTIAL GROWTH AREAS

- \* Promote more activities
- \* Develop sites with WWII ruins

### RESULT:

- \* Lengthen stay
- \* Increase more visitors and repeat visitors
- \* Spend more money

## Appendix D: Table and Graphs

Table 4-2. Maximizing Revenue from Tourism Fees: The Case of Rwanda's Gorilla Tourism  
(All figures in US Dollars)

YEAR	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
FEE INCOME	7,072	8,954	10,195	12,240	36,513	88,837	114,917	135,281	261,198	298,780	348,276	378,821	512,195	1,000,000
EXPENSES	16,027	20,716	34,244	44,625	56,633	84,210	95,410	97,405	113,873	187,847	168,791	196,586	197,561	197,561
PROFIT/(loss)	(8,955)	(11,762)	(24,049)	(32,385)	(20,120)	4,627	19,507	37,876	147,325	110,933	179,485	182,235	314,634	802,439

Note: Expenses include salaries for guides and guards.

Source: Ministere de Plan, 1989; Vedder and Weber, 1990.

Figure 4-2: Appropriate Entrance Fees for Non-residents:  
Opinions at Three Costa Rican Parks

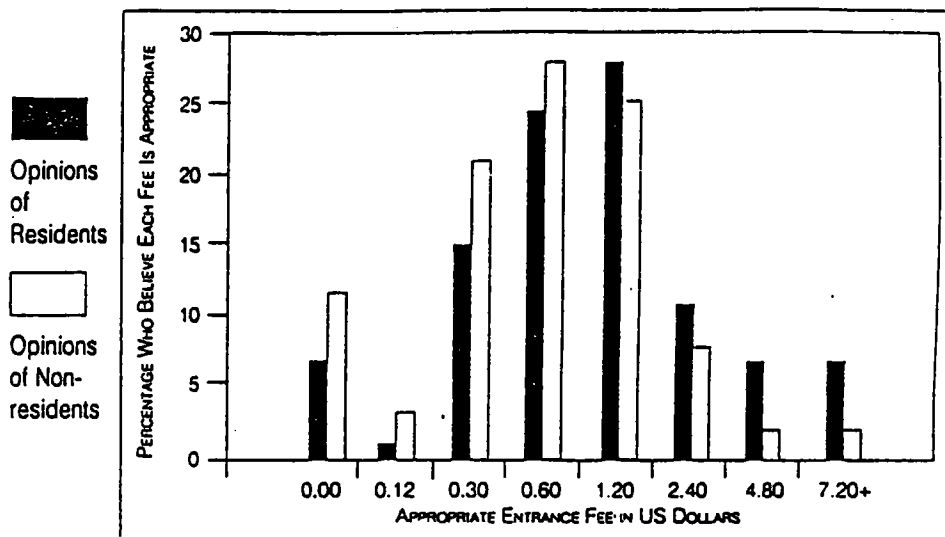


Figure 1.

**Figure 4-3. Sample Questions to Determine Viability  
of Expanding Infrastructure and Services**

*Management Goal #1: To collect baseline information about visitors.*

Question: In which country do you live?

Question: How many times have you visited this country?

*Management Goal #2: To determine the level of interest in ecotourism destinations.*

Question: Have you visited any national parks or other natural attractions in this country?

If yes, which ones?

If no, would you be interested in doing so on future visits?

Very Probably  Probably  Possibly  Probably not  Don't Know

*Management Goal #3: To determine the level of interest in supplemental attractions.*

Question: Would you be interested in visiting a botanic garden, archaeological site, historical museum, or other natural or cultural attraction?

Very Probably  Probably  Possibly  Probably not  Don't Know

*Management Goal #4: To determine whether investment in additional facilities should be considered.*

Question: Would you spend one to three days of a future visit in the area of this park if more amenities or facilities were available?

Very Probably  Probably  Possibly  Probably not  Don't Know

Question: What facilities or services do you feel would greatly improve the quality of your experience here?

- |                   |                      |                        |
|-------------------|----------------------|------------------------|
| 1. Picnic Area    | 4. Information signs | 7. Brochures           |
| 2. Restaurant/Bar | 5. Hiking trails     | 8. Other (please list) |
| 3. Visitor Center | 6. Trail guides      | _____                  |

Question: If we were to develop these facilities or services, would you be willing to pay higher fees for the higher quality experience?

Source: Adapted from Huber and Park, 1991.

Figure 2.

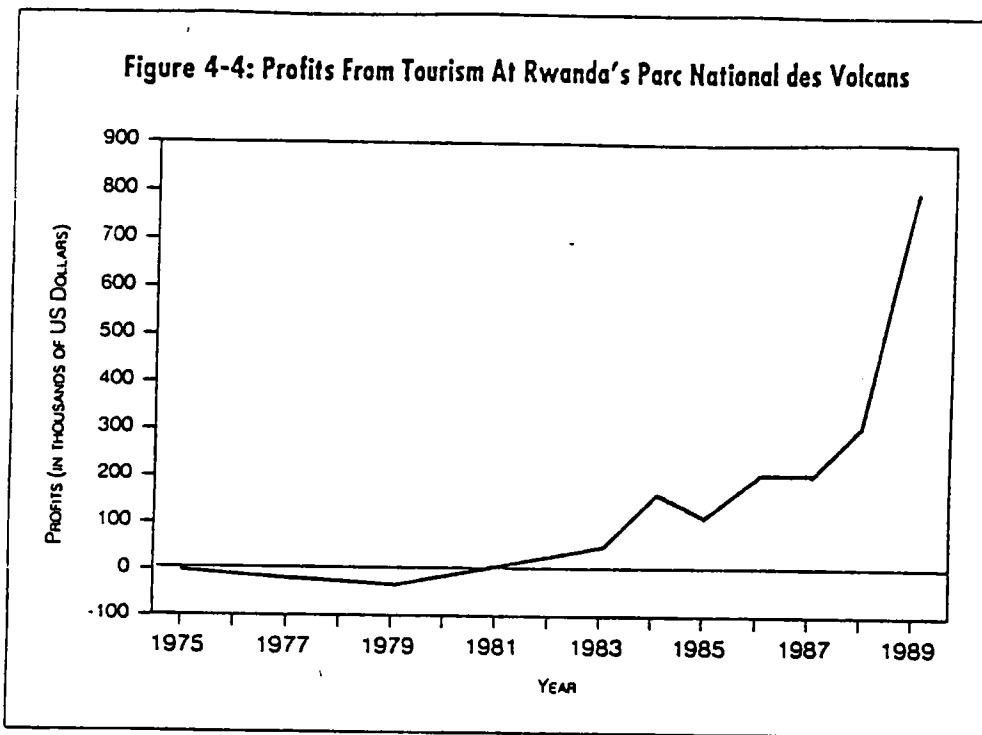


Figure 3.

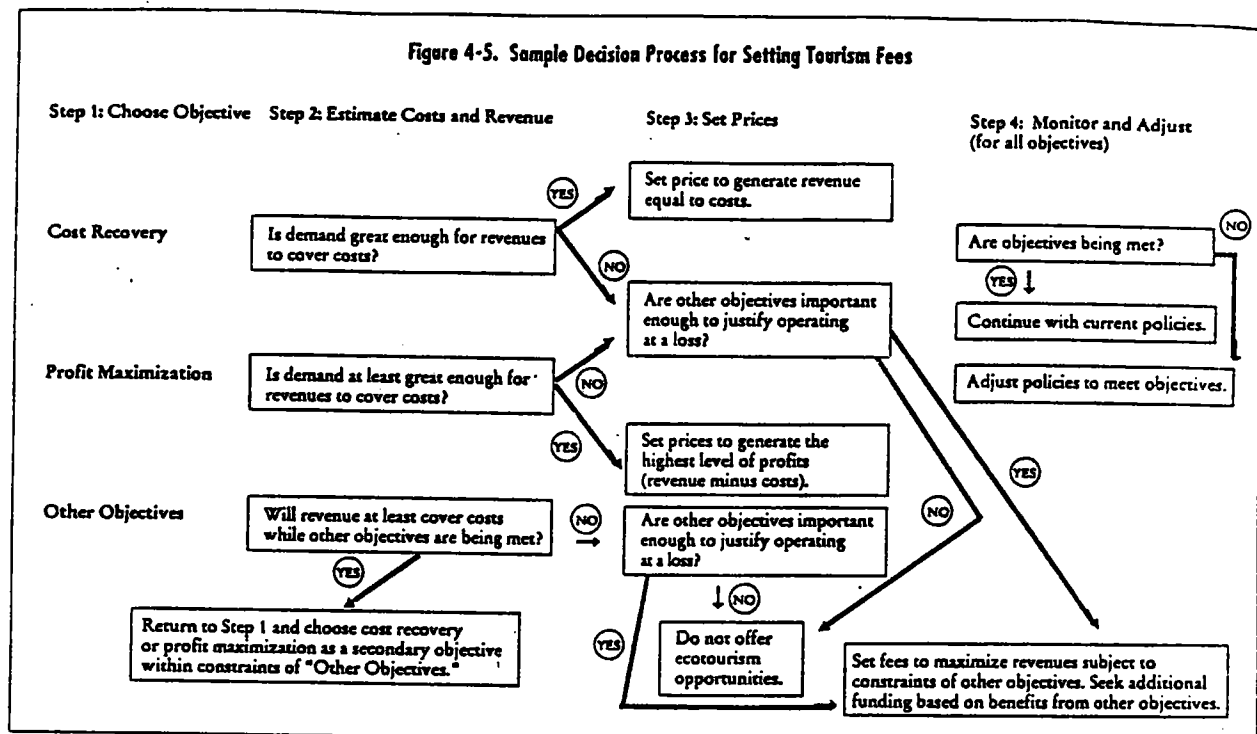


Figure 4.

Figure 4-6. Social Benefit Cost Analysis for the Korup Project  
(In thousands of British pounds, base case results, 8 percent discount rate, 1989)

BENEFITS		COSTS	
<b>DIRECT BENEFITS</b>		<b>DIRECT COSTS</b>	
Watershed protection of fisheries	3,776	Capital costs excluding roads (1989-1995)	7,697
Sustained forest use	3,291	Capital costs of roads	1,859
Control of flood risk	1,578	Long-term operating costs (post-1995)	4,761
Tourism	1,360	Labor credit (negative cost)	(2,404)
Replaced subsistence production	997		
Soil fertility maintenance	532	<b>OPPORTUNITY COSTS</b>	
Genetic value	481	Lost forest use	2,620
		Lost stumpage value	706
<b>INDUCED BENEFITS</b>		<b>TOTAL COSTS</b>	<b>15,239</b>
Induced cash crops	3,216		
Agricultural productivity increase	905		
Induced forestry	207	<b>NET BENEFIT:</b>	<b>1,084</b>
<b>TOTAL BENEFITS</b>	<b>16,323</b>	<b>IRR TO THE PROJECT:</b>	<b>8.3%</b>
		<b>IRR TO THE COUNTRY:</b>	<b>13.4%</b>

Source: Adapted from Dixon and Sherman, 1990 (original source is Ruitenbeek, 1989).

Figure 5.

Figure 4-7. Sample Survey Questions for Identifying Opportunities  
to Increase Tourism Spending and Reduce Leakage

If we developed lodging or restaurant facilities here would you use them?

Definitely  Probably  Unlikely  No

What type of facilities would you prefer?

High quality and expensive  Average quality and price   
Basic and inexpensive

Did you purchase any souvenirs during your trip? If yes, can you give us an approximation of how much they cost?

If we expanded our selection of souvenirs, would you buy more?

What kinds of souvenirs are you most interested in?

1. Local crafts; what types? \_\_\_\_\_
2. Books and other information materials.
3. T-shirts and other clothing.
4. Other items; please list: \_\_\_\_\_

Did you eat food which, as far as you could tell, was special to this region?  
Yes  No  If not, why not?

1. It was not offered to me.
2. I was concerned about the quality of the food.
3. I did not like the taste of local food.

If we were to develop XX, would you be interested and willing to pay to participate in this activity? (XX could be a supplemental activity such as a visitor center, a cultural performance, etc.)

Figure 6.

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**ENVIRONMENTAL AND PUBLIC  
HEALTH EDUCATION PROJECT, AND  
HEALTH CAREER SUMMER TRAINING  
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Micronesia has three of the most newborn nations in the world: Federated States of Micronesia, Republic of the Marshall Islands, and the Republic of Belau. As population grows, the leaders are faced with more demands for economic development. If Micronesia is to be economically developed, there are many things that need to be improved. As of today the infrastructure is very poor. Because the Micronesian newborn nations are very small and have limited resources, they depend very much on foreign aid for their development. Another problem is that these nations lack manpower too. They have a long way to go in order to achieve self-sufficiency.

The types of foreign aid that are available to these nations vary from funds to manpower. This summer, I had the opportunity to go back to the Federated States of Micronesia and do an internship, where I worked with a United Nations volunteer. The project that I worked on was a water project provided by the United Nations to help improve the FSM water system. These volunteers were sent out to different areas in FSM to do research on water, to develop a water system that will be reliable to the people as well as the economic development of the area. Because the four states in Micronesia, Chuuk, Kosrae, Pohnpei, and Waap, are made up of groups of islands, water projects are proposed for each different island. I was working in Chuuk on the island of Weno, which is the center of Chuuk State.

The original proposed work was to conduct a door-to-door survey on the 670 private households that are connected to the present water system on Weno. Unfortunately, I was only able to visit 150 houses.

There were four students from Xavier High School, a Catholic school, that were working with me. They were doing this as their Community Service, a requirement for them to graduate. One of these students quit during the third week of the project. The other three students helped me conducted the survey. Everyday, we spent our morning visiting houses. When we visited a house, we asked permission to check their waters, rainwater and well, and we distributed posters and leaflets containing information of how to conserve water and how to keep their water clean. We also checked for leakage in the pipes. We interviewed them and collected water samples for our testing. During the interviews we asked them questions about how much water they get everyday, how many times they clean their tanks or well, and the dimension of their water catchment (see attached page). In the afternoon, we tested the samples we had collected. We tested for total coliform, fecal coliform, pH, conductivity, turbidity, and hardness. We also test for iron, but only a couple of times because of limited resources. After this we recorded the result from the previous day. I usually reported the leakage, if any, to our supervisor. If there were any complaints from the consumers, my supervisors and I would discussed them. In the afternoon, people who were interested in the quality of their water would called us to find out about their water test results.

