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FOREWORD

This special issue of the Silliman Journal contains results and summaries of the Environment and Resource Management Project - Bais Bay Basin (ERMP-BBB). The Project was funded by the Canadian International Development Agency (CIDA) through the Institute of Environmental Science and Management (IESAM), University of the Philippines at Los Baños. Start up date of the project was August 1991. It ran for one and a half years.

Much work and research have been conducted in the area ever since, most of which have not been included in the profiles and bibliography, although efforts were made at updating the articles. A more recent (1996) survey and monitoring of the area was conducted by the Silliman University Marine Laboratory as part of the Negros Oriental Learning Site Assessment of the Coastal Resources Management Project funded by the United States Agency for International Development. Results of this survey are published as contribution Number 2 of the Center of Excellence in Coastal Resources Management, Silliman University, Dumaguete City.

H.P. Calumpong
Chair, SJ Editorial Board

Notice to Authors

The **Silliman Journal** welcomes contributors in all fields from both Philippine and foreign scholars, but papers should normally have some relevance to the Philippines, Asia or the Pacific. All submissions are refereed.

Articles should be products of research, taken in its broadest sense; a scientific paper should make an original contribution to its field. Authors are advised to keep in mind that **SJ** aims a general, international audience, and to structure their papers accordingly.

SJ also welcomes the submission of "Notes," which generally are briefer and more tentative than full-length articles. Reports on work in progress, queries, updates, reports of impressions rather than of research, responses to the work of others, even reminiscences are appropriate here. Book reviews and review articles will also be considered for publication.

Manuscripts should conform to the conventions of format and style exemplified in Volume 37, number 1 of SJ. Whenever possible, citations should appear in the body of the paper, holding footnotes to a minimum. Pictures will be accepted only when absolutely necessary. Scientific papers should be accompanied by an abstract. all authors must submit their manuscripts in duplicate, typewritten double-spaced on good quality paper.

The Editorial Board will endeavor to acknowledge all submissions, consider them promptly, and notify authors of its decision as soon as possible. Each author of an article is entitled to twenty-five offprints. More may be had by arrangement with the Editor before the issue goes to press.

PROFILE OF THE BAIS BAY BASIN

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INTRODUCTION

General Profile

Bais Bay is located on the eastern side of Negros Island (123° 9' E long. 9° 34' N lat.) facing Tañon Strait in Central Philippines, 45 km north of Dumaguete City. It occupies an area of about 54 km^2 (5,430 ha), naturally divided into North Bais Bay and South Bais Bay by Daco or Dewey Island. Near the center of North Bais Bay stands the smaller Olympia Island or Polundyot (also called Diutay Island) which unlike Daco Island has no road connection to Bais City. Both islands are coral rocks with a very thin layer of about 1-2 inches of topsoil (Cadeliña, 1983) and are populated.

Three rivers, Panambalon, Alangilanan, and Lutao (or Tamogong), empty into North Bais Bay. Only one river, the Panamangan, supplies fresh water to South Bais Bay.

Figure 1 shows that Bais Bay actually belongs to three municipalities. The northern end of North Bais Bay belongs to the municipality of Manjuyod. The greater portion of this and a large part of the northern portion of South Bais Bay belong to Bais City while the remaining small part of South Bais Bay belongs to Tanjay.

North and South Bais Bays each has a pier and a fishing port. The pier in South Bais Bay, located in Luca, Tanjay, was built by Central Azucarera de Bais (CAB) in 1925; the one in North Bais Bay, located in Campuyo, Manjuyod, was constructed by the Universal Robina Sugar Milling Company (URSUMCO) in 1974. Both piers accommodate foreign cargo ships (British, Japanese, Greek and Swiss) which enter the bay during and after sugar milling seasons (November to May) to purchase sugar and molasses from the two sugar factories. The two fishing ports, one located in Hindungawan, South Bais Bay, the other in Canibol North Bais Bay, both belong to Bais City. A new pier was constructed in Capiñahan in 1993.

Importance of Bais Bay

Bais Bay has long been a source of food for the local populations of Bais and neighboring towns, including Dumaguete City. Because of this, it has generated inter-