### Rainwater Quality Test Results

pH	Total coliform	fecal coliform (E. Coli)	pH	Total coliform	fecal coliform (E. Coli)
1. 6.5	2	0	34. 7.0	36	0
2. 6.5	2	0	35. 7.0	75	0
3. 7.5	100	0	36. 7.0	100	0
4. 7.0	100	0	37. 6.8	100	0
5. 6.5	3	0	38. 6.5	23	0
6. 6.0	0	0	39. 6.0	7	0
7. 6.5	100	0	40. 7.7	50	+
8. 6.5	3	0	41. 7.7	50	1
9. 7.5	1	0	42. 7.5	100	0
10. 6.0	2	0	43. 7.5	100	0
11. 7.0	27	0	44. 6.5	100	0
12. 6.0	0	0	45. 7.0	100	0
13. 6.3	0	0	46. 8.5	50	0
14. 7.5	100	0	47. 8.0	100	0
15. 7.3	400	0	48. 6.0	8	0
16. 6.0	100	0	49. 7.0	15	0
17. 6.4	100	0	50. 7.3	6	0
18. 6.5	100	0	51. 7.2	200	0
19. 6.5	100	0	52. 7.3	100	0
20. 7.5	100	0	53. 8.2	200	0
21. 7.5	100	0	54. 7.2	1	0
22. 7.5	100	0	55. 6.8	100	0
23. 7.5	50	0	56. 6.5	100	0
24. 6.5	27	0	57. 8.5	100	0
25. 6.5	20	0	56. 7.5	22	0
26. 6.5	75	0	57. 8.5	2	0
27. 7.5	75	0	58. 7.5	50	0
28. 7.0	100	0	59. 7.5	100	0
29. 6.5	5	0	60. 6.5	200	6
30. 9.0	200	0	61. 6.5	+	-
31. 7.0	100	0	62. 7.5	+	-
32. 6.0	22	0	63. 7.0	+	-
33. 6.3	39	0	64. 9.0	+	-

### Rainwater Quality Test Results

pH	Total coliform	Fecal coliform (E. Coli)	pH	Total coliform	Fecal coliform (E. Coli)
65. 7.0	+	-	74. 7.0	+	+
66. 6.5	+	-	75. 6.5	+	+
67. 7.0	+	-	76. 7.5	+	?
68. 7.0	+	-	77. 7.5	+	+
69. 6.8	+	-	78. 8.2	+	+
70. 7.0	+	+	79. 8.2	+	+
71. 7.5	+	+	80. 7.5	+	+
72. 8.0	+	+	81. 6.5	+	+
73. 7.5	+	+	82. 7.5	+	-

Toward the end of our project, the supplies were short and, as a result, our testing kits were different. The first kit we used was a Japanese brand. With this particular one we were able to read the numbers of coliforms that grew on the medium. There were two separate media for total coliform and fecal coliform. With this kit we were only using 5 to 10 drops of the water collected from the households. If there are 100 or more number of coliform, the water may be hazardous to drink.

The second one that we used was the standard total coliform test with the 100 ml volume. With this one, we could only read the test as positive, if the initial color changed to a darker color. And we had to use a florescent light to detect for the presence of E. Coli. When the water tests positive, it is not safe to drink. Rainwater is the main source of daily drink on the island of Weno. According to our tests the quality of most of the rainwater indicated it was not safe to drink. When we asked how they treat their water, most of them cook the water to kill the bacteria. Out of curiosity, I tested cooked water, and the results are in the next table.

### Heated Rainwater Quality Test Results

	pH	Total coliform	Fecal coliform (E. Coli)
1.	7.0	10	0
2.	6.8	100	0
3.	9.0	+	-

The water tested above was boiled for 30 minutes. We recommended that they boil their water for an hour or more.

### Dug Well Water Quality Test Results

	pH	Total coliform	Fecal coliform (E. Coli)
1.	6.5	?	1
2.	7.0	?	28
3.	6.5	100	0
4.	6.5	20	0
5.	6.0	100	0
6.	6.5	15	0
7.	7.0	200	0
8.	6.0	100	0
9.	7.5	100	0
10.	6.0	200	1
11.	7.0	100	0
12.	7.5	12	0
13.	7.5	+	+
14.	7.5	+	+
15.	7.4	+	+

During drought, the people of Weno turned to their traditional source of water, which is the well. Because Weno often goes through seasons of drought, we decided to tests the few existing wells. Dug wells have a higher number of fecal coliform than the rainwater catchment.

### Springwater Quality Test Results

	pH	Total coliform	Fecal coliform (E. Coli)
1.	6.5	26	0
2.	7.0	100	0
3.	6.8	100	50
4.	6.5	100	0
5.	7.5	100	0

Weno also has few springs, which are the most reliable source of water. During drought these spring may also be use for drinking. Most of the springs today are taken care of and protected from getting contaminated with any coliform. Spring #3 in the Spring Water Quality Test Results was not being taking care of. It has the highest number of fecal coliform.

I did not include the results from the conductivity, turbidity, hardness, and irons because they were incomplete. I would like to mention that at places like Chuuk, resources are very limited and it could take time to get orders through; my internship time was also limited, and the completion date was fixed. The first kit that was used during the first part of the testing had expired. The results may not be accurate. Although the results may not be accurate, the knowledge that I, as well as my students, gained was tremendous. If I have the chance and the proper kits to do another test, I am better equipped and ready to do it again with more accuracy.

The second part of my internship was teaching at Xavier High School. For the first time, Xavier High School hosted a Health Career Summer Training Institute for 25 of the top high school students in Micronesia. This training offered courses on mathematics, english, and research papers and presentation of the research. This project was six weeks long.

My responsibility in this program was to teach physical fitness. I conducted daily exercises, facilitated a research on the hospitals in Micronesia and the types of services that are available, and facilitated a group of six students on a two-week research project on suicide.

The purpose of this program is to provide information and motivation to the young Micronesian about the health field, especially to train those motivated and interested in the health field to be well prepared and aware of demands and expectations of an education in health.

Working on both projects was a very unique experience because I was learning from different aspects. I learned about some of the health problem by direct contact with the community members, and I learned from the Health Career Summer Training Institute program. I learned that both programs were both beneficial to the development of the Federated States of Micronesia. The Water Survey project will help improve the infrastructure and the Health Career Summer Training Institute will help improve the manpower. Both of these projects are exactly what is needed in Micronesia today.

# **MARKET STUDY OF GIANT CLAMS IN AMERICAN SAMOA**

by  
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## **Introduction**

Giant clams, family Tridacnid, are biologically well adapted for cultivation and domestication. They reproduce readily in captivity and have a short, simple larval phase. Young giant clams are hardy and fast growing. Tridacnids are essentially immobile and amenable to cage culture. Perhaps most important, however, is their remarkable ability to feed themselves through symbiosis with resident microscopic algae, the zooxanthellae. This unusual relationship simplifies life considerably both for the clams themselves and for the farmers who cultivate them. Additionally, tridacnids are truly a product of a hundred uses. The meat finds its way into many seafood dishes and the shell is in demand for marketing jewelry, ornaments, craftware and even building materials. Small giant clams also make great aquarium pets.

Tridacnids are widespread in American Samoa. Samoa is the native name of the group of volcanic islands in Central Polynesia long known as the "Navigators Islands" and are an American Territory. It is situated about 3,000 miles from Sydney, Australia, at 13 degrees and 15 degrees south latitude, and 168 degrees and 173 degrees west longitude. American Samoa has a population close to 50,000 people. The islands in many places are surrounded by coral reefs, which skirt the shore and form lagoons. These reefs are valuable, by providing good fishing grounds and secure and pleasant voyaging in canoes or boats.

In summer 1995, I was elected to participate in the Micronesia and American Samoa Student Internship Program (MASSIP). The main purpose of my internship, was to help in a market study of giant clams. The market study was conducted to determine the size of a commercial market in American Samoa for giant clams. If there is sufficient demand for giant clams, jobs can be created for farmers who were interested in raising them. Additionally, by selling cultured clams to local stores and restaurants, farmers would provide a consistent supply of clams to the market which would give clams on the reefs a chance to repopulate.

The government of American Samoa is trying to encourage cultivation of giant clams. It's giant clam hatchery at Fogagogo is always open to the public for visits, questions, or as a sightseeing place for tourists. Forms have also been posted at the Marine and Wildlife Resource Department (DMWR) main office, the hatchery itself, and in newspapers to get the attention of those who may be interested in raising giant clams. Interested farmers come to the hatchery and fill out application forms which give the hatchery supervisor an idea of their willingness to spend some of their time raising clams. After approving their applications, hatchery employees then check out the rearing site by snorkeling. Advice for preparation of a fence for protection is given to the new farmers. When preparations are complete, clams are delivered by the hatchery employees to the farms and are set within the fence on the reef. To start a farm, five 25-inch clams are given free and more can be bought from the hatchery at \$3 a piece.

There are currently 35 giant clam farms in American Samoa including nine from Manu'a, a nearby island. More farmers are also interested.



# Methods

## Training

My internship consisted of four parts: training, promotional sale, taste test, and market study. The training portion took the first two weeks. The other activities were completed during the remaining six weeks of the internship.

I was trained in hatchery maintenance, like cleaning tanks and washing away the algae which is really a problem with the young clams. I was also trained to make zooxanthellae which is a microscopic algae symbiont of the clams. Additionally, I was trained to transfer clam larvae from tank to tank in order to keep any bacteria, dirt, and especially algae away so that there would be no interference with the growth of clams. Spawning was the biggest and most exciting part of my training because it was something new and amazing for me to actually spawn the clams. Later, I learned data collection and interviewing techniques for use in the market study.

## Promotional Sale

DMWR had a promotional sale on Wednesday June 21, 1995 at 9:00 a.m. – 11:00 in the parking lot. The promotional sale was conducted to promote local mariculture giant clams as a food product and to get feedback from the consumers.

Promotional announcements were made on television and radio prior to the sale. Approximately 500 giant clams of *Tridacna derasa* were graded into three different sizes and offered for sale at special promotional prices. The three different sizes used for the promotional sale were: Size A, five inches, was sold for \$2.50, Size B, seven inches, was sold for \$3, and Size C, nine inches was sold for \$5. Three large tables were set up in an "L" shape with the shorter leg of the L having the DMWR employees to take the order and the cashier. The longer leg of the L were product samples and other employees to fill the orders. Customers stood single file in one line and placed their orders with the order taker based on the samples displayed on the table tops. The order taker documented the order and recorded each customer's ethnicity. After the order was taken, the form was passed on to the cashier who collected the cash for the purchase and handed part of the form to an employee who was filling orders at the long leg of the L, who then filled the order from large stock of clams behind the tables.

## Taste Test

On August 2, 1995, DMWR conducted a taste test. The taste test was performed to compare *Hippopus hippopus* with the *T. derasa* in the sensory categories of taste, appearance, smell, texture, and overall preference. The three main objectives of the taste test were first to establish whether there was any significant level of preference between two species of giant clams being considered for commercial production in American Samoa. Second, to obtain data on serving size and price expectations for giant clams served as restaurant items. And third to obtain demographic data on the taste test participants, such as nationality. There were 25 randomly selected participants from different villages and professions who expressed an interest in trying giant clams. The two different types of clams were labeled A for *H. hippopus* and B for *T. derasa*. The participants were to rate both sample A and B on appearance, smell, texture, flavor, and overall rating. There were also three serving sizes marked ONE as the largest serving, TWO as the medium, and THREE as the smallest. These servings were showed to the participants so

they could rate them using a scale of one to three according to what they would expect to receive as a single serving when they order giant clams, and an estimated price they would expect to pay for each serving.

### **Market Study**

The market test established a test distribution system to evaluate two potential marketing channels for giant clams as food products in American Samoa restaurants and retail stores. Three criteria were used in the selection of participating stores and restaurants in the market test. The stores and restaurant were selected based on: (1) compliance with the DMWR's seafood inspection program; (2) reputation for serving or selling seafood; and (3) location. Five stores and one restaurant were selected to participate in the market test. The market test was held for one month period during July to August of 1995. During this period, giant clams of *T. derasa* were distributed to selected stores and restaurants for sale to the public. Survey forms (customer questionnaire for restaurants and customer questionnaire for stores are included in the list of illustrations to this report) were to be filled out at every purchase of the clams no matter if the customers were repeating. Every Tuesday and Friday for the entire month, I would go to all the participating stores and restaurant to deliver their new sets (10 six-inch clams). The delivery person and I would replace the unsold clams from the stores and restaurant with new clams. At the same time I would pick up all the survey forms that had been filled out by the customers together with the store's or restaurant's payment of the sold clams on a consignment basis of \$1.50 a clam. The clams were sold whole because other people tend to like the shell for decorations.

## **Results**

### **Promotional Sale**

The outcome of the promotional sale was very promising. The sale was promoted to the general public one day prior to its onset and there was a turnout of over 100 people. The sale was well attended and 98 purchases were recorded. Of the initial inventory of 549 clams, 400 were sold, generating \$1,325 in revenue. Seventy-three percent of the total inventory of clams was sold. The revenue from the clams sold as a percentage of the total possible revenue was 83 percent. The higher revenue expressed as a percentage of total possible revenue occurred because of the large-and medium-size clams sold out first. Most of the remaining 149 clams were size A (five inch) and would have commanded a lower price. The ethnic makeup of the purchasers was 95 percent Samoan. The remaining 5 percent of the purchasers were White and Asian. On average, a purchaser of giant clams was of Samoan ethnicity, purchased four clams and spent \$13.52 on the purchase. Larger size clams were more popular with the largest clams (nine inch) sold out entirely in the first hour of the sale.

### **Taste Test**

Participants rated both species favorably in all sensory categories. The *T. derasa* species was preferred in the "Smell" and "Appearance" categories (chart 2.3 and 2.1). There appear to be no significant preference between the two species in the "Flavor" and "Texture" categories (chart 2.5 and 2.7). A marginally significant preference for the *T. derasa* species appeared in the "Overall" category (chart 2.9).

Serving sizes prepared with five-and seven-inch clams were smaller than what the respondent expected, and a serving size prepared using a nine-inch clam was more than what they would expect (chart 2.11). The participants, on average, expect to pay the following prices for different serving sizes of giant clams (prepared as restaurant items): \$2.50 for a serving prepared with a five-inch clam, \$4.50 for a serving prepared with a seven-inch clam, and \$7.30 for a serving prepared with a nine-inch clam.

### **Market Study**

Participating stores sold clams to customers at several different prices. Data collected revealed that there was little or no relationship between volume of sales at each store and average prices. Other factors such as population density and store popularity probably influenced the volume of sales at each store. Of the people that reported they have tried giant clams, 58 percent were repeat purchasers. Both the repeated purchase behavior and the behavioral intention to purchase giant clams if they were available were strong indicators that the typical consumer was likely to be a repeat purchaser of giant clams.

### **Discussion**

There is certainly a market for giant clams in American Samoa and farming the giant clams may be profitable. Starting clam farms would help repopulate clams on the reefs and not only that it could create businesses for the farmers themselves. Profitability is only one of many considerations to evaluate when assessing a business opportunity. The questions below should be considered by anyone interested in farming giant clams.

- \* Do you have the skills and motivation to be self-employed?
- \* Do you have enough money to get your farm started at a large amount?
- \* Do you like working with giant clams and being in the ocean most of your time?
- \* Do you have enough access to reef space for farming and far away from a site where a waterfall meets the ocean?
- \* Is the amount of income you can earn from farming worth your effort?
- \* Do you have enough patience to cope with problems like theft?
- \* Do you have the knowledge to care for the clams?
- \* Are there any special considerations?

Only the individual can decide whether giant clam farming is suited for him or her.

### **Reference**

Teichman, J. 1995. Market Analysis - Giant Clams as Food Products in the American Samoan Domestic Market. The Pacific Business Center Program. University of Hawaii.

**MICRONESIAN & AMERICAN SAMOA  
STUDENT INTERNSHIP PROGRAM  
(MASSIP)**

**POHNPELAN WOMEN'S FISHING**

by

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## **Executive Summary**

This report has been prepared as a joint project of Sea Grant Extension Service and the Math & Science Department at the Pohnpei Campus of the College of Micronesia. This project is funded by the Pacific Island Network (PIN) and the Sea Grant Extension Service at the University of Hawai'i. The report is based on a fishing field survey on women and men of the six Pohnpei municipalities; Kitti, Uh, Kolonia, Madolenihmw, Sokehs, and Nett. The field survey is carried out by myself, Mr. Ahser Edwards from the Math and Science Department, and Melza Miguel, a COM student volunteer.