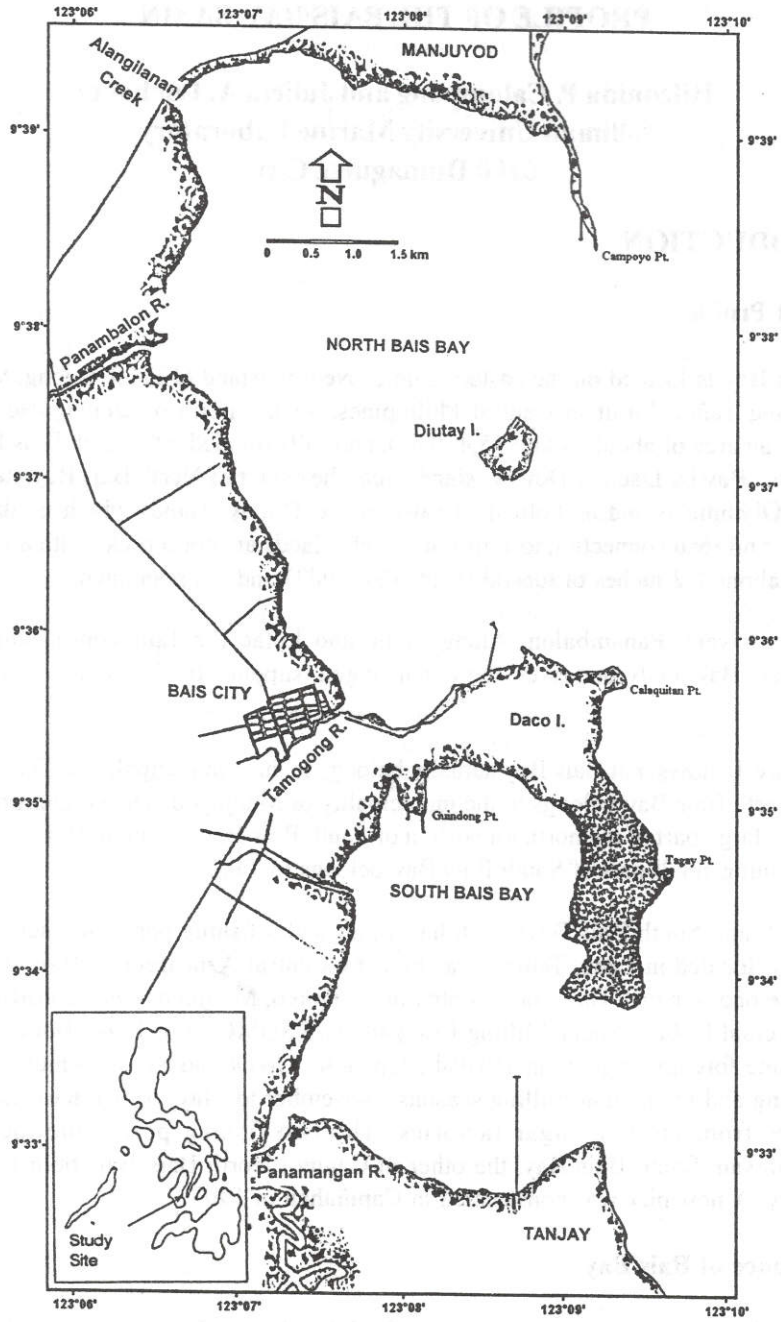

Figure 1. Map of Bais.

est for many scientific investigations, especially by students and scientists from Silliman University and abroad. Among these are important studies on the primary productivity of mangroves (de Leon, *et al.*, 1991a) and seagrasses (Estacion and Fortes, 1988); litter production and exportation (de Leon, *et al.* 1991b; Oñate, 1991; Calumpong, 1992a); listing and quantification of economically-harvested species (Alcala, 1979; Alcala and Alcazar, 1984) and associated fisheries (Dolar and Lepiten, 1991; Dolar, *et al.*, 1991); structure and ecology of benthic invertebrates (Maravilla, 1975; Notosoedarmo, 1977; Estacion and Oñate-Pacalioga, 1990; Calumpong, 1979; Pauly and Calumpong, 1984); environmental (Alcala and Ortega, 1976); pollution (Lowrie and Anfone, 1980; Lowrie, *et al.*, 1979; Ng, 1978); plankton (Alcazar, 1983) and energetics (Calumpong and Serate, 1994).

This report incorporates data from these biological and chemical studies. Additional information was gathered from government agencies such as the Department of Agriculture (DA), Bureau of Fisheries and Aquatic Resources (BFAR), and Department of Environment and Natural Resources (DENR). In organizing this paper, we drew much inspiration from the work of Tagarino, *et al.* (1985) on their analysis of Lake Buhi.

SYSTEM HIERARCHIES: THE BAIS BAY MARINE SYSTEM

Bais Bay Subsystems

Figure 2 gives an idea of the system hierarchies existing in the Bais Bay Basin. These systems are both natural and political. At the very top of this hierarchy is the Bais Bay Basin, naturally divided into the North and South by Daco Island. North Bais Bay occupies an area of about 32 km^2, the rest is occupied by South Bais Bay. The third level of hierarchy is a political one, placing the Bay under three jurisdictions: part of the North Bais Bay Basin belonging to the municipality of Manjuyod, a small part of the South Bais Bay belonging to the municipality of Tanjay, and a major part of both Bays belonging to the city of Bais. Within each of these municipalities are subsystems contributing to the overall basin ecosystem, namely the watershed, the farmlands, the industrial and urban areas, rivers, coasts and the bay itself with its distinct but interconnected ecosystems. Figure 3 shows the different ecosystems in Bais Bay.

Bais Bay Ecosystems

The most recent report by Calumpong and Serate (1994) reveals that Bais Bay covers a total area of 5430 ha including the outermost reef margins. In

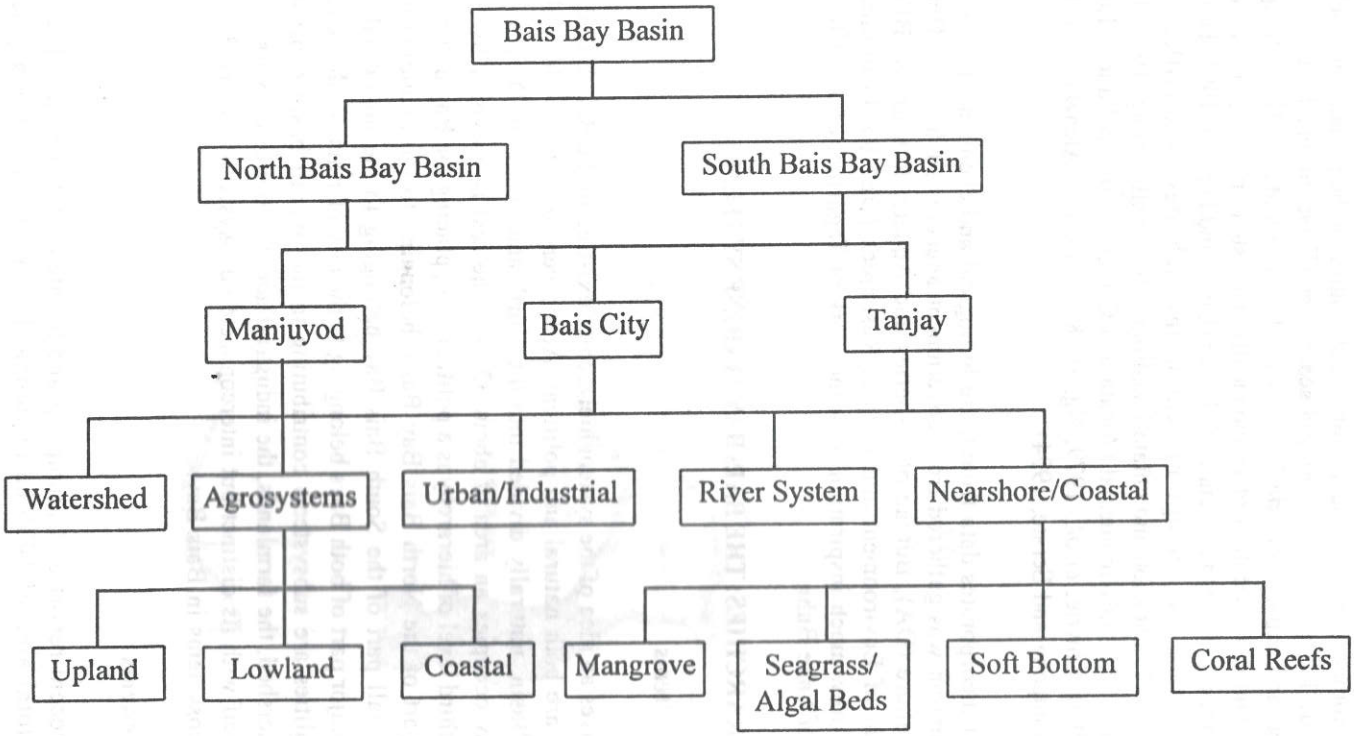

Figure 2. System hierarchies of the Bais Bay Basin.