The primary objective of the project was the assessment of women's involvement in fish harvest, the fishing techniques, styles, types, typical catch, traditional fishing knowledge and practices that are still in use today by women as well as men.

In addition, the project aims to find out how fishing in general has changed over the years and the factors that influenced such change. The traditional fishing techniques, skills, knowledge, and preservation of these cultural informations are considered by the project to be essential at this stage of the development of the island of Pohnpei and the FSM as a whole, especially for the future generation.

In the longterm, the successful conservation of the limited coastal marine resources and the traditional knowledge and skills depends on the level of environmental and cultural awareness, and public support for conservation initiatives such as those recommended in this report.

Other objectives of the project are promotion of traditional women's fishing techniques indigenous knowledge of fishing management in Pohnpei State.

## **Acknowledgments**

This project is sponsored and funded by the University of Hawai'i Pacific Island Network (PIN) and the Sea Grant Extension Service. My participation in this program is sponsored by the Micronesia and American Samoa Student Internship Project (MASSIP). Thanks to MASSIP for providing this opportunity to share and give something back to the Federated States of Micronesia.

A big mahalo to the MASSIP coordinators Dr. Graig Severance, Jim Mellon, and Jenny Samaan for believing in my capability to carry out such a project as this one. Killisou chapur to Sharon Ziegler, Elizabeth Kumabe, and Mimmy for their supports throughout the duration of the project. Kalahngan douluhl to Fr. Hezel for his insightful input and for his help in finding the right people to interview; my great translators Melza Miguel and Berlinda Waltu both from Kitti; to the Mercedes Catholic Association, especially Mercedes Santos and Maria Yamada for their patient with my persistent questions; COM-Library, especially Iris Falcom and Takyo Syne for their assistance in my library research; the Congress Library, Dr. Rufino Mauricio from the FSM Division of Archives/Historic Preservation Office for his helpful inputs on my survey; the JTPA Newspaper for printing my fishing advertisement free in their July publication; Alicy Ehsa from the Catholic Mission for having her daughter drive me around to do interviews; COM campus for allowing me the use of xerox machines and for treating me as a staff; the "Summer in the Lagoon Project" students for their help in translating my surveys; everyone connected with this project and with whom I interacted on a daily basis and, of course, Ahser Edwards, my

supervisor for his support and assistance with this project, and the interviewees for putting up with my non-stop and pesty questions.

## **Survey Background**

Pohnpei State is one of the four states within the Federated States of Micronesia (FSM) which includes Yap, Chuuk, Pohnpei, and Kosrae. Within the FSM, traditional cultures are very much alive and continue in practice even in the 20th century. Some vital roles of both men and women are largely unaltered the encroaching western ways.

FSM as a struggling nation, a third world nation, doesn't have much to speak of economically. The main financial resources for the nation's income come from the Compact of Free Association with the United States which the Federated States signed in 1986 and the FSM fishing agreements with other foreign companies. In this offshore fishing sector, FSM has an alternative to fish its own waters in which other foreign fishing companies are allowed to fish for pelagic fish within the 200-mile Exclusive Economic Zone for a fee. The Law of the Sea treaty defines the 200 miles of Exclusive Economic Zone around the archipelago. Since the beginning of the arrangement, FSM has collected almost \$80 million in fishing fees.

Fish and fishing were significant in traditional Micronesia and continue to be more so in the contemporary FSM, especially in regards to economic progress and sustainable resource management. There were diverse traditional fishing skills and there are still skilled local fishers of both sexes on the island of Pohnpei.

Women fishers who fish inside the coral reefs have played an important community role in providing animal protein for families and household incomes, especially in families where the adults are not employed by either the government or private sectors.

## **Survey Methodology**

The field survey used in this project was developed by myself with the help of my MASSIP advisor, Dr. Craig Severance, and my field supervisor Mr. Ahser Edwards. Beside the field survey there were other techniques employed which include using focus groups, fish identification, and in-depth interviews on an individual basis.

The survey itself was translated into Pohnpeian and backtranslated into English (appendix II). The survey was first tested on the COM volunteer students. Most of the surveys that people filled out were in Pohnpeian. Others were in English for those who speak and understand the language. Most of the interviews were conducted in English with and sometimes without translators. Other interviews were done in Chuukese as the interviewees speak Chuukese.

The focus group technique was done only with small groups of women. I threw out questions and ideas and let them discuss them. I listened and learned how they feel about fishing and got some glimpses into the changes in women's fishing from their perspectives.

Using fish identification revealed how much people really know about their significance in the traditional culture and how they have changed over time. I cut out pictures of fish from fish posters and had people identify them by local names, species types, spawning grounds, usual catch then and now, and so on.

The in-depth interviews were done with selected individuals chosen from people who had and had not completed the surveys. In some of these interviews I recorded the conservation with their permission. I went back to the individuals to follow up on things that were missed in the first interview or to clarify issues.

## **Survey Itinerary**

Survey itinerary:	May 13, 1995 to July 28, 1995 is summarized below:
Survey Preparations in Hilo:	May 13 - May 17, 1995
Survey Translation & Backtranslation:	June 5 - June 9, 1995
Survey Testing at COM-FSM:	June 12 - June 14, 1995
Finalizing Survey:	June 15 - June 16, 1995
Field Survey & Interview:	June 23 - July 28, 1995

## **Interview Survey**

An interview survey was conducted with fishermen and fisherwomen of Pohnpei State in all six municipalities. The questionnaires used in this survey are shown in Appendix II. The results of the survey are also summarized (see Appendix I). A total of 65 women and men participated in the survey and 12 others were interviewed but didn't fill out the questionnaires.

Out of the 56 respondents there were 45 women and 17 men from all the communities that were surveyed. The majority of the interviewees were from Kitt where I was able to spend weekends.

## **Physical Geography and Background History**

Pohnpei State is located 414 nautical miles north of the equator in the Eastern Caroline Islands of the Western Pacific Ocean. It is the largest in the Eastern Caroline group located at 6 54' N and 158 14' E and is surrounded by coral reefs. The island has a complex topography with punctuated valleys, mountains, many rivers and waterfalls. It has been called the "flower garden of the Pacific" for its exotic lush forests and plants. The island itself has no natural sandy beaches and most of the shoreline is covered by mangrove swamps. However, artificial beaches have been created and the nearby reef islands have beautiful beaches. The island's highest point Mt. Nahna Laud is 798 meters high and is thought to be one of the wettest spot in the world with an average annual rainfall in excess of 400 inches. Pohnpei is the state capital of the Federated States. Consequently, the Federated States of Micronesia (FSM) national government headquarters are located some five kilometers from Kolonia, in Palikir.

Pohnpei is rich in history and natural resources. The island itself is 129 square miles. There are 25 smaller islands within the barrier reef and 137 widely scattered coral atolls. Coastal waters in the FSM as a whole are regarded as a key to economic development, a means of providing income and employment opportunities for Micronesians.

Historically, the marine environment is of enormous significance to the people of Micronesia as the source of a wide variety of traditional foods. Traditionally, the use of terrestrial resources and all accessible marine resources were distributed among the people under the controlling chiefs.

## Geography

Pohnpei is everyone's idea of a perfect tropical paradise. As one of the high volcanic islands in the Micronesia region, Pohnpei Island gets between 150 and 200 inches of rain annually in the inhabited areas and an estimated 400 inches in the interior where the forest is dense and maintains the watershed.

## Climate

Pohnpei is blessed with waterfalls and streams that, along with prevailing trade winds and normal cloud cover, keep Pohnpei cooler than other islands close to the equator. Normal daytime temperature is about 80 degrees Fahrenheit. Temperatures range from 93 degrees high to 69 degrees low. A short dry season for the island is from January to February. From April on, it tends to be wet throughout the rest of the year. Rainfall average's 300 days each year (Ashby, 1993:102).

## Political History

Pohnpei was once a very highly stratified society in the Traditional Period. Evidence of that period can still be found in the continuing respect for chiefs, the fishing practices, archaeological sites and associated legends that have passed down from generation to generation.

According to oral tradition, during the pre-historic period, Isokelekel, a warrior from the east, came with 333 men and overthrew a group tyrannical chieftains or the **saudeleurs**. He became the first **nahnwariki**, or the paramount chief, in the chiefdom of Madolenihmw. His son became the secondary chief, the **nahnken**. As the legend has it, this is how the kingdom of Pohnpei was established and became one of the most powerful and complex hierarchy system in the region.

Encounter with Spain, missionaries, and traders in the mid-1800s were the beginning of changes in all the aspects of society. Pohnpei was taken as a possession of Spain in 1886 to 1899 (Ashby, 1993:53). Germany took possession from 1899 to 1914 along with the rest of Micronesia. The island was then taken possession of by Japan from 1914 to 1945 at the end of the World War II. The U.S. government took Micronesia from Japan and made it its legal ward.

Micronesia was under a United Nation Trusteeship (Trust Territory of the Pacific Islands) with the United States holding the administrative authority. The Compact of Free Association with the United States was signed in 1986. The Federated States of Micronesia has a 15-year COFA agreement with the United States. FSM controls all of its domestic and foreign affairs, but the United States provides for defense and security.

Furthermore, by the COFA terms, FSM has agreed not to allow military access to other nations, especially those considered hostile to the U.S. In exchange, the U.S. provides economic and technical assistance to the FSM to help the development of the nation's economy toward self-reliance and sufficiency. What the United States government gets out of this agreement is free access to the area's vast size for military use.

During the Japanese administration, the number of civilian settlers from Japan who came to start personal businesses surpassed the indigenous population. In the present population on the island today, evidence of the past administrative authorities can still be found in language, culture, food tastes, fishing techniques and many other things. The traditional chiefs/kings and their power seem to have diminished every year.



That is not to say that they're disappearing, because they are very much still there. However, they don't have the same authority that they had before outside invasion and domination of the islands.

## Economy

Land ownership is the most valued right in Micronesia. The landless person has much lower status than the landowner. In the traditional economy, land is not a commodity to be sold or traded and under the FSM constitution, ownership of land is restricted to citizens of the four states.

Traditionally, the use of terrestrial resources and all accessible marine resources was distributed among the people under the control of chiefs. Lands and resources are collectively owned by clans or kinship groups. Land tenure patterns generally involve communal ownership of a single plot, single ownership of several and separate plots, or use rights to land owned by traditional chiefs/leaders. Shallow reefs and the intertidal flats and their resources were traditionally usually owned by the nearby landowners, but this traditional ownership is no longer recognized in Kosrae and Pohnpei. However, in Yap and Chuuk it persists and is a central consideration in marine resources management. Pohnpei is one of the richest islands in the Micronesian region, but still its resources are limited and adequate management programs are needed to promote and conserve resources, especially nearshore marine resources.

## Culture

In Pohnpei, as well as in other Micronesian communities, children are born into more than one kinship unit. *Kienik*, or clans are a very significant kinship unit. Within a municipality or village, one has to know all his relatives so he/she behaves appropriately toward them. Genealogy is important to Micronesians. *Peneinei*, extended family is a closely tied family unit. In Pohnpei, children of the *Nahnmmwariki* inherit the title. *Nahnmmwariki* and the *Nahnken* in each municipality are the two principal chiefs. Under the two high ranking titles, there are other lower titles belonging to individuals who serve the higher titleholder. The lower titles are acquired through service. Sometimes, some titles would be present in all the five municipalities on the islands, but the titleholders are not of equal rank and authority because the municipalities themselves are ranked with Madolenihmw ranked the highest.

Clans are matrilineal, consequently clanship is inherited through the female line instead of the male line, although the elder man of a clan is the head of the clan. A father and his children are from different clans as members of the same clan are not supposed to marry. Some clans on the island, and on other Micronesian islands, have totems of either land or marine animals that are considered members of the clans. These animals are treated as such by the members and cannot be eaten by them.

In any Micronesian culture, sharing is very much part of customs. Because resources are collectively owned, the harvest of the resources are shared among the group members. Within a clan, everyone knows who the big fish or kava should go to. Everyone knows his or her responsibilities and obligation to the group/clan.

## **Land Ownership**

Lands are significant in the Pohnpeian culture. To have lots of lands means to have power and influence. Land holds resources that are important in the traditional culture such as sakau or kava. These things confer prestige and social status.

A clan has its own lands in which the members work together and share the harvest. First harvests of resources plus accessible marine resources are given to the chiefs. Under the FSM constitutions, lands are not to be sold or traded.

Specifically, lands shouldn't be sold to non-FSM people. However, they can be leased. Some of the lease money is shared with all the clan's members.

## **Religion**

Traditionally, Pohnpeians had their own forms of religion, but after the invasion of the islands by missionaries in the eighteenth century newly introduced religions such as Protestant and Catholic soon dominated the local religions. At present the island is divided between the two Christian religions. However, there are other religions newly established including the Assembly of God, Baha't National, Calvary Baptist, Church of Jesus Christ of Latter-day Saints, Jehovah's Witness, Roman Catholic, Seventh Day Adventists, and the United Church of Christ.

Since the introduction of Christianity on the island of Pohnpei, things have changed dramatically. Christianity puts restrictions on local people's lifestyles and the culture itself. Local people are told to stop fishing and working on Sunday because God does not work on Sundays, and as his followers they shouldn't either. Christianity has changed local people's outlook on life and other things as well as their attitudes toward their own culture in some ways. Now everybody belongs in Christianity. It will be very difficult to find someone who doesn't belong to one or the other religions. Today, religion has become a major part of the local life, deeply embedded into the culture.

## **Traditional Fishing**

In Pohnpei and in other Micronesian Islands fishing and fish are major components of the day-to-day lifestyle. To islanders, the whole island group is not small at all. Micronesians practically grow up in the water so the ocean is no enemy to them as they travel and fish the waters since childhood and are trained in navigation. The ocean then is considered home to the islanders. They don't just count the dry land as home but the ocean too, because in truth it is. Micronesians, like other Pacific islanders, tend to live close to the shore and depend very much on the ocean to provide for their subsistence needs.

In some communities in the Micronesian region, women and children provide most of the protein sources for families from the reefs and mangroves where they collect foods. Sometimes small children, including the male children, learn fishing from their mothers first because they would hang around with their mothers the most. Fishing has always been a part of Micronesians' life. It is their livelihood. Traditionally, women do the reef gleaning and men do the offshore fishing. Consequently, women do a various types of fishing and reef collecting of all different types of marine species.

## **Survey Results**

The short time available to do this project did not allow me to do a large sample. At the end of the field interview, I came up with 65 individuals I interviewed and/or surveyed. I was able to get enough sample to make a preliminary analysis. Out of the six municipalities, 65 percent of the responses were from Kitti, 6.7 percent from Uh, 3.3 percent from Nett, 10 percent from Kolonia, 10 percent from Madolenihmw, and 5 percent from Sokehs. These figures include both sexes, ages from 16 to 75.

## **Survey Results and Discussion**

Until recently, most of the literature has ignored the gender dimension of indigenous knowledge systems. Apart from a few ethnographic and anthropological studies, there has been no systematic attempt to document women's indigenous knowledge. In recent years there has been a growing interest in women's indigenous knowledge systems within the field of gender and the environment. It is increasingly being recognized by researchers and grassroots workers that in many communities women are the primary natural resource managers and that they possess an intimate knowledge of the environment.

Fishing in Pohnpei has changed or evolved in response to modern technology, Christianity, and social and cultural change. In this research, there are more females respondents as this research focuses on women's fishing. However, a number of men were also interviewed/surveyed just to get their point of view on women's fishing and fishing in general in regards to the changes that have taken place.

## **Survey Results By Women**

A total of 48 women ages 16 to 72 participated in the project from all the six municipalities on the island. It was apparent during the interviews and on the surveys that women fish and catch a various of marine species from sea cucumber (loangon) to humphead parrotfish (kemeik) inside the reef alone. With the changes in women's fishing, today's women are able to go outside the reef where only men would go before on the traditional wooden carved canoes. The availability of the advanced technology has allowed women who can afford such things to fish for skipjack tuna, yellowfin tuna and many others, with and sometimes without their husbands. 62 percent of that 48 are part-time fishers and only 37.5 percent are full-time fishers. The 37.5 percent full-time fisherwomen are mostly housewives who goes fishing almost everyday of the week. They fish for food and for sale to provide household incomes. The 62 percent part-time fisherwomen are employed by government, private sectors, and full-time/part-time students at COM.

The most common women's fishing techniques includes reef gleaning, net fishing, crabbing, and line fishing. There is a 58 percent of the 48 number of women engage in reef gleaning (see Appendix I). There is a 4.2 percent of women who actually spend up to 14 1/2 hours a day fishing. These are some of the women who complained about spending three times the usual time fishing.

## **Survey Results By Men**

Only 17 males participated in the survey and interview of the project. Men are extensively involved in fishing other than the four traditional techniques (see Appendix I). They now use the techniques formerly considered as women's. Men's fishing technology is much more complex and includes a myriad of different types of hooks and lines, traps, nets, and spears. In the old days, men's fishing was surrounded by complex beliefs and taboos because it can be risky and at times even dangerous (Chapman, 1987:270). Christianity minimized or stopped most of the fishing rituals. Furthermore, the men themselves refrained from fishing the old fashion way.

### **Results: Analysis & Discussion**

Overall in women's fishing, things have been altered dramatically. In the traditional Pohnpeian culture, women did most of the inshore fishing usually in groups from sections or from households of extended families. Today, it's hard to find this kind of group activity. In fact the only group fishing I saw and was told about is husband and wife fishing. In addition, very few women still fish either because they have full-time jobs with the government or other private companies or are going to school at the college and don't have time to fish. Still there are others who just don't fish for any particular reason. These type of non-fishers don't seem to be interested in fishing at all, let alone fishing in the traditional way.

Other factors attributing to the loss of fishing interest and knowledge among women today include family structure breakdown, Christianity, social structure changes, changes in values, introduction of technology, and new techniques. With the exception of the still traditional communities such as Kitti, there is a little group fishing and it is restricted to the nuclear family members. Most times, a single person from a household would go fishing with the catch divided only to next door relatives, providing it's enough or it's not for sale.

The introduction of new effective and efficient technology also contributes a lot to the break down of group fishing. Now one or two people can fish all by themselves and don't need others to help. The technology used is not for group outings.

Even one person can fish effectively all by himself. These effective modern technologies require money to buy the materials from the store. A man who works and earns money doesn't depend on his relatives to supply fishing gear or company. He could go spearfishing all by himself even at night, in which case the wife often comes along. This is reflected in the reduced number of both men and women involved in stationary fishtrap fishing.

There are more nuclear families in the island. Usually, they earn the money so they keep the catch. Families who live quite far away from them don't get to share the catch or the money. One of the questions I asked was "who goes fishing from a household the most" and response was "my husband" or "the males."

Christianity restrains people from fishing the usual or traditional way of fishing any day. People were told not to fish on Sunday because it's a holiday. Everyone on the island has been converted to Christianity. It has become a very much part of their lives and who they are. Furthermore, Christianity also restricts people from fishing certain time of the day as they have to go to church and bible class in the morning and/or afternoon. Those who don't go to church regularly are looked down on.

The changes in values and lifestyle certainly contribute to the fact that very few young people know or use the traditional fishing techniques and the loss of the traditional knowledge of such things. Not very many people young and old use or fish in the traditional fashion. This is largely because of the newly introduced technology that is discovered to be more efficient and effective and to the fact that young people have now other things to do such as school. Parents want their children to get good educations so they encourage them to do better in school and do not teach them all the very significant traditional customs. Sometimes, parents are just too busy to spend time with their kids to teach them anything. Moving into town away from the grandparents doesn't help any. Children play games such as volleyball and basketball after school when they would have gone fishing with their grandparents or relatives.

Now instead of young couple living close to relatives, they move into town to pursue jobs in the private sector or they go to school overseas. They learn so much about other cultures, especially the American culture, more than they learn about their own. Sometimes because they don't have time to learn their own, or simply because they would rather learn the American culture to have a better life.

Some of the women I interviewed don't even know the culturally significant fish such as the humpheaded parrotfish (kemeik). Not all these women are young, some are in their late twenties and early thirties. I found that those women who grew up in the still traditional communities seem to know at least something of the culturally important fish. Other women and men don't even know their own clans, let alone their clan's totems.

Although men now do most of the fishing, especially commercial fishing, there are some men who don't fish, or go fishing only once or twice in their entire lives. Again these are not just young men, but men in their late twenties and early thirties too. Some men think that women should fish for various reasons. Fishing is believed to be good for health purposes. Other men think that fishing is better for the women than working the land. However, when I asked who goes fishing from their households, their response usually "me" or "my brothers and I." Both men and women agree that the fish and the marine resources are not protected. The Pohnpei Environmental Protection Agency is weak, almost non-existent.

There is reported damage to the habitat of marine life from dumping in the area of all sorts of things and from land erosion as result of road/land construction. Other respondents claimed to have seen fish who belong in the deep water now in the shallow area. There are other reports of too many sharks in the fishing area where there weren't any sharks before. A few people blamed Ting Hong (a tuna transshipment company) for the latter.

The most complaints I heard about was fewer fish available to catch. People repeatedly told me that there weren't any more fish to catch. If this is true, this could be one of the reasons that a lot of women don't go fishing anymore. In fact, they told me in the interviews that now they spend three times the usual amount of time they used to spend fishing because they can't catch anything. On another note, this could also be because there are more people now than before. The whole population of FSM is rapidly growing while their lands and waters stay the same. According to statistics, there is a 3.3 percent annual population growth for the whole nation.

In addition, not all the fishing techniques used are safe. Although the new technology is effective and efficient, it is also unsafe in the sense that some techniques kill all types and all sizes of fish that happen to be trapped. Others don't only kill the fish but the coral as well. These

techniques include root poisoning, electricity, and clorox. These particular techniques are illegal but some people still use them if no one is looking. And usually no one is looking, especially the EPA.

Other reports include the notion that women have more fishing techniques than men and can catch various types of marine animals. Traditionally, women had more fishing techniques than men. These techniques are restricted to the shallow waters. Because of the various fishing women did close to the island, when there are bad weather men wouldn't be able to fish but women still could fish in the lagoon. This is the reason women used to provide most of the protein source from fishing.

In the contemporary Pohnpei, fishing has become more than what it used to be, fishing to feed the family. Now it has become a part of sport and recreation which attracts the tourists visiting the island. Some women in the Kolonia area own their motorboats and would go fishing just for fun and enjoyment. Now they find themselves enjoying fishing even more because it doesn't matter if they don't catch enough—it is still fun.

Sometimes, if people catch more than enough, they would sell it to the local markets and neighbors. This is usually the case with the people who have good jobs and can afford the technology. But in the families who don't have a means of earning money, fishing serves two important purposes: to feed the family and to make a profit. Reportedly, they would sell the big fish and the good catch and keep the small catch for family consumption.

### **Recommendations**

Pohnpei once was an independent island which stood on its own in the past and was able to support its population and its unique culture. People were educated in the traditional culture so everyone knew their responsibilities. Today, responsibilities are not as clear. Sometimes people are clear about their obligations, but other things prevent them from carrying out their responsibilities.

The following are some recommendations as to what people should do to take good care of their environment and to take interest in preserving the future of their children and grandchildren.

1. Government should establish recycling programs. State agencies should support the project by conducting "can drives." Instituting a refundable deposit on aluminum cans should be considered and on-going.
2. EPA should enforce its existing laws. Fines for first offenses should be raised considerably to help encourage compliance.
3. Disposal of trash in wetlands and water should be prohibited. Dumps should be relocated away from the water to a more appropriate site.
4. There should be more community educational and demonstration projects like the Watershed Project. Communities should take part in educational projects pertaining to preserving their resources.
5. There should be more information of women's fishery careers. Information should be available at COM-FSM and at the high schools, both private and public.
6. Communities should sponsor local fishing workshops for children and adults. These workshops could include actual demonstration of traditional fishing and techniques.

It is essential that the communities take part in programs and projects that would help preserve and conserve their environment and resources. The environmental educational projects would get people reacquainted with their environment and really understand it. For people to start caring, they have to understand the natural environment first and their role in preserving the resources. It is important that as human beings, the most destructive living thing to the environment, they understand their impacts on the natural and marine resources.

Getting the local communities interested in their own environment and the management of their resources should be encouraged to make conservation projects work. As communities, they get to decide what works for them and what doesn't. It will give them power and control over their own affairs and resources.

Implementing and strengthening the existing laws regarding preserving and protecting the natural environment is another must. Having organized groups to lobby for laws that affect the success of a community project is equally important. It requires the working together of the national government and the local municipal governments with the communities.

Education is really the key whether in the local culture or the western culture, or both. Knowing and understanding natural resources and the impacts of humans on the resources themselves that will affect the future of the island and the new generations to come is important. Usually it's when people understand something, that they will follow the rules.

Other Recommendations:

1. Short survey
2. Survey should be stripped of the jargons
3. Cultural knowledge of subjects
4. Work out arrangements with cultural leaders
5. Longterm study

The above recommendations are based on my experience. They are useful guides to anyone interested in doing this type of research.

## **Conclusions**

"Without healthy people you cannot have a healthy nation, and without healthy mothers you cannot have a healthy nation." Women traditionally contributed most the household protein, but more and more women have stopped fishing which is the main source of protein in the Micronesian Islands. Today, most families get their food from the grocery stores. Women are no longer the main food providers (mainly protein) for the family, particularly in the urban areas. Men and husbands who have jobs provide most of the family food consumption, usually from the stores.

Traditional fishing knowledge and skills are lost to the new generations in both sexes. Today's generation seems to look down on fishing as a career for a female. Fishing isn't attractive to young people, not when they want to be like the Americans they see in movies. Children grow up away from their grandparents who would have taught them the things they need to know.

On the other hand, fishing is deeply embedded in the culture and it will always be a part of their identity. Fishing is even more important today for economic purposes. In other words, fishing is still in the culture. The only thing lacking is women in fisheries. Women are great

resource managers as reflected in the power of women in the matrilineal societies in Micronesia where women have more influence and more to say about things that concern the land and family. They have been the resource managers as far as anyone can remember. On the whole, women's position in fishing throughout Micronesia has shifted significantly since the introduction of the western culture and lifestyles into the once independent islands.

Although fishing in general is still significant, women's fishing is not as important as it once was. This is the feeling throughout Micronesia according to the other studies already done in Palau and Kosrae (Des Rochers, 1992; and Mathews and Oiterong, 1995). There hasn't been any published study done in Chuuk yet, but from personal observation, it is no exception.

There are still a few active women who fish and own outboard motorboats for deep water fishing, but this is more of an outdoor sport than a traditional practice. There are women who feel very strongly about women's fishing being significant but the feeling is not shared by the young women who see themselves working in the office from eight to five.

Nevertheless, some women are very much against the changes that have occurred that altered and changed the traditional fishing style and techniques. But these changes are not just negative but some are positive as well depending on whose point of view one looks at. The fishing corporation and companies would look on the new technology as good. They allow the fishermen to catch more fish and make more money. The concerned old traditional folks look on the new technology as damaging to the resources and culture. The fishermen whose main concern is catching as many fish as they can are very happy with the changes. Those who couldn't afford the technology don't benefit in any way. Local fishers who can't afford to go out to fish in the rich deep water are not happy either.

I would imagine that fishermen using the new technology are happy with its efficiency and effectiveness. Although the old traditional techniques preserve the resources, they are not as effective and efficient or sustainable. However, their role in preserving local resources was effective. "Centuries ago Pacific islanders, for example developed almost all of the marine conservation measures that Westerners devised only within the past 80 year" (Johannes, 1981, 1987d). In the old days, before modern technology was introduced, and before fishing and fish became the key to the national government economic development, the old folks would only catch enough fish to feed the family and relatives. If only people would reconstruct some of their fishing tradition that would allow for safe fishing, it would make a little difference in the local resources. I encourage young children and women to learn all they can about fishing and the limited local resources.



### **Traditional Fishing Techniques\***

<b>Women's</b>	
Reef gleaning	collecting reef vertebrates and invertebrates w/hands and sticks
Naik	using traditional net attached to sticks
Upaup	root poisoning
Pikmasaht	collecting small mangrove bivalves
Rohsoapwoau	catching mangrove fish with hands
Pwoadipwad	catching reef fish with hands
Rikpahsu	collecting giant clam
Rikloangon	collecting sea cucumber
Soailipwei	collecting reef clam
Koap woaroar	collecting giant sea cucumber's intestines
Fishtraps	trapping fish in shallow water on the reef
Mangrove crabbing	collecting crabs in the mangrove during low tide
Net fishing on reef	using traditional or modern net
Line fishing on reef	fishing on the reef using line
Tia kopil	collecting bivalves in the mangrove swamps
<b>Men's</b>	
Net fishing	using traditional net to catch fish and crabs
Spear fishing	using traditional wooden spears
Line fishing	using line
Line fishing w/canoe	using line from canoe

Above are techniques traditionally used by fishermen and fisherwomen before the introduction of modern fishing technology.

### **Contemporary Techniques**

<b>Women's</b>	<b>Men's</b>
Reef gleaning (58%)	Reef gleaning (29.0%)
Tia kopil	Tia kopil Spear fishing
Net fishing on reef (11.7%)	Net fishing on reef (22.8%)
Line fishing on reef (10.7%)	Line fishing on reef (19.3%)
Line fishing w/canoes/ motorboats (9.0%)	Line fishing w/canoes or motorboats (14.9%)
Mangrove crabbing (8.7%)	Mangrove crabbing (10.5%)
Fishtraps (1.9%)	Fish traps (3.5%)

\*Above are the techniques now employed by fishermen and fisherwomen in Pohnpei after the introduction of modern fishing technology and changes in the culture. In this instance, men seem to have more fishing techniques than they did before. Women on the other hand, have experienced a significant change in their techniques. Furthermore, the percentage of women actually engaged in fishing and who use the techniques are less than that of the men with the exception of reef gleaning in which case women have a seemingly higher number.