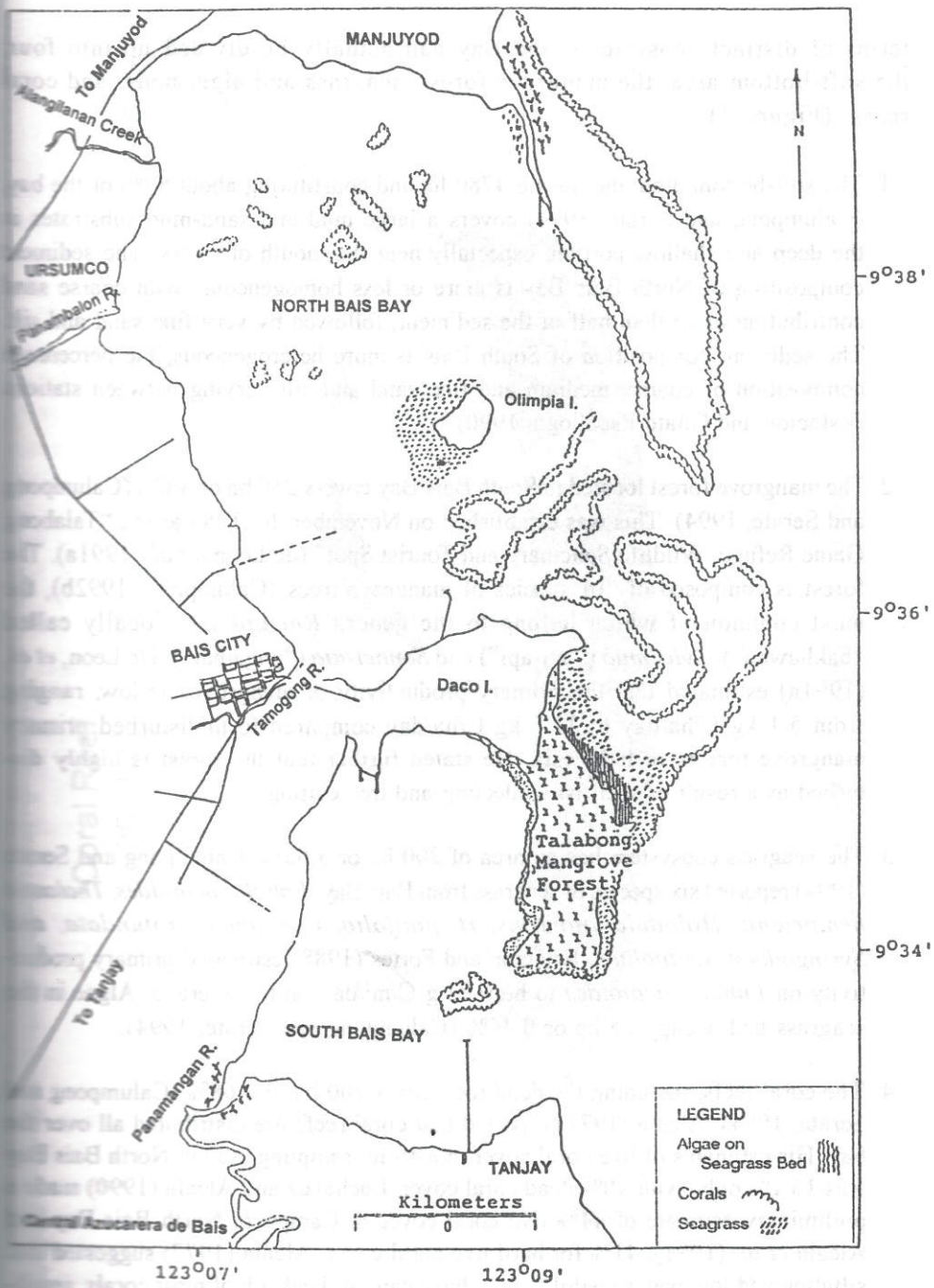

Figure 3 Ecosystems in Bais Bay.

terms of distinct ecosystems, the Bay can actually be divided up into four: the soft-bottom area, the mangrove forest, seagrass and algal beds, and coral reefs. (Figure 4).

1. The soft-bottom area, measuring 4780 ha and constituting about 87% of the bay, (Calumpong and Serate, 1994) covers a large mud and sand-mud substrates in the deep and shallow portion, especially near the mouth of rivers. The sediment composition of North Bais Bay is more or less homogeneous, with coarse sand contributing more than half of the sediment, followed by very fine sand and silt. The sediment composition of South Bais is more heterogeneous, the percentage composition of coarse, medium and fine sand and silt varying between stations (Estacion and Oñate-Pacalioga, 1990).

2. The mangrove forest located in South Bais Bay covers 250 ha or 4.6% (Calumpong and Serate, 1994). This was established on November 26, 1985 as the "Talabong Game Refuge, Wildlife Sanctuary and Tourist Spot" (de Leon, *et al.*, 1991a). The forest is composed of 14 species of mangrove trees (Calumpong, 1992b), the most common of which belong to the genera *Rhizophora* (locally called "bakhawan"); *Avicennia* ("api-api") and *Sonneratia* ("pagatpat"). De Leon, *et al.* (1991a) estimated that the primary productivity of mangroves is low, ranging from 5.1 kg C/ha/day to 11.6 kg C/ha/day compared to undisturbed primary mangrove forests in Indonesia. He stated further that the forest is highly disturbed as a result of shellfish collecting and tree cutting.