## Usual Catch

English	Scientific	Pohnpeian
Gold-spotted rabbitfish	<i>Siganus punctatu</i>	Palapal
Octopus		Kihs
Sea cucumber	<i>Holothuria leucopsilota</i>	Loangon
Bluebanded surgeonfish	<i>Acanthurus lineatus</i>	Wakapw
Marbled grouper	<i>Epinephelus microdon</i>	Moaroar
Redgill	<i>Lethrinus rubrioperculatu</i>	Medi
Pink opakapaka	<i>Pristipomoides filamentosus</i>	Lol
Bigeye emperor	<i>Monotaxis grandoculus</i>	Masokod
Bigeye scad	<i>Selar crumenophthalmus</i>	Pedihdi
Yellowstrip emperor	<i>Lethrinus ramak</i>	Samwein Pohn Rar
Tomato groupe	<i>Cephalopholis sonnerati</i>	Mwanger-weita
Bluefin trevally	<i>Caranx melampygus</i>	Arongen
Humpback snapper	<i>Lutjanus gibbus</i>	Pwalahl
Black jack	<i>Caranx lugubris</i>	Arong toal
Half-barred snapper	<i>Lutjanus semicictus</i>	Inahme
Milkfish	<i>Chanos chanos</i>	Kih
Greater amberjack	<i>Seriola dumerili</i>	Arong-seik
Onespot snapper	<i>Lutjanus monostigmus</i>	Pwehu
Highfin ruddedfish	<i>Kyphosus cinerascens</i>	Limwilimw
Great barracuda	<i>Sphyraena barracuda</i>	Suhre
Bicolor parrotfish	<i>Cetoscarus bicolor</i>	Weleir
Striped bristletooth	<i>Ctenochaetus straitus</i>	Doarop
Bigscale soldfish	<i>Myripristis berndti</i>	Mwuhn Weitahta
Highfin grouper	<i>Epinephelus maculatu</i>	Mwanger keipwaip
Pacific longnose parrotfish	<i>Hipposcarus longiceps</i>	Mwomw mei
Lyretail grouper	<i>Variola louti</i>	Sawi-mwei-pwet
Forktail rabbitfish	<i>Siganus argenteus</i>	Umwile
Brown-spotted grouper	<i>Epinephelus chlorostigma</i>	Witir
Long-jawed squirrelfish	<i>Sargocentron spiniferum</i>	Sara sike weitahta
Peacock grouper	<i>Cephalopholis argu</i>	Mwoalus
Dolphinfish	<i>Coryphaena hippurus</i>	Kohko
Yellowfin tun	<i>Hunnus albacares</i>	Karangahp
Skipjack tuna	<i>Katsuwonus pelamis</i>	Kasuo
Kawakawa	<i>Euthynnus affini</i>	Sidaudau
Orangespine unicornfish	<i>Naso lituratus</i>	Pwulangking
Bluelined snapper	<i>Lutjanus kasmira</i>	Ikem-ahl-meith
Pacific Asaphis	<i>Asaphis violescens</i>	Lipwei
Blue-lined squirrelfish	<i>Sargocentron tiere</i>	Sara weitahta
Clam		Pahsu
Black-spotted grouper	<i>Epinephelus macrospilos</i>	Mwanger pwet
Oriental sweetlips	<i>Plectorhinchus orientalis</i>	Koahng

English	Scientific	Pohnpeian
Turtle		Wehia
Humphead wrasse	<i>Cheilinus undulatu</i>	Merer
Humphead parrotfish	<i>Bolbometopon muricatum</i>	Kemeik

### Techniques Presently Employed by Both Sexes

Women's	Men's
Root Poisoning 16.6%	Root Poisoning 15.0%
Net Fishing 11.7%	Net Fishing 22.8%
Line Fishing On 10.7%	Line Fishing On 19.3%
Reefs	Reefs
Line Fishing with Boats 9.3%	Line Fishing with Boats 14.9%
Mangrove Grabbing 8.7%	Mangrove Grabbing 10.5%
Fish Traps 1.9%	Fish Traps 3.5%
Others: 44.7%	Others: 14.0%
Tia Kopil, Spearfishing, Night Fishing, Reef Gleaning	Tia Kopil, Spearfishing, Night Fishing, Reef Gleaning

### Fishing Frequency

Women (Ages 16-72)		Men (Ages 16-75)	
7 days a week	8.3%	7 days a week	8.7%
4x a week	11.1%	4x a week	0%
3x a week	0%	3x a week	26.2%
2x a week	11.1%	2x a week	4.3%
Once a week	22.2%	Once a week	34.8%
Once in 2 weeks	0%	Once in 2 week	4.3%
Once in 3 months	13.9%	Once in 3 months	0%
Once a year	8.3%	Once a year	0%
No answer	25.1%	Rarely (months)	13.0%

### Hours Spent Fishing Per Trip

Women		Men	
14:30 hrs.	4.2%	12 hrs.	5.0%
10 hrs.	8.3%	8 hrs.	10.0%
8 hrs.	8.3%	7 hrs.	5.0%
5 hrs.	8.3%	6 hrs.	15.0%
4 hrs.	4.2%	5 hrs.	20.0%
3 hrs.	20.8%	4 hrs.	24.0%
2 hrs.	8.3%	3 hrs.	5.0%
1 hr.	4.2%	No answer	16.0%
No answer	33.4%		

# Survey Agreement

## Women's Fishing on the island of Pohnpei, Federated States of Micronesia: Effect of Technological, Economic, Social, and Cultural Change.

This survey is part of my research on Women's Fishing in the six municipalities of Pohnpei; madolenihmw, Kitti, Uh, Sokehs, Nett, and Kolonia. I am looking at women's contribution to the communities at large and their families as well as any changes in techniques, and types of fishing. I am also looking into the changes that have occurred overtime that have impacted fishing in general such as introduction of modern technology, Christianity, effects of economic, social and cultural change. The results will essentially be incorporated into a coastal resource management program that is being developed for the State of Pohnpei by the agency I am working with. This research is sponsored by the Pacific Island Network (PIN) and the Sea Grant Extension Service located at UH-Manoa/College of Micronesia in Pohnpei. My participation in this program is sponsored by the Micronesia & American Samoa Student Internship Project (MASSIP). Answering these questions is voluntary, you may choose not to participate or stop participating at any time. All responses will be kept confidential and *only* response summaries will be described in the final report.

\_\_\_\_\_ I *agree* to participate in this research.

\_\_\_\_\_  
Name/Date

\_\_\_\_\_  
Signature

\_\_\_\_\_ I choose *not* to participate in this research.

\_\_\_\_\_  
Name/Date

\_\_\_\_\_  
Signature

## Survey Form (Pohnpeian)

Date \_\_\_\_\_

Municipality \_\_\_\_\_

Village \_\_\_\_\_

Name \_\_\_\_\_

Place of Origin \_\_\_\_\_

Sex \_\_\_\_\_

Age \_\_\_\_\_

Educational Level \_\_\_\_\_

1. Songen laid dah ke kin wia?

- a. Soh uhk
- b. Epiiep
- c. Epiiep sand nan wahr de pwoht
- d. Laid in elimong(dilin elimong
- e. Songen lidipin en mwahmw teikan
- f. Upaup

Mie pil ekei laid ke kin wia

2. Ke kin laid?

- a. Pak depe nan ehu week?
- b. Ia uwen reirein omw kin laid nan ehu rahn? Awa depe?
- c. Pak depe nan sounpwong ehu
- d. Pak depe nan sounpar ehu?

3. Ke tapiada laid ni amw sounpar depe?

4. Sohngen mwahmw de ke kin koledi?

- a. Mie mwahmw me kin kolkoldiongete ahnsou kesemwpwal?
- b. Mie mwahmw me mie eh ahnsoun kolkoldi? Songen mwahmw da?
- c. Mie omw wasahn laid?

5. Ia wasa ke kin laid ie?

- a. Mie omw wasahn laid?
- b. Ia uwen me ke kin koledi ehu omw laid?
- c. Ia uwen me ke kin koledi ehu?
- d. Ke kin netkihla?
- e. Mie mwahmw me kin doadoahk ong kasarawi? Songen mwahmw da?
- f. Ia uwen me kin kihdiong ni imwomwo de konomwail oh me ke kin kisakiskihla?

6. Mie menihkehn nansed wie malawalawalarhr rahn pwukat? Re me dir mahs? Song da?

7. Ia mwomwen omw kin laid?

- a. Ia wen tohtohn ansou me ke kin wia songen laid pwukat?
- b. Ke kin wia songen laid pwukat ia?
- c. Mie wasa me songen laid pwukat kosonned uwong?
  1. Nan ehu rahn?
  2. Nan ehu sounpwong?
  3. Nan ekai pahr?

8. Mie weklahieu ong nansed ke diarade?  
 a. Ia wekla kan?  
 b. Ia wasa wekla pwukat tepsangie?  
 c. Ia was wekdakla pwukat waiwai ie?  
 d. Dah ke lemeleme me kahrenhda wekdakla pwukat?
9. Mie kosonned en tiahk me apwalih mour en sehd?  
 a. Ia kosonned kan?  
 b. Mie kosonned en gov't me apwalih pali wet?  
 c. Ia kosonned kan?
10. Depehnen nansed kan me ke pepehm me anahne mie perehpe?  
 a. Songen menihkehn nansed da me ke lameleme en pil mie perehpe?
11. Ia uwen menihkehn nansed me ke ese oh kin kilang.  
 a. Ia adarail  
 b. Nanpwungarail, mehnia me ke diarada me malaulaulahr de solahr?
12. Mie mwahmw udahn ongete pali en tiahk?  
 a. Ia adarail?  
 b. Ia wasa ke kin laidih ie songen mwahmw pwukat?  
 c. Ahnsou da  
 d. Mie wekdekla ke diarada ong songen mwahmw pwukat ongtiahk?  
 e. Ia wekdeklahnkan?

13. Ia wekpesengen en ohl oh lih arail laid? Songen laid da ohlkin wia? Ia uwen me ohl kin koledi/ia uwen me lih kin koledi?

Peidek 14-19 Kapwonoponiala nepe me kesalehda kupwuroamwi.

14. Mwamw oh laidih mwamw uhdahn kesempwal.

1	2	3	4	5
Sohte ekis pwungki	sohte pwungki	nan werenge	ekis pwungki	pwungki douluhl

15. Pwehki iei wia pwledak en Pohnpei, ai laid kin kesempwal ong ihs ngei nahn pali en tiahk.

1	2	3	4	5
Sohte ekis pwungki	sohte pwungki	nan werenge	ekis pwungki	pwungki douluhl

16. Kesempwal en laid in lih nahn mwei et duehte mahs.

1	2	3	4	5
Sohte ekis pwungki	sohte pwungki	nan werenge	ekis pwungki	pwungki douluhl

17. Tohn ai kousapw te me ahneki manaman en laid wasa me tohn kousapw wet ahneki.

1	2	3	4	5
Sohte ekis pwungki	sohte pwungki	nan werenge	ekis pwungki	pwungki douluhl

18. Laidi mwahmw ansowet wie tohtohte duehte mahso.

1	2	3	4	5
Sohte ekis pwungki	sohte pwungki	nan werenge	ekis pwungki	pwungki douluhl

19. Eh inenihn kesempwal kitail en perehsand atail pahina kan oh naniangkan sang kahpwal en melaulaulahn menihkeh kan.

1	2	3	4	5
Sohte ekis pwungki	sohte pwungki	nan werenge	ekis pwungki	pwungki douluhl

## Survey Form

Date \_\_\_\_\_

District \_\_\_\_\_

Village \_\_\_\_\_

Name \_\_\_\_\_

Place of Origin \_\_\_\_\_

Age \_\_\_\_\_

Sex \_\_\_\_\_

Educational Level \_\_\_\_\_

1. What type of fishing do you do?
  - a. Net fishing on reef
  - b. Line fishing on reef
  - c. Line fishing from canoes or motor boat
  - d. Mangrove crabbing
  - e. Using root poisoning
  - f. Fish traps
  - g. other
2. Do you fish?
  - a. How often during a week?
  - b. How often many hours during a trip? day?
  - c. How often during a month?d. How often during a year?
3. At what age did you start fishing?
4. What kind of fish do you often catch? What are they?
  - a. Are there any fish that are only caught during specific occasions? What are they?
  - b. Are there any fish that are only caught during specific season? What are they?
  - c. Are there any specific areas for certain schools of fish? Where?
5. Where do you fish?
  - a. Do you have a special area where you fish?
  - b. What is the average catch for a trip?
  - c. What is the average catch for a day?
  - d. Are the fish sold to market?
  - e. Are there any fish used for ceremonial occasions? What are they?
  - f. How much of the catch is kept at home or given to relatives?
6. Are there any marine species that are harder to find now that they were before? What are they?
7. What method do you use to fish?
  - a. How often do you use these methods?
  - b. Where do you use these methods?
  - c. Are they restricted to certain areas of the reef?
  - d. Are they restricted to certain time of the day?
  - e. Are they restricted to certain time of the month?
  - f. Are they restricted to certain time of the year?

8. Are there any changes that you have noticed on the reef?
  - a. What are they?
  - b. Where did these changes begin?
  - c. Where are these changes occurring?
  - d. What do you think caused these changes?
9. Are there any traditional laws that protect the marine species?
  - a. What are they?
  - b. Are there any state laws that protect the marine species?
  - c. What are they?
10. What areas do you think should be protected?
  - a. What species do you think should be protected?
11. How many species do you know/ see on the reef?
  - a. What are they?
  - b. Have you noticed any decline in any species?
12. Are there any culturally significant fish species?
  - a. What are they?
  - b. Where do you fish for these species?
  - c. When do you fish for these species?
  - d. Has there been any change in the significant of these species?
  - e. What are they?
13. Is there a difference between women's and men's fishing? Methods? Average catch?

Questions 14-19 Please, circle the number that most described your feelings.

14. The fish I catch are very important.

1	2	3	4	5
strongly disagree	disagree	neutral no opinion	agree	strongly agree

15. My fishing is important to my sense of being Pohnapeian, my cultural identity.

1	2	3	4	5
strongly disagree	disagree	neutral no opinion	agree	strongly agree

16. Women's fishing is as important now as it was in the past?

1	2	3	4	5
strongly disagree	disagree	neutral no opinion	agree	strongly agree

17. Only people from my section(kousap) should be allowed to fish from my section's reefs?

1	2	3	4	5
strongly disagree	disagree	neutral no opinion	agree	strongly agree

18. The fishing is as productive now as it was in the past?

1	2	3	4	5
strongly disagree	disagree	neutral no opinion	agree	strongly agree

19. It's important to protect the reefs and the mangrove from overfishing?

1	2	3	4	5
strongly disagree	disagree	neutral no opinion	agree	strongly agree



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# **PORT SAMPLING WITH MICRONESIAN MARITIME AUTHORITY**

by

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## **Introduction**

For the most part, my internship at the MMA was a success. I managed to achieve most of the goals that I set for myself at the beginning of the internship. By goals I mean both my personal goals and the goals of the internship. In this report I will be talking about what I learned on the internship and about the general workings of the MMA. Also, I will write about the future plans of the MMA.

## **Body**

The Federated States of Micronesia is at a crucial time in its history. It's Compact of Free Association with the United States has almost run out and FSM citizens are faced with true independence for the first time in almost 200 years. To many FSM citizens, true independence is a scary proposition. For this and many other reasons, it is vital for the FSM to take a serious look into its future to determine how its resources can be used to the best benefit of its citizens.

Because of its small land area, the FSM has almost no natural land resources. Instead the FSM has an Exclusive Economic Zone (EEZ) that covers almost 900,000 square miles of water. From this vast expanse of ocean comes the FSM's primary source of economic income: tuna. It is the job of the MMA to oversee everything what goes on in this EEZ and to monitor and maintain the precious stocks of tuna that have proven very valuable to the FSM. For an agency of its size the MMA has an enormous job. The FSM puts a big responsibility on the 10 employees that work for the MMA. As I saw it, these 10 people are doing an extraordinary job. In his State of the Union address, FSM president Bailey Olter commended the MMA by saying that "Fisheries remain the largest revenue generator for the FSM." The MMA has collected over \$70 million in the last four years alone. Since its inception in 1979 the MMA has collected well over \$123 million in fishing rights access fees alone. The MMA is well deserving of all the praise that it gets. But still I saw several areas that I thought needed improvement. One of these areas is to take major focus off of bringing in Distant Water Fishing Nations (DWFN) and putting that focus on the development of domestic fishing corporations.