3. The seagrass ecosystem has an area of 200 ha or 3.68%. Calumpong and Serate (1994) reported six species of seagrass from Bais Bay: *Enhalus acoroides, Thalassia hemprichii, Halodule uninervis, H. pinifolia, Cymodocea rotundata, and Syringodium isoetifolium.* Estacion and Fortes (1988) estimated primary productivity on *Enhalus acoroides* to be 0.92 g C/m^2/day on the average. Algae in the seagrass bed occupy 25 ha or 0.46% (Calumpong and Serate, 1994).

4. The coral reefs, including the dead reef, cover 200 ha or 3.68% (Calumpong and Serate, 1994). Alcala (1977) reported that coral reefs are distributed all over the bay. His estimates of live coral cover in a 49 m^2 sampling area in North Bais Bay was 16.1% only, with 40% dead coral cover. Luchavez and Alcala (1990) made a preliminary estimate of 44% live coral cover in Campuyo, North Bais Bay and Alcala *et al.* (1991), 41% for hard live coral cover. Alcala (1977) suggested that siltation and low water visibility may have caused the death of most corals, resulting in very low live coral cover.

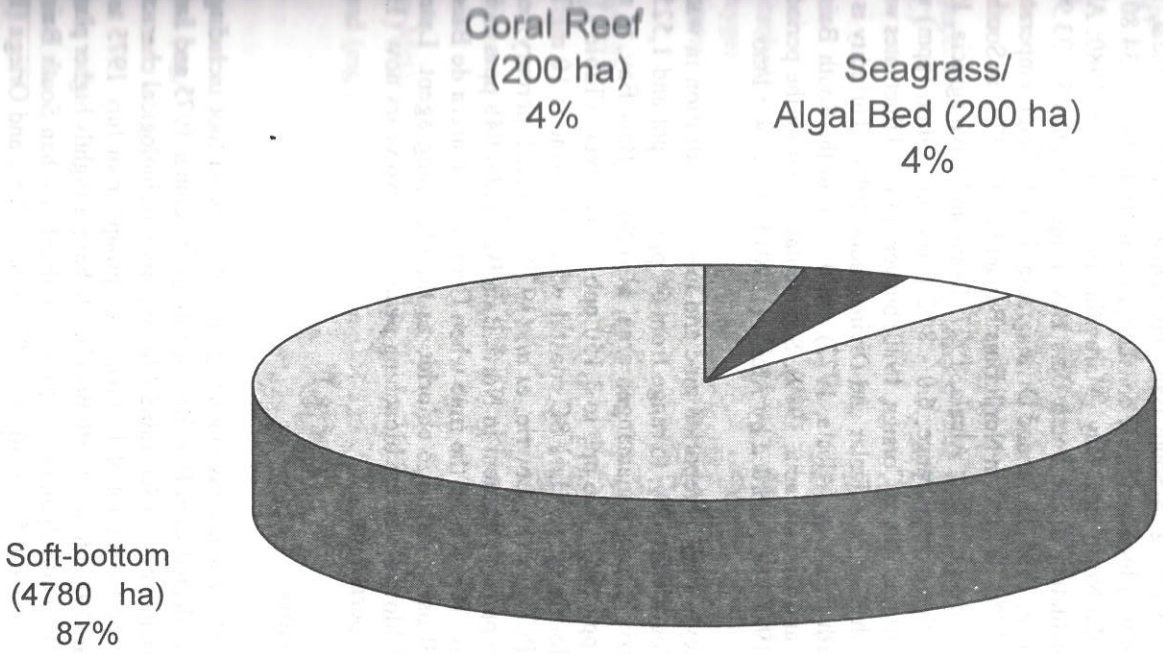

Figure 4. Bais Bay Ecosystems

SPATIAL RELATIONSHIPS

Water Quality

Physico-chemical Characteristics. Table 1 summarizes the physico-chemical characteristics of the water in Bais Bay. The water in the Bay is alkaline, pH is 8.65 in North Bais Bay and from 7. 25 - 9.12 in South Bais Bay (Dolar and Divinagracia, 1989; Maravilla, 1975). Salinity is high and fairly constant, ranging from 34.19 - 34.80 parts per thousand (ppt), in the North Bais Bay (Maravilla, 1975; Corsiga, 1980; Alcala, 1977) but low and fluctuating in the South Bais Bay, ranging from 25 - 33.90 ppt (Maravilla, 1975; Alcazar, 1983; Dolar and Divinagracia, 1989). Water temperature is variable, ranging from 25°C - 31.2°C in North Bais Bay and 26°C - 33°C in South Bais Bay (Maravilla, 1975; Corsiga, 1980; Alcala, 1977; Dolar and Divinagracia, 1989). Dissolved oxygen is within normal range, 6.0 - 8.92 parts per million (ppm) in the North Bais Bay (Maravilla, 1975 and Corsiga, 1980) but very low and fluctuates widely, 0 - 5.6 ppm, in the South Bais Bay (Dolar and Divinagracia, 1989). Turbidity is 1.3 - 13.0 meters in the North Bais Bay (Alcala, 1977) and 0 - 3.0 in the South Bais Bay (Alcazar, 1983; Dolar and Divinagracia, 1989). Sedimentation during the period November 1987 to June 1988 was recorded by Alcala (1990) to be 1.84 g/l/mo.

Heavy Metals. Reyes (1986) reported zinc and lead concentration in water in Hindungawan area, South Bais Bay, to range from 64 ppt to 91 ppt and 1,525 ppb to 1,875 ppb, respectively, and Panamangan area, also South Bais Bay, to range from 136 ppb to 452 ppb and 1,516 ppb to 3,150 ppb, respectively (Table 1). The maximum allowable levels set on class SC coastal waters for zinc is 10 mg/1 and for lead 0.5 mg/1 (NPCC, 1982). Lowrie, *et al.* (1979) reported mercury content of 0.027 ppm to 0.046 ppm in sediment in North Bais Bay and 0.048 ppm to 0.063 ppm in South Bais Bay. This was at the time when Central Azucarera de Bais was operating a paper mill using mercuric chloride as the bleaching agent. Later the paper mill shifted to Chlorox(R) as the bleaching agent. For two years now (1992), the mill has not been operational.

Biological Characteristics

Plankton. A total of 19 major taxonomic groups of plankton (not including fish eggs and larvae) were collected from Bais Bay in July to December 1975 and January 1976 by Alcala and Ortega (1976) (See Table 2 for summary of biological characteristics). Alcazar (1983) reported a total of 11 taxonomic groups from July 1975 to July 1976. Although Alcazar (1983) found North Bais Bay to have a slightly higher plankton volume in day (0.49 - 0.90 ml/m^3) and night (0.60 - 0.98 ml/m^3) than South Bais Bay (0.46 - 0.59 ml/m^3 for day and 0.51 - 0.80 ml/m^3 for night), Alcala and Ortega (1976)

Table 1. Physico-chemical characteristics of Bais Bay.

	North Bais Bay	South Bais Bay	Source	NPCC Std. Coastal Waters
1. Salinity (ppt)	34.19-34.8	25.00-33.9	Maravilla, 1975 Corsiga, 1980 Alcala, 1977	
2. pH	8.65	7.25-9.12	Maravilla, 1975 Dolar and Divinagracia, 1989	5.5-9
3. Temperature (°C)	25-31.2	26-33	Maravilla, 1975 Corsiga, 1980 Alcala, 1977 Dolar and Divinagracia, 1989	not>40°C
4. Dissolved Oxygen (ppm)	6-8.92	0-5.6	Maravilla, 1975 Corsiga, 1980 Dolar and Divinagracia, 1989	DO = not<5 BOD in mg/l =250
5. Turbidity (m)	1.3-13	0-3	Alcazar, 1983 Dolar and Divinagracia, 1989	
6. Sedimentation	184mg/l/mo	-	Alcala, 1990	suspended solids = 200 mg/l
Heavy Metal Concentration				
1. Lead (mg/l)	- Hindungawan area - 1.525 1.875		Reyes, 1986	0.5 mg/l
	- Panamangan area - 1.516 3.150			
2. Zinc (mg/l)	- Hindungawan area - .064 .091		Reyes, 1986	10 mg/l
	- Panamangan area - 0.136 0.452			

did not find apparent differences in the average plankton volumes in the two bays. However, the total number of species and the total number of plankton groups were slightly higher in South Bais Bay than those in North Bais Bay, indicating a possible enrichment of the South Bais Bay (Alcala and Ortega, 1976 and Alcazar, 1983).

Mangroves. In 1979, Biña estimated the mangrove patches in Bais Bay to occupy a total of 811.6 ha using land satellite data. Now the area has decreased to about 250 ha (Calumpong and Serate, 1994) due to its conversion into brackish water fishponds. The density of mangrove trees was estimated by de Leon, *et al.* (1991a) to be 627/ha for trees > 7 cm diameter at breast height (dbh). Forty percent of these belong to the genus *Avicennia*. Saplings (those with dbh of < 4 cm and height > 1 m) had a density of 2,920/ha, 62% of which belong to genus *Rhizophora*. The seedlings (those which are <1 m in height), 81% of which are *Rhizophora*, had a density of 37,000/ha.

Seagrasses. The seagrass distribution in the bay is patchy. In some areas, especially in the subtidal, are pure beds of *Enhalus acoroides* while in the 200-ha seagrass bed in the intertidal in front of the Talabong mangrove forest are found six species. Biomass for the two most common species was estimated by Oñate *et al.*, (1991) to range from 30-144 g dry weight/m^2 ($gdwm^{-2}$) for *E. acoroides* in mixed beds and 189-345 $gdwm^{-2}$ for pure beds and 19-317 $gdwm^{-2}$ for *Thalassia hemprichii*.

Algae. Although algae are found in all the four ecosystems, the majority are found in the seagrass bed in front of the Talabong mangrove forest. Calumpong (1991) listed 19 species in South Bais Bay, two of which were mangrove algae and two common in the coral reefs. Standing crop during a one-year period (May 1990 to May 1991) varied from 22 gdw/m^2 to 202 gdw/m^2 .

Corals. Live hard coral cover in shallow and deep parts of Campuyo Reef, North Bais Bay, range from 37 to 47.6% (Alcala, 1990). The rest of the substrate consists of dead corals, soft corals, algae, sand, rubble and rock. During the period August 1987 to September 1988, live coral cover of Bais Bay was found to decrease from 47% to 40%. This was attributed to increase in fishing activities and dynamite blasting (Luchavez and Alcala, 1988).

Soft-bottom Fauna. A total of 191 species belonging to four groups constitute the fauna of soft-bottom communities in South Bais Bay (Estacion and Oñate 1991). More than half of the species are polychaetes (105 species), followed by molluscs (33), crustaceans (21), unknown organisms (17), nematodes (9), chordates (3), echinoderms (2) chaetognath (1).

Table 2. Biological characteristics of Bais Bay.

	North Bais Bay	South Bais Bay	Source
1. Plankton Composition			Alcazar, 1983
Ave. vol. (ml/m³) day	0.49-0.90	0.46-0.59	
Ave. vol. (ml/m³) night	0.60-0.98	0.51-0.80	
No. of species	76	77	
No. of taxonomic groups	9	10	
2. Fish			
Coral reef	141		Luchavez & Alcala, 1990
Seagrasses	53		Dolar & Lepiten, 1991
Mangroves	30		Dolar & Lepiten, 1991
3. Molluscs	27*		Alcala & Alcazar, 1984
4. Sea Cucumber	16		Alcala, 1979
Sea Urchins	5		
5. Mangroves		9	Calumpong, 1992b
% productivity		5-11.5 kg C/ha/day	De Leon, et al. (1991a)
Density: > 7 cm dbh		627/ha (40% *Avicennia*)	
Sapling: < 4 cm dbh and > 1 m ht		2,920/ha (62% *Rhizophora*)	
Seedlings: 1 m ht		37,000/ha (81% *Rhizophora*)	
6. Seagrasses	6	6	Oñate et al. (1991)
Biomas:(gdwm⁻²)			
E. acoroides	189-345	30-144	
T. hemprichii	19-317		
7. Algae		19	Calumpong, 1991
Standing crop		22-202 gdw/m²	
8. Corals: Live coral cover	37-47%		Alcala, 1990
9. Soft-bottom fauna			
Polychaetes	105		Estacion and Oñate, 1991
Crustaceans	21		
Mulluscs	33		
Others	32		

* harvested

Fishery Resources

Bais Bay fishery resources include fish, molluscs, holothurians and sea urchins, crustaceans, and seaweeds. Table 3 and Figure 5 give the amounts harvested and peso values of these organisms.