First let me tell you about the daily workings of the MMA. Let us look at its structure. The MMA has a five member board of directors. The chairman represents the national government while the other members represent the states, one from each state. The MMA has grown substantially over the past few years, though in my opinion not enough. It's funny that although they make the most money for our country, they still own the smallest office in the national government. Besides the 10 full time staff members, the MMA also employs 10 fisheries observers and five port samplers. These guys are part of the Fisheries observer program that I did most of my work with.

The Licensing and Fees division of the MMA now has become the most important division of the MMA. They are responsible for issuing board approved permits to the various fishing corporations both foreign and domestic. They also do collection of monies that are paid for these fees. These monies are then put into the FSM national government general fund. The fishing fees that are collected differ from year to year. This is because fishing agreements are renewed each year and these agreements are liable to change. Also, these fees can be determined by the type of gear that a fishing vessel uses or the type of permit or license desired. There are two fees that are generally charged, one for a three month permit and one for a one year license. In 1993 MMA

collected 761 trip permit fees and 634 license fees. These fees total an amount of \$20,510,042 USD. Between 1979 and 1993 fees collections have increased over 1,000 percent.

Several years back most of the fees collected were from longline fishing vessels. Now 56 percent of all fees collected come from purse seiners while 39 percent comes from longliners and 5 percent from pole and line fishing. I think the shift toward purse seiners mostly stems from the fact that purse seiners catch more fish in a shorter amount of time. Also, tuna stocks within the FSM EEZ are among the most plentiful in the world and therefore attracts more and more foreign fishing companies.

As I said earlier, I think most of the focus by the national government is directed at these foreign fishing companies. Although there have been several domestic fisheries projects done by the national government throughout the FSM, almost all of them have either failed, or are on the brink of bankruptcy. A lot of commotion is going on about what should be done about these failing domestic corporations. Many feel, as I do, that more money should be invested in these companies and that the government should not be allowing so many foreign fishing corporations to fish our waters.

## **Port Sampling and Observer Programs**

The port sampling program at the MMA is among the best in the Pacific. They monitor transactions that go on at the various docks. They also collect biological data such as species, weight, and length frequency from both foreign and domestic fishing vessels. The MMA receives funding for its Port Sampling Program from the South Pacific Commission (SPC) under the Tuna and Billfish Assessment Program and from the Forum Fisheries Agency (FFA) under the Economic Development Fund of the United States Multilateral Treaty on Fisheries. The information gathered by the port samplers is collected and then entered into a database at the MMA. Copies of the information are then sent to SPC in Noumea for entry into their database. They use this information to help gauge the tuna population, their migratory habits, and their spawning grounds.

## **Fisheries Observer Program**

This program has been in operation since 1979. This program puts SPC-trained FSM citizens aboard foreign and domestic fishing vessels to collect vital information on fishing practices, law violations, biological data such as gonad samples, and rake detailed catch reports so that we can monitor more closely our fisheries resources. These observers are some of the hardest working people I have ever met. They stay out on the ocean for months at a time. They record every single fish that the ship catches and can never return to land while on a trip, even in case of emergencies.

I was very impressed with this program as I was with the MMA in general. Overall, I can only say that my internship with the MMA was a very good teaming experience and that I had a lot of fun doing it. I am very thankful that I had a chance to participate in the MASSIP program.

**SURVEY OF SOIL CHARACTERISTICS  
AND VEGETATION DYNAMICS OF SITE  
USED IN TWO GARDENING METHODS  
ON SELECTED AGRICULTURE SITES  
ON YAP**

by  
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sponsored by  
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## Introduction

In the experiment, intermittent mixed garden system was studied and compared with a recently introduced system in terms of soil characteristics and vegetation dynamics. The introduced method was especially of great concern because of the impact it has on the natural systems: the affects it has on native plant species and soil characteristics. Therefore, it was investigated by looking at the type of plants that invaded each system and the methods of land clearing and their affects on soil characteristics.

The Yapese approach to agriculture has developed into four systems due to increasing population and limited land. The four systems are woven together in an interrelated web. The four systems are taro patches, open canopy for sweet potatoes in the savanna, tree gardens (referred to as agroforestry), and intermittent mixed gardens (referred to by the Yapese as malay). The intermittent gardens are a subsistence type of farming for annual and perennial crops. Usually areas inland of the villages are used for intermittent mixed gardens. The area is gardened for one to three years. When it is harvested, some crops are left on the land and the farmers move on to a next plot. "A fallow period is periodically allowed during which secondary growth develops" (Falanruw, 1989).

In contrast, the western approach to agriculture, the area is usually bulldozed, tilled and bedded-up. Fertilizer are used by western approach but the intermittent mixed garden (traditional) approach uses only the natural fertility of the site.

Yap is in the humid tropics. The four main islands of Yap proper cover 100.04 km<sup>2</sup> with a mean annual rainfall of 3,000 mm. The mean annual temperature is 27°C with a monthly variation of 2°C and the relative humidity ranges from 79% to 85% (Goldman 1994).

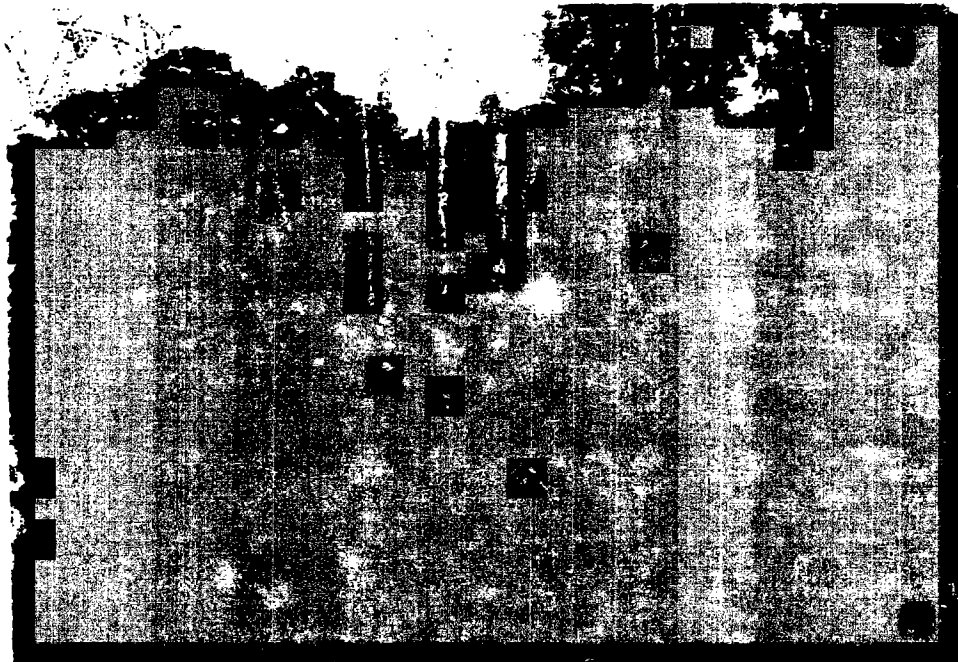
## Background

The study was conducted in Amun, Yap, in a forest, a traditional intermittent mixed garden, and on a bulldozed plot (Figures 1-3). The bulldozed plot was developed according to a method introduced by Mr. Franco Mateariki. Therefore, it is hereafter referred to as a "Franco plot." The recently introduced method is the same as the Franco plot. The intermittent mixed garden is near the Franco plot with part of the forest still intact between the two plots. The forest has grown up since it was gardened about 20 years ago. The area of the Franco plots was formerly covered with trees. It was bulldozed and tilled two years ago. On the other hand, the intermittent mixed garden was open one and half years ago by burning/girdling. Burning was done by gathering fire wood and shrubs and burning them around trunks of trees (Figure 1).

In all three plots, the soil is Yap silty clay loam. It is well drained with slope of two to six percent. The surface layer is dark brown with silty clay loam (50 cm), and the subsoil is strong brown silty clay (40 cm). It is formed in residuum derived dominantly from volcanic breccia and turf. The taxonomic class is clayey, mixed, Isohyperthermic Tropeptic Eutrorthox (Smith, 1980).



*Figure 1. A forest area opened up for a intermittent garden. The undergrowth has been cleared and the trees were either slashed or girdled by burning. They are left standing to serve as trellises for yams.*



*Figure 2. Intermittent garden in the first year of the fallow phase. Slashed trees and seedlings have already begun to grow.*



Figure 3. *The Franco plot in the foreground with the remnant of the forest that was sacrificed to make the two gardens.*

## Methods

### Soil Fertility

Soil fertility tests were run to determine the impact of the agricultural methods on soil productivity. Four representative soil samples were taken on each site. They were taken at the depth of 0"-6". Samples were taken randomly over the plots. The four soil samples taken at each site were mixed together separately according to the sites. They were put on a plastic material under shade and air dried for two weeks. Each site would be compared for nutrients in the soil to determine the effect that traditional and western methods of clearing land have on the soil. Tests were run at the U.H. soil laboratory. The following were the things tested for in the soil.

A. Ca	E. P	I. Zn
B. pH	F. Na	J. NO <sup>3</sup>
C. Mg	G. N	
D. K	H. organic C	

### Water Percolation

Percolation tests were run in the forest, intermittent garden and on the Franco plot. They were done on the same sunny day in the mid-afternoon. A six centimeter diameter pipe was pounded into the soil to a depth of 15 cm and 30 cm at 10 randomly selected points on each of the three sites. In each plot, five tests were carried out at the depth of 15 cm and five for 30 cm. Thus, there were 30 tests in all. Two 15 cm and two 30 cm tests run in the intermittent garden were taken three feet away from decaying trees. A cup of water was poured in the holes and timed for how long it took to move down by a centimeter. Figure 4 shows the 15 and 30 cm holes filled with water.



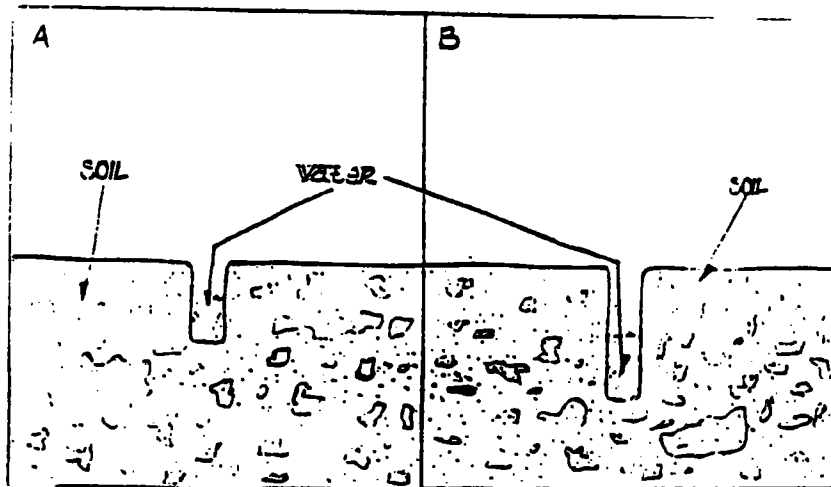


Figure 4. 15 cm and 30 cm holes. Diagram A is the 15 cm and B is the 30 cm.

### Vegetation dynamics

The purpose is to describe the natural vegetation of a forest site used for gardening about one and half years ago, and compare it with the secondary vegetation which invaded the intermittent mixed garden and the Franco plot. Plants growing within a transect made through each site were surveyed. The transect was made up of a series of contiguous subplots three meters wide by 1.5 meters long. Subplots were added to the transect until no new species were encountered. The transects were run perpendicular to the slope. In the case of intermittent mixed garden and the forested fallow site, the transect followed ancient garden beds which were oriented parallel to the slope. In the case of the Franco plot, the transect ran perpendicular to the formed rows which had been formed across the slope. In this site, running the transect perpendicular to the rows provided a better sample of the vegetation on the site.

The species encountered on each site were then categorized by habit and status (native or introduced). Each site was compared in terms of the presence of trees, shrubs, grass, ferns, and herbs, and in terms of the percentage of introduced species.

## Result

### Percolation Rates

In the 15 cm percolation test, water entered the soil the fastest on the Franco site and the slowest on the forest site. The Franco site was faster because the soil was tilled. Most of the organic matter on the intermittent mixed garden was not burnt or washed away and this was believed to have some affect on the percolation rate. On the other hand, the forest site was largely shaded by adjacent trees and wide variety of organic matter. The ground was immensely covered which kept the soil moist and it was presumed that this helped slow down the movement of water in the soil.

#### PERCENTAGE

l	I	Organic C	N	I	N	M	I	I	2.17	O-I	0.33	
N	I	I	2.70	PI	0.33	1	O-	I	v	3.45	0.36	1
P	v											

In the 30 cm percolation tests, the results were different: it took longer for the water to enter the soil on the Franco plot than on the intermittent mixed garden. Percolation time at the intermittent site may have been the shortest because of the decaying roots from the burnt or slashed trees and shrubs in the soil that created channels in the ground. The result of percolation studies are shown in Figures 5–6.

### 15 CM PERCOLATION TEST

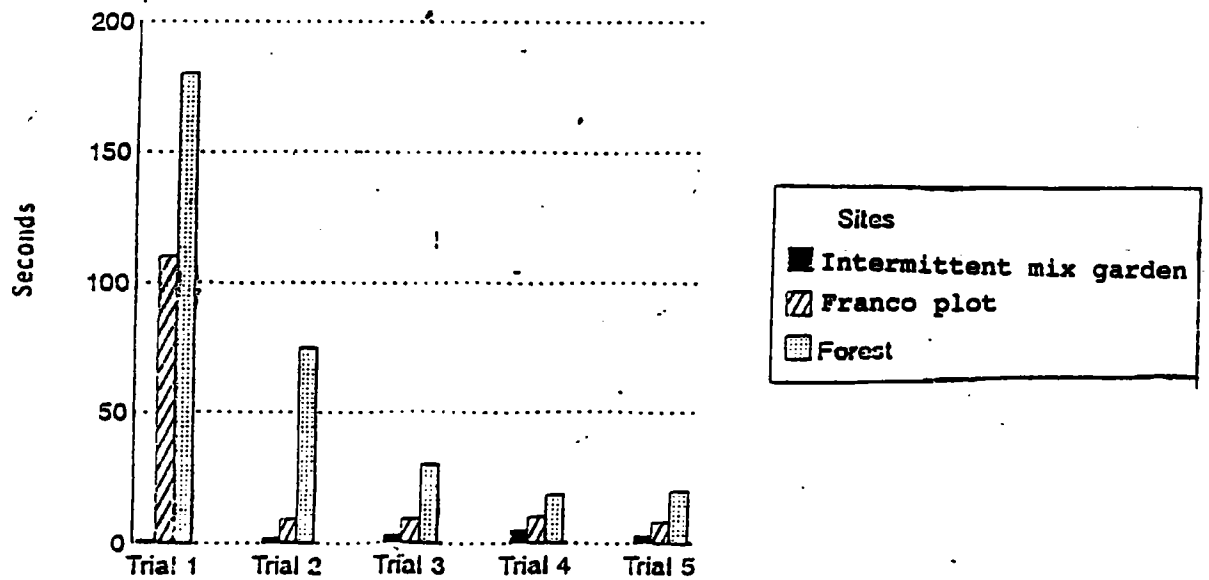


Figure 5. Fifteen centimeter percolation tests.