Fish. Luchavez and Alcala (1990) gave a preliminary estimate of 141 species (28 families) of fish in Bais Bay coral reefs in 1989 and 1990, with pomacentrids (or damselfishes) as the most abundant. They also reported that intense fishing (including the use of dynamite, poison and spearfishing with SCUBA) probably reduced the abundance and standing stock of fish in Bais Bay coral reef.

In seagrass beds, 53 species were sampled by Dolar and Lepiten (1991) with *Siganus canaliculatus* as the most abundant species. Alcala (1979) reported five species of juvenile siganids and noted that fry (about 1-3 months old) of *Siganus canaliculatus* were abundant from January to November and those of *S. spinus* from February to September.

In the mangroves, Dolar and Lepiten (1991) sampled 30 species (15 families) of juvenile fishes in May to November 1990. Using seine net, they found that majority of the catch, both by number and by weight, consists mainly of fishes belonging to family Apogonidae (45% and 34%, respectively). This is followed by the siganids (locally called "danggit") and mugilids ("gisaw"). Alcala and Alcazar (1984) reported that *Siganus guttatus* fry were abundant from January to September in the mangroves. Dolar, *et al.* (1991) found that mangroves serve as nursery ground to most of the coral reef fishes.

Cadeliña (1983) reported that fishermen in Daco and Polundyot Islands use different fishing techniques and gears which he considered low-energy-using technology. These gears include: *pukot, pamana, katay, bunsod, pasul, bubo, panggal, sahid, panulo, tapsay, sudsud, patuloy, sarap, sabinit, sikpaw* and *kubkub*. He also mentioned the operation of illegal and destructive fishing such as blasting and poisoning with "tuble" (fish poison from bark of a mangrove species), or commercialized chemicals, and muro-ami by fishermen from Cebu who regularly come to fish in Bais Bay. There was, however, no data on fish catch for these gears.

Molluscs. A survey of the edible molluscs harvested by local fishermen in Bais Bay (Alcala and Alcazar, 1984) included 27 species of bivalves and gastropods found in either seagrass beds, sand-coral rubble with little mud and/or sand-mud substrates (Table 4). They reported 12,000 kg per year (wet weight) in 267-ha shell areas, exclusive of *Modiolus metcalfei* (which is farmed), with an esti-

Table 3. **Important marine fishery of Bais Bay.**
(Values from Alcala, 1979 and Alcala and Alcazar, 1984).

	Species	Est. Harvest (kg/yr)	Est. Value (Pesos)
1.	Cultured danggit 0.7 ha fish pen	770	11,550
2.	Shellfish, exclusive of tahong (*Modiolus metcalfei*)	12, 000	24,000
3.	Tahong (*Modiolus metcalfei*)	500	1,000
4.	Lukot (*Dolabella auricularia* egg masses)	1,000-2,000	4,800-8,000
5.	Sea cucumbers	1,300	2,800
	Dried sea cucumbers (Trepang) in 1980	600	9,000
6.	Shrimps	2, 111	31,000
7.	Mud crabs (*Scylla serrata*)	2,356	15,000

mated value of P24,000 and that most species were exploited from January to December while other species were gathered from 5 to 10 months.

Alcala (1979) also estimated that about 1,100 to 2,000 kg egg masses of sea hares *(Dolabella auricularia)* or "donsol," valued at P4,800 to P8,000, were harvested from the Bay during a one-year period. Pauly and Calumpong (1984) reported that spawning and recruitment of this species occur throughout the year, with peaks in May to July and September to October.

Holothurians and Sea Urchins. Sixteen species of edible sea cucumbers were distributed in an area of about 110 ha at the seaward (eastern) edge of Daco Island and in Talabong Mangrove Forest (Alcala and Alcazar, 1984). Their preliminary data indicate that about 108 kg per month (1.3 tons per year) were gathered for local consumption, valued at about P2,800 per year. Alcala (1979) reported five species of sea urchins common in Bais Bay. All species are edible but the favorite species is "salawaki" or *Tripneutis gratilla* which is usually gathered during full moon when their gonads are ripe.

Crustaceans. Several species of crustaceans in the families Gecarcinidae, Penaeidae, Portunidae and Grapsidae were found to be harvested for food in Bais Bay but no quantitative data are available (Alcala, 1979).

Snakes and Turtles. Alcala (1979) reported that there were three species of snakes in North Bais Bay which have not been exploited as yet. Neither have their biomass been quantified. These have potentials as sources of skins for the manufacture of leather and of meat for animal or human consumption.

Alcala (1980) estimated the biomass yield of the Pacific hawksbills in North Bais Bay and vicinity (area of approximately 20 km^2) for January to June, 1977 (six months) to be 122 kg (14 animals) and for January to October 1978 (10 months) 167 kg (25 animals), or an average yield of 10.02 kg to 20.20 kg per km^2 per year for 1977-1978.

Fish and Shellfish Culture

Figure 6 shows the fishing gears and mariculture techniques employed in Bais Bay, namely, fish pens, fish corrals, *Eucheuma* farms, mussels and oyster farms.

A total of four fish pens were introduced to Bais Bay from 1983 to 1993, two of which were owned by cooperatives. The first one was constructed in Okiot, South Bais Bay, in 1983, covering an area of 0.7 ha. The second fish pen was constructed in Capiñahan, South Bais Bay, in 1986, covering an area of one hectare

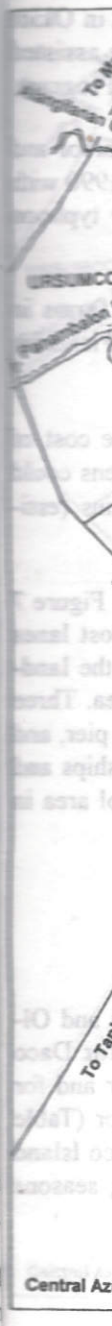

Figure 6.