### 30 CM PERCOLATION TEST

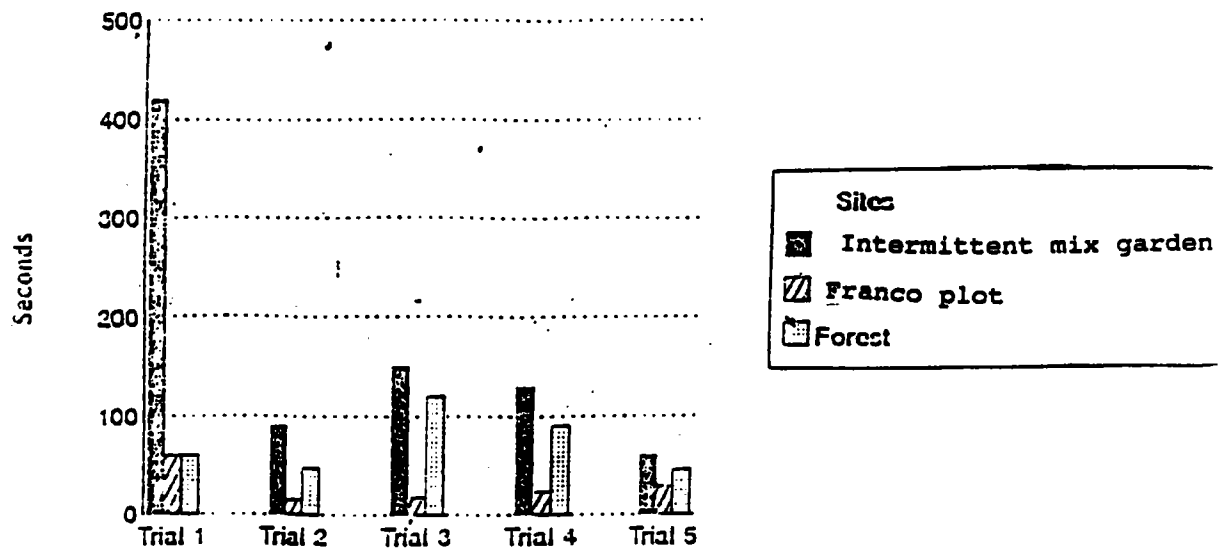


Figure 6. Thirty centimeter percolation tests.

## Vegetation dynamics

Figure 7 presents the total number of species inventoried in relation to increasing plot sizes. In each case, the transect was eventually stopped after no new species were found in two successive plots.

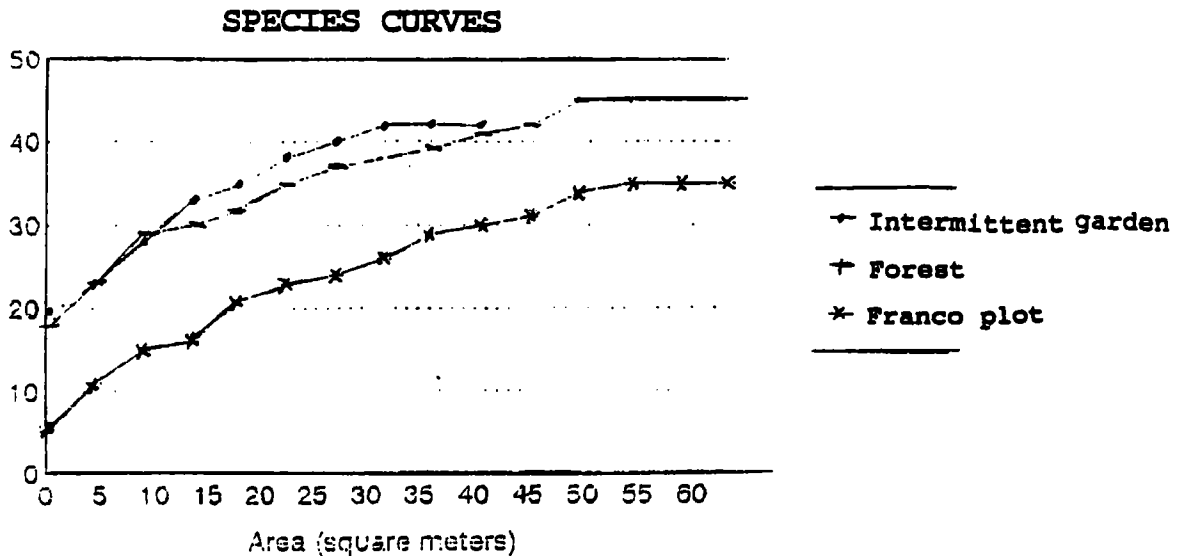


Figure 7. The total cumulative number of species inventoried in relation to increasing plot size.

Table 1 shows the average number of species per square meter on each of the sites. The greatest diversity of species was found in the intermittent mixed garden, and the least diversity was found in the Franco plot. The species diversity of the forest is intermediate. This is because it is a young forest. An older forest would probably have more species.

Table 2 presents data on total plot sizes, habits of inventoried species, and the number of native and introduced species in each category. It was not possible to determine the status of some of the grasses. The forest had the most number of native species and the bulldozed area had the highest introduced species. The introduced species in the Franco plot was invading the area. They grew so fast they were choking the native trees.

Table 3 shows the number of native and introduced species in each site. Of the 45 species found in the forest, only one species was introduced and it was not possible to determine its status. The intermittent garden had 41 species, nine were introduced and the status of two were not known. The Franco plot had 17 native and 15 introduced species.

The number of native in comparison to introduced species were pretty much the same. It had the most number of introduced species whereas the forest had the least number of introduced species.

Table 4 shows the number of species on each site for which there is a known use. Uses include food, fiber, building or craft material, and local or Yapese medicines. The intermittent had the greatest and the Franco plot had the least known uses. The Franco plot was not good for Yap because after it was left fallow for two years. Very few useful species had grown back and crops that were left on the field were struggling to survive. In the intermittent garden, many useful species are growing back and crops that are on the field are able to withstand the plant competition during fallowing.

**Table 1. Average number of species per plot.**

	No. plots	Area (M <sup>2</sup> )	Total No. spp	spp/Area (M2)
Intermittent garden	10	45	41	0.93
Forest	14	63	45	0.71
Franco plot	15	67.5	35	0.52

**Table 2. Habit and status of species found on site.**

	Size (m <sup>2</sup> )	Trees		Shrubs		Ferns		Grass			Herbs		Vines		Total Spp		
		N	I	N	I	N	I	N	I	?	N	I	?	N	I	N	I
Intermittent garden	45	14	1	5	1	5		1		2	2	3		3	4	30	9
Forest 2	63	17		6		8		2	1	3	4			4	41	1	
Franco plot 3	67.5	7	1	2	7	1		4	1	1	2	4	2	2	1	17	15

\* including Bambusa ? Unknown

**Table 3. Number of native and introduced species on each site.**

	Native	Introduced	Total spp.
Intermittent mix garden	30	9	41
Forest	41	1	45
Franco plot	17	15	35

**Table 4. The number of species on each site for which there is a known use.**

	No. useful	Percentage of uses	
Intermittent mix garden	27	27/41	66%
Forest	20	20/45	44%
Franco plot	7	7/35	20%

## Soil Fertility

In each area, topography, texture, structure, drainage, color of topsoil, and past management are pretty much uniform throughout the field. The soil data suggested that there is a little difference between the intermittent mixed garden and the Franco plot, except for greater availability of phosphorus and higher organic carbon. The nutrients data were shown in Table 5. Soil pH on the Franco and forest were 5.6 and the intermittent had 5.9.

**Table 5. Soil nutrients of all three of the sites.**

	PPM							Percentage	
	P	K	Ca	Mg	Na	Zn	NH <sub>4</sub> -N, NO <sub>3</sub> -N	Organic C	N
Intermittent mix garden	1.3	13	1160	240	120	6.7	0.95	2.17	0.33
Franco plot	5.8	22	650	250	100	6.85	0.7	2.70	0.33
Forest	1.3	26	890	600	140	0.0	1.0	3.45	0.36

## Discussion

The soil fertility tests were not really comparing the impacts of agriculture methods, because there was not really good measuring before and after the methods were applied. In full-scaled study, it would be appropriate to have more extensive soil sampling to document the likelihood that the two sites (Franco and intermittent) had similar soil fertilities before they received their treatments.

When the percolation tests were taken at the sites, the soil aggregate or pore volume were not examined at any of the sites. At 15 cm depth, the percolation rate in the Franco plot was quicker than the intermittent. As the other tests were taken at the depth of 30 cm, the water percolated faster in the intermittent than the Franco plot.

The number of species on each plot showed that the ecosystem was more disturb in the Franco plot than the intermittent garden. Therefore, the introduced methods will take longer for the plot to revert back to an ordinary forest.

## Conclusion

The Federated State of Micronesia's Compact of Free Association is coming to an end, with decreasing funds each year. The agriculture system and methods of preparing gardens need to be improved. We need to study the western (Franco plot) and traditional systems (intermittent garden) in terms of the impact it has on the soil and native plant species. Intermittent gardens have been sustaining Yap long before WWII. When preparing the sites, some trees must be left untouched, such as *Hibiscus tiliaceous*, *Inocarpus fagifer*, and legume trees must be planted before moving on or when the land is left to fallow. As demonstrated in Tables 3 and 4, intermittent gardens are faster to revert back to a forest fallow than the Franco plots.

Although the western system is recently introduced, it can be good for Yap if people are willing to provide the high inputs and constant demanding management. However, farmers should clear and prepare plots with consideration for the younger generation that will need to use the land in the future.

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# Customer Questionnaire for Restaurants

Date \_\_\_\_\_

The Department of Marine and Wildlife Resources thanks you for completing this questionnaire. This information will help us to determine if there is a market in American Samoa for locally grown Giant Clams.

You are invited to join in a raffle for giant clams just for buying giant clams and taking your time and filling out this survey honestly. Prizes include:

- 1st Prize                    10 Giant Clams
- 2nd Prize                    7 Giant Clams
- 3rd Prize                    5 Giant Clams
- 4th Prize                    3 Giant Clams
- 5th Prize                    2 Giant Clams

When you have completed filling out the survey, ask the store owner for a raffle ticket and join in the fun!

1) Have you tried Giant Clams before?                    Yes \_\_\_\_\_                    No \_\_\_\_\_  
    If you answered "no" to this question, skip to question 3

2) Have you tried Giant Clams within the past month?                    Yes \_\_\_\_\_                    No \_\_\_\_\_  
    Where? \_\_\_\_\_

3) Please rate the clam dish you just ate by placing an X above the number that best reflects your opinion (use only one X for each line).

The clams were very fresh	_____	:	_____	:	_____	:	_____	:	_____	:	_____	The clams were not very fresh
	1		2		3		4		5		6	
The clams were attractive	_____	:	_____	:	_____	:	_____	:	_____	:	_____	The clams were unattractive
	1		2		3		4		5		6	
Serving size was too small	_____	:	_____	:	_____	:	_____	:	_____	:	_____	Serving size was too large
	1		2		3		4		5		6	
The price was very inexpensive (cheap)	_____	:	_____	:	_____	:	_____	:	_____	:	_____	The price was very expensive
	1		2		3		4		5		6	
The clams tasted very good	_____	:	_____	:	_____	:	_____	:	_____	:	_____	the clams tasted very bad
	1		2		3		4		5		6	
The clams smelled good	_____	:	_____	:	_____	:	_____	:	_____	:	_____	The clams smelled bad
	1		2		3		4		5		6	
Overall I felt the clams were very good	_____	:	_____	:	_____	:	_____	:	_____	:	_____	Overall I felt the clams were very bad
	1		2		3		4		5		6	

*A Samoan language translation is on the back side of this form. Please use whichever side you feel comfortable with.*

4) If Giant Clams were available, how likely would you be to purchase them again (circle one)?

1                      2                      3                      4                      5  
Very Likely          Likely                  Neutral                Unlikely              Very Unlikely

5) Your residence:

Currently live in American Samoa \_\_\_\_\_, Village \_\_\_\_\_;

Visitor \_\_\_\_\_; From where ? (please fill in) \_\_\_\_\_

6) What is your ethnic background ?

Samoaan \_\_ Western Samoaan \_\_ Tongan \_\_ Caucasian \_\_ Phillipino \_\_ Korean \_\_

Other (please fill in) \_\_\_\_\_

7) What is your age? \_\_\_\_\_

Thanks for participating. Your input will help the DMWR determine if Giant Clam farming is a good business for American Samoa. Don't forget to give this survey back to your host and join in the raffle for giant clams!

*A Samoan language translation is on the back side of this form. Please use whichever side you feel comfortable with.*



## Customer Questionnaire for Stores

Date \_\_\_\_\_

The Department of Marine and Wildlife Resources thanks you for completing this questionnaire. This information will help us to determine if there is a market in American Samoa for locally grown Giant Clams.

You are invited to join in a raffle for giant clams just for buying giant clams and taking your time and filling out this survey honestly. Prizes include:

1st Prize	10 Giant Clams
2nd Prize	7 Giant Clams
3rd Prize	5 Giant Clams
4th Prize	3 Giant Clams
5th Prize	2 Giant Clams

When you have completed filling out the survey, ask the store owner for a raffle ticket and join in the fun!

1) Have you tried Giant Clams before? Yes \_\_\_\_\_ No \_\_\_\_\_  
If you answered "no" to this question, skip to question 3

2) Have you tried Giant Clams within the past month? Yes \_\_\_\_\_ No \_\_\_\_\_

Where? \_\_\_\_\_

3) If giant clams are available, how likely would you be to purchase them again (circle one)?

1                      2                      3                      4                      5  
Very Likely      Likely              Neutral              Unlikely              Very Unlikely

4) Your residence:

Currently live in American Samoa \_\_\_\_\_, Village \_\_\_\_\_;

Visitor \_\_\_\_\_; From where? (please fill in) \_\_\_\_\_

5) What is your ethnic background?