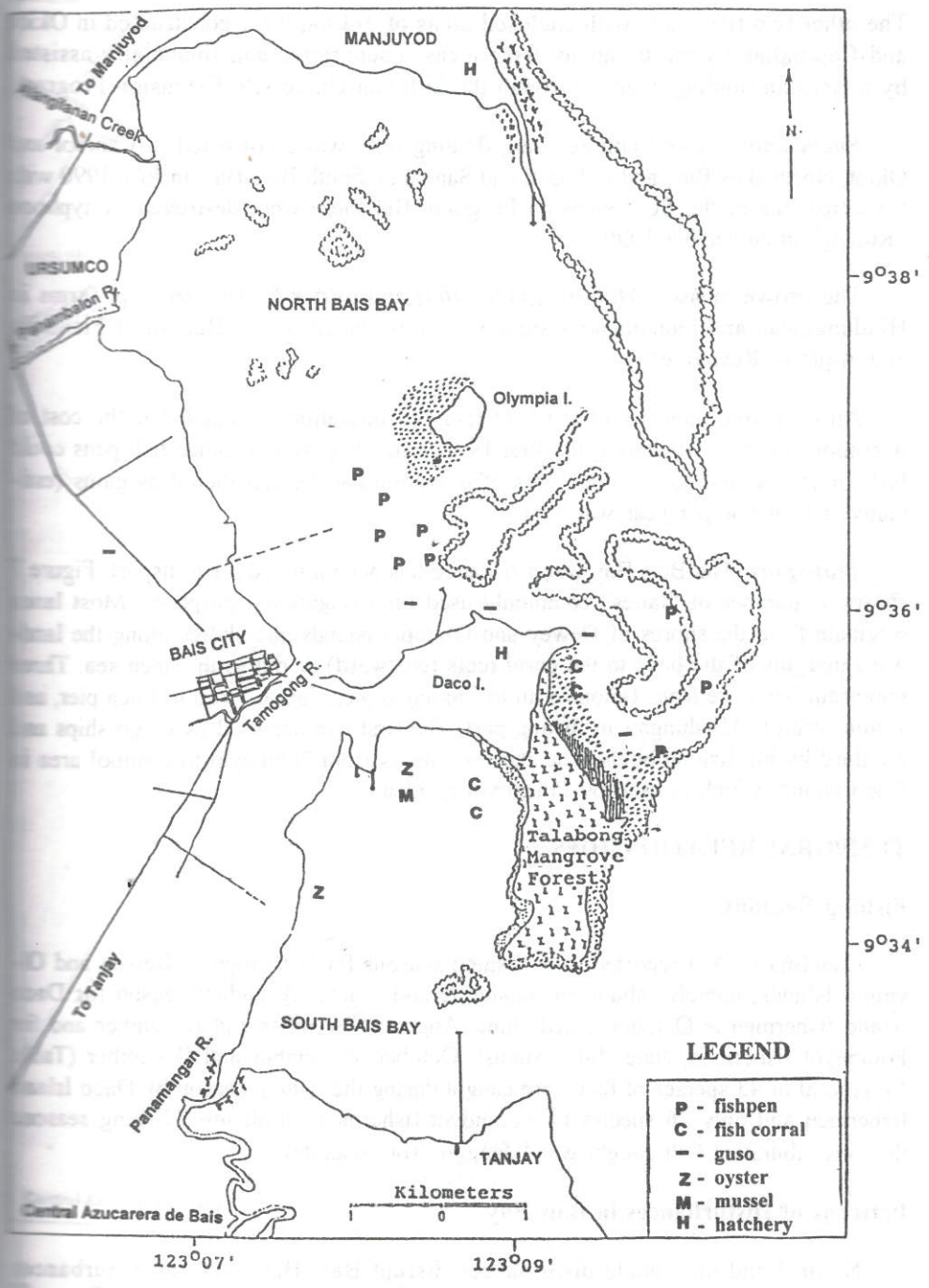

Figure 6. Fishing gears and mariculture techniques in Bais Bay.

The other two fish pens, with enclosed areas of 2-3 ha, were constructed in Okiot and Capiñahan by the barangay fishermens' cooperative and financially assisted by a German funding agency through the Silliman University Extension Program.

Eucheuma ("guso") culture using floating rafts was constructed in Canibol and Okiot, North Bais Bay, and in Lag-it and Sanlagan, South Bais Bay, in July 1990 with the assistance of the SU Extension Program. But these were destroyed by typhoon "Ruping" in November 1990.

The brown mussel (*Modiolus metcalfei*) and oyster *Crassostrea* sp. farms in Hindungawan and Panamangan areas were introduced by the Bureau of Fisheries and Aquatic Resources.

An economic analysis of the first fish pen operation revealed that the cost of operation was paid off during the first 14 months of operation. Since fish pens could last for four years, succeeding years of operation can be considered as gains (estimated net income per year was P10,550).

Transport. The Bais Bay water resource has been utilized for transport. Figure 7 shows a number of "lanes" commonly used for navigational purposes. Most lanes originate from the shores of Dewey and Olympia islands and shores along the landward margins of the bays to the coral reefs (eastward) or out to the open sea. Three important lanes are from Tañon Strait to Campuyo pier, Tañon Strait to Luca pier, and Tañon Strait to Hindungawan fishing port. The first two are used by cargo ships and the third by big fishing boats. The shortest lane is from Polundyot to Canibol area in Daco Island, which is used by Polundyot residents.

TEMPORAL RELATIONSHIPS

Fishing Seasons

Cadeliña (1983) reported three fishing seasons for fishermen in Dewey and Olympia Islands, namely: abundant, moderate and scarce. Abundant season for Daco Island fishermen is October, April, June, August, November and December and for Polundyot fishermen, June, July, August, October, November and December (Table 5). A total of 43 species of fish were caught during the fishing season by Daco Island fishermen and only 26 species by Polundyot fishermen. In all three fishing seasons the most abundant fish caught was "danggit" (or siganids).