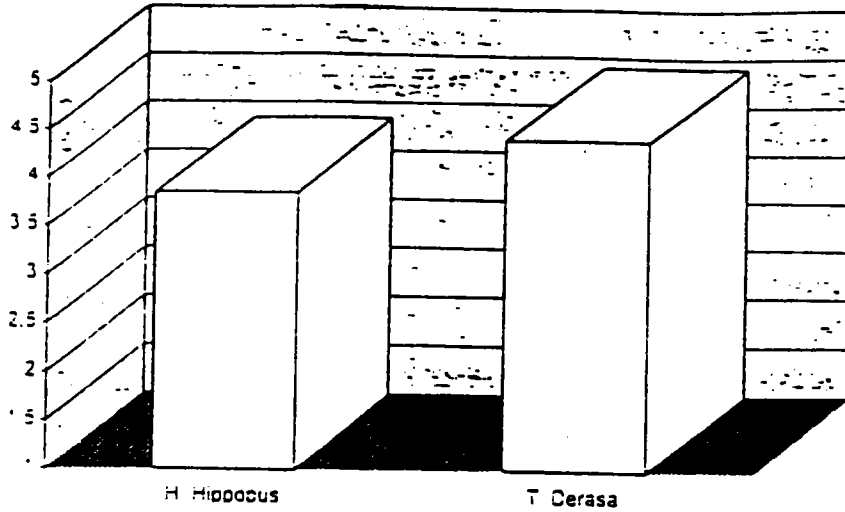
Samoan \_\_ Western Samoan \_\_ Tongan \_\_ Caucasian \_\_ Filipino \_\_ Korean \_\_

Other (please fill in) \_\_\_\_\_

6) What is your age? \_\_\_\_\_

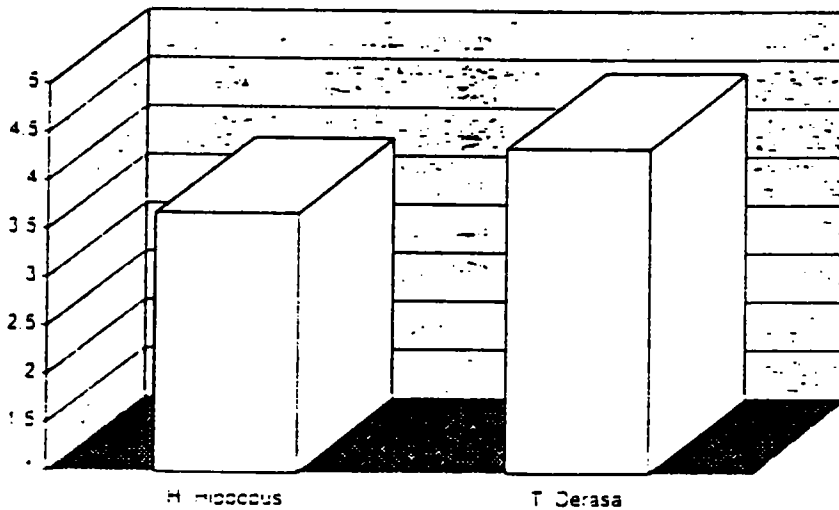
Thanks for participating. Your input will help the DMWR determine if Giant Clam farming is a good business for American Samoa. Don't forget to give this survey back to your host and join in the raffle for giant clams!

**Chart 2.3 Average Sensory Ratings of Two Different Species of Giant Clams - Smell**



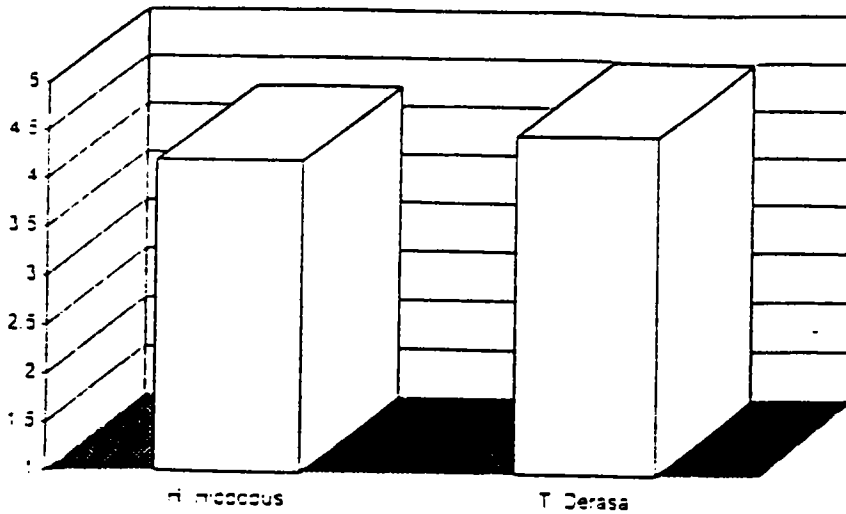
Ref. Market Analysis-Giant Clams as Food Products in the American Samoa Domestic Market Pg. 33

**Chart 2.1 Average Sensory Ratings of Two Different Species of Giant Clams - Appearance**



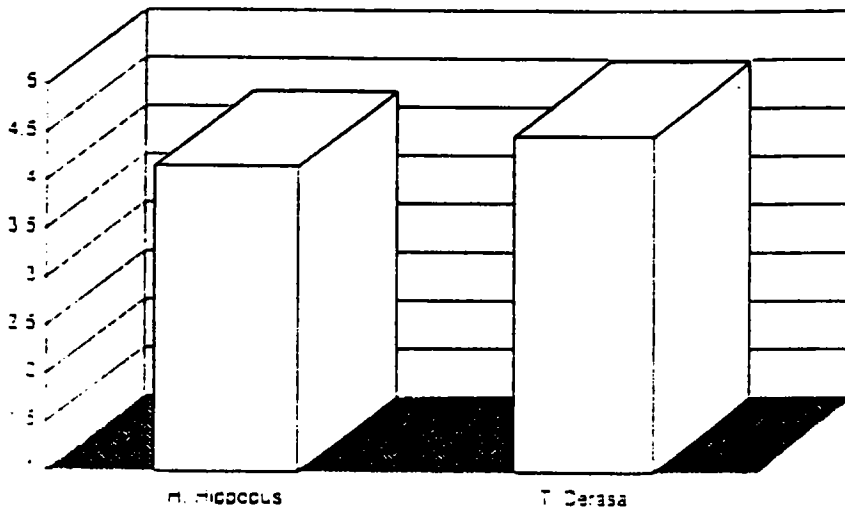
Ref. Market Analysis-Giant Clams as Food Products in the American Samoa Domestic Market Pg. 31

Chart 2.5 Average Sensory Ratings of Two Different Species of Giant Clams - Flavor



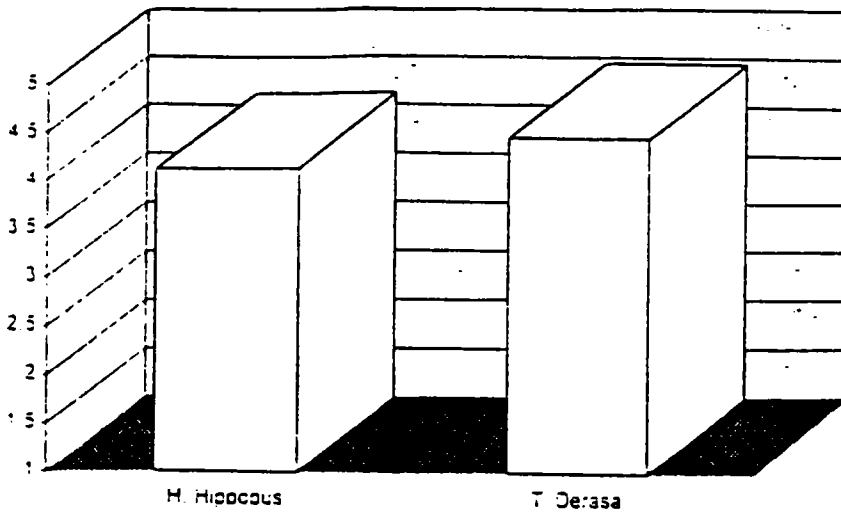
Ref. Market Analysis-Giant Clams as Food Products in the American Samoa Domestic Market Pg. 35

Chart 2.7 Average Sensory Ratings of Two Different Species of Giant Clams - Texture



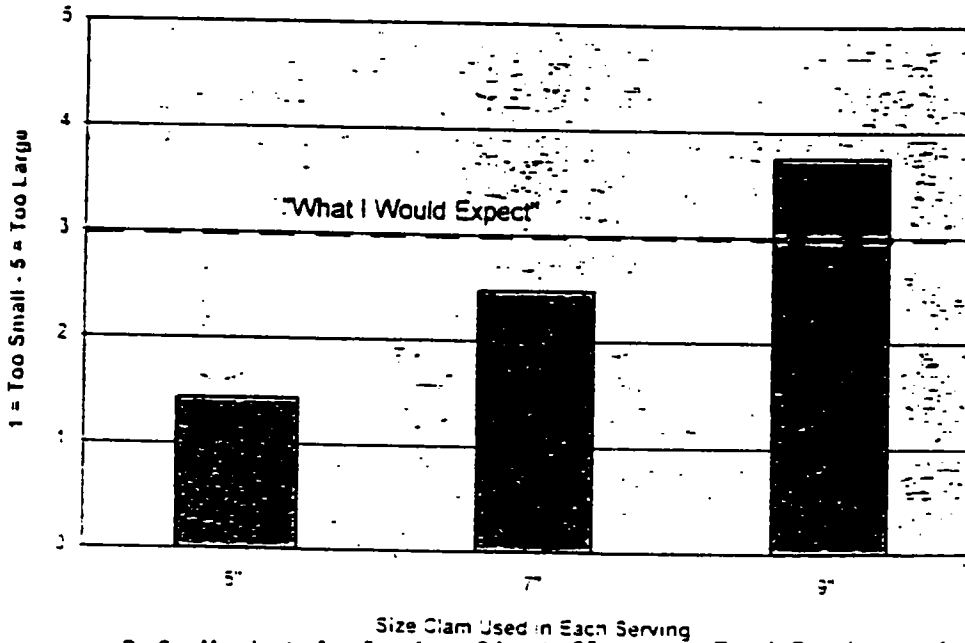
Ref. Market Analysis-Giant Clams as Food Products in the American Samoa Domestic Market Pg. 37

**Chart 2.9 Average Sensory Ratings of Two Different Species of Giant Clams - Overall**



Ref. Market Analysis-Giant Clams as Food Products in the American Samoa Domestic Market Pg. 39

**Chart 2.11 Size Expectations for Three Different Size Servings of Giant Clams (prepared as restaurant items)**



Ref. Market Analysis -Giant Clams as Food Products in the American Samoa Domestic Market Pg. 42

# **WILDLIFE RESEARCH IN AMERICAN SAMOA**

**by**

**Tyra Toluiva**

**University of Hawai'i at Hilo**

**Project Sponsor**

**Department of Marine and Wildlife Resources**

**Pago Pago, American Samoa**

**Faculty Advisor**

**Bruce Mathews**

**College of Agriculture**

**University of Hawai'i at Hilo**

**Project:** Work with three biologist, the fish biologist, bird biologist and bat biologist.

**Objective:** Observe and learn about marine and wildlife management.

## **Introduction**

I participated in the Micronesia and American Samoa Student Summer Internship Program (MASSIP). The program was established to provide career opportunities for undergraduate student. The program also helps the student develop problem-solving skills and gain hands-on work experience in an area of interest.

I, Tyra Toluiva, was assigned to work at the Department of Marine and Wildlife Resources in American Samoa for eight weeks. The Department of Marine and Wildlife Resources (DMWR) was established to manage, protect, preserve and maintain the marine and wildlife resources in the territory of American Samoa. I worked four weeks in the fisheries and four weeks in the wildlife division. From the internship program I learned about the marine and wildlife resource management.

## **Fisheries Statistic Division**

I was working at the Fisheries Statistic Division under the supervision of Alan Kingsolving. The division is responsible for the offshore survey, inshore survey, and coral reefs survey data. I participated in the offshore survey.

What is an offshore survey? It is a count of fish that are caught by fishermen in boats.

For the offshore survey the main type of fishing boat we count is call alia. On Tutuila the number of alia is approximately 50 fishing boats. On sampling days we interviewed all fishermen who went offshore to fish and we recorded the amount of catch (fish caught) and effort (amount of time that a fisherman spent fishing). We interviewed few fishermen on sampling days because not all 50 alia go out to fish. When these alia went out to fish they caught skipjack tuna, yellowfin tuna, mahimahi, wahoo, blue marlin, and other different species of fish.

We sample three times per week during 16 hours a day, which means there are two shifts: 1) start at 5:00 a.m. to 1:00 p.m. and, 2) 1:00 p.m. to 9:00 p.m. On each sampling day we collect two data: 1) participation data, which is the number of fishermen who went out to fish, 2) catch data, number of fish caught. From the data collected we are able to calculate the annual catch and efforts of each fishing boat. We also calculated the average catch of individual species caught by trolling (baited line trailing behind the boat), and bottomfishing.

From working at the Fisheries Statistic Division I was able to calculate average catch and effort by using collected data. I was also able to see what is happening to the natural resources. It was reported in previous years fishermen can only go out about five miles to fish and now it takes ten miles in order to get fish. Why is this happening? From my own point of view, the cause of this problem is people who are polluting and destroying the coral reefs.

## Wildlife Division

Secondly I was assigned to work with Holly Freifeld, a bird specialist. I participated in bird surveys and Pacific pigeon surveys that were conducted by DMWR to determine the abundance and distribution of the native land birds on Tutuila, American Samoa. These surveys have been conducted since 1992.

Bird survey was conducted monthly at six transects (35 stations). These transects are made up of four in the native forest and two in plantation. Counts of all bird detected by hearing or sight were conducted once per month at each station. The counts were conducted from 6:00 a.m. to 9:00 a.m. every morning on sampling days. In the given three hours, two types of data sampling were collected: 1) distance data, which is the place where the bird is at the moment of counting, 2) method of detection, which is sight or sound. During each count we are required to use good judgement in deciding if we are hearing the same bird because we don't want to record the same bird over and over. We also keep track of new species of bird that we detect during the next count at the next station.

On certain days of the week we go out in the field and do Pacific pigeon survey. Pacific pigeon survey was conducted by DMWR since 1995 to determine the relative abundance, seasonality and general movement of the bird. On sampling days we record all lupe seen and how many fly over during each count either in the north, south, east, west or in vegetation.

In the middle of the internship I worked with Anne Brooke, bat specialist. I participated in the bat survey. The purpose of the survey is to see if the bat population increased or decreased. Bat surveys were conducted monthly at six sites. The counts of all bats detected by sight during the ten-minute counts were conducted once per month. On sampling days, we recorded the number of bats seen in each survey site and their activities. We also recorded them according to their species.

There are two species of fruit bat in Samoa. The *Pteropus samoensis* and *Pteropus tonganus*. *P. samoensis*, is the samoan fruit bat which is known as the *pe'a vao*. *P. tonganus*, the white-necked fruit bat is known in Samoa as the *pe'a fanua*. Both species are very important culturally and for pollinating the flowers and dispersing the seed in the rainforest trees.

How can you tell the difference between the two fruit bats? *P. samoensis* has a wingspan of about three feet and weighs almost one pound. It sometimes has a yellowish or grayish spot on the top of its head. In flight it has broader, less scalloped wings, slower wing beats and appears to lack a tail. The Samoan bat lives by itself. *P. tonganus* is about the same size as the Samoan bat, but in flight, the *pe'a fanua* has narrower, more scalloped wings, faster and sometimes jerky wing beats, and appears to have a tail. The *pe'a fanua* lives in big roosts. It rarely soars and generally does little flying during the day.

Secondly, I participated in radio tracking. Radio tracking is a method use to keep track of the bats' flight and help locate its direction. Radio tracking was establish by DMWR to determine the biology of bats on Tutuila Island, and to provide information about their feeding locations, how much time they spend in each area, whether they return to the same feeding area each night, and whether they return to the same roost site everyday.

From the internship I learned so much about the marine and wildlife resource management. I also learned that in order to have available resources we should stop destroying our native

forest and our coral reefs. We should also pay attention to those who are trying hard to maintain the economical importance of the marine and wildlife in the territory of American Samoa.

Last but not least, I'd like to take this opportunity to thank the MASSIP coordinator and Ray Tulafono, director of the DMWR for the wonderful opportunity they offered me during the summer to study about the importance of marine and wildlife resources. I also thank Aito Sunia, Alama Tua, Lee Yandall, Chris Solek, Donna and Fia Tiapula, and all the DMWR staff for making my summer internship a successful and a memorable summer of pursuing my career goal.