Patterns of Disturbances in Bais Bay

Natural and man-made disturbances disrupt Bais Bay. Natural disturbances include northeast monsoon ("amihan"), which hit during the months of Novem-

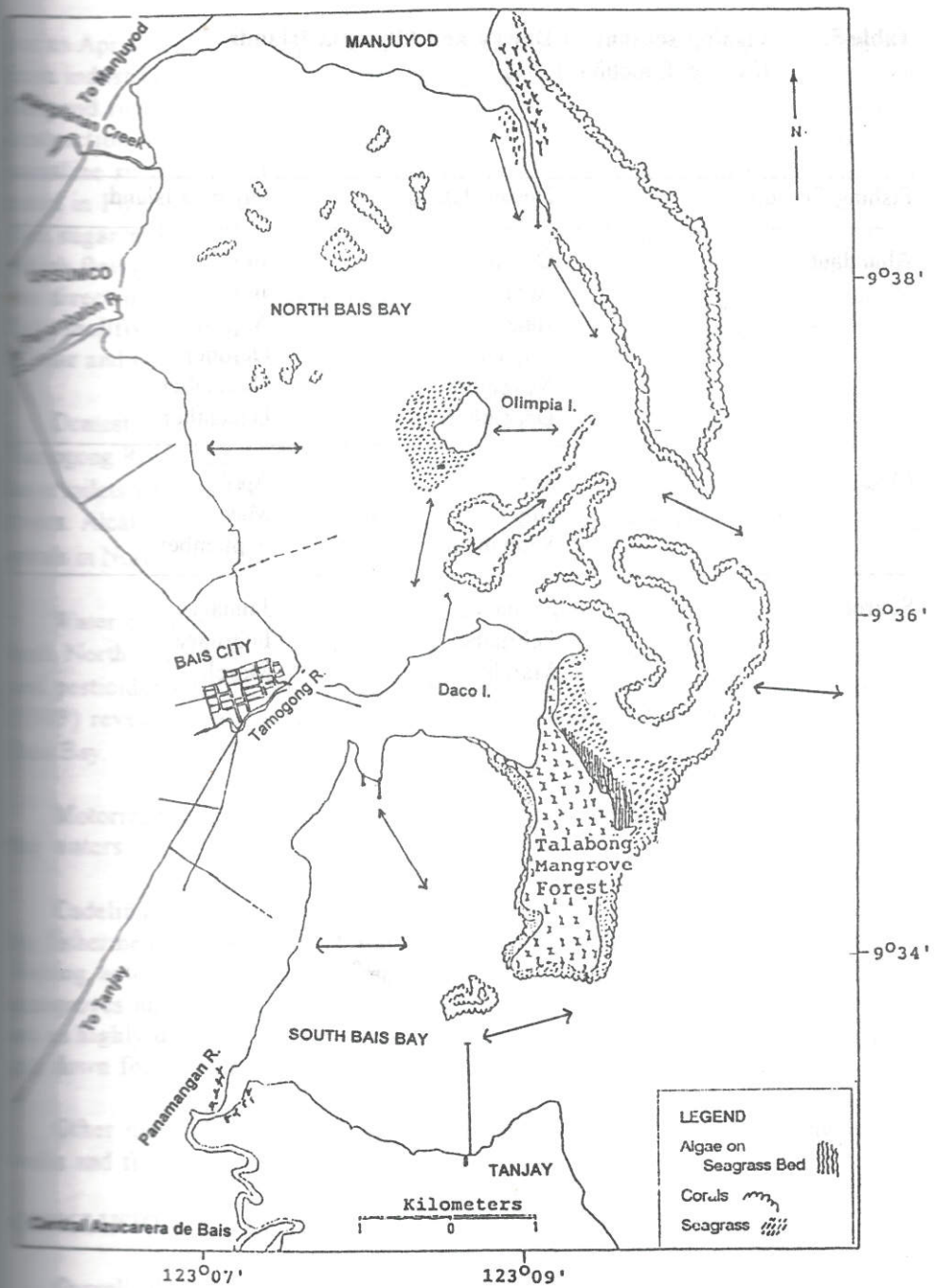

Figure 7. Navigational lanes in Bais Bay.

Table 5. Fishing seasons in Dewey and Olympia Islands.
(Source: Cadeliña, 1983)

Fishing Season	Dewey Island	Olympia Island
Abundant	October	June
	April	July
	June	August
	August	October
	November	November
	December	December
Moderate	March	April
	July	May
	September	September
Scarce	January	January
	February	February
	March	March

ber to April, and occasional typhoons. Man-made disturbances include effluents from industrial plants, domestic sewage, silt due to deforestation, agricultural and fishpond run-off, dynamiting and fishing with poisons, oil from boats and ships, destruction of mangroves for fish and other forest products, and alteration of coastline such as building of sea walls. Sources of such disturbances are indicated in Figure 8. The most important source of pollution is the effluent from the two sugar mills and the pulp and paper factory of Central Azucarera de Bais which flows into the South Bais Bay through the Panamangan River. In the past, the direct discharge of effluent into the bay had caused massive mortalities of fish, shellfish and other invertebrates by depleting dissolved oxygen in the water (Dolar and Divinagracia, 1989).

Domestic sewage pollution comes from Bais City (into North Bais Bay through the Tumogong River) and from Daco and Polundyot Islands. (Many houses in Daco Island have toilets which open directly into the water.) Silt comes into the bays through the rivers. Alcala (1979) suspected siltation as the possible "culprit" in the death of most corals in North Bais Bay.

Water outflows from agricultural fields and fishponds at the western side of both North and South Bais Bays bring agricultural chemicals such as fertilizers and pesticides into the bays' waters. Report received by Dolar and Divinagracia (1989) revealed that pesticides were used in cleaning fishponds in Dawis, South Bais Bay.

Motorized fishing boats and cargo ships have contributed to oil pollution to the waters.

Cadeliña (1983) reported that blast fishing and "tuble" poisoning are employed by fishermen of Daco and Diutay islands in harvesting fish from coral reefs. Fishing activities like gleaning and shellfish collection are also reported in the mangroves and seagrasses. De Leon *et al.*, (1991a) described the mangrove forest as highly disturbed as a result of shellfish collection. Mangrove trees are also cut down for fuel and other forest products and for fishpond construction.

Other disturbances include alteration of coastline with the building of sea walls and fishing ports and piers.

CONCLUSION

Overall, the status of the Bais Bay Basin as it exists today (1993) is shown in Figure 8. From this figure it is obvious that the properties of the bay, namely produc-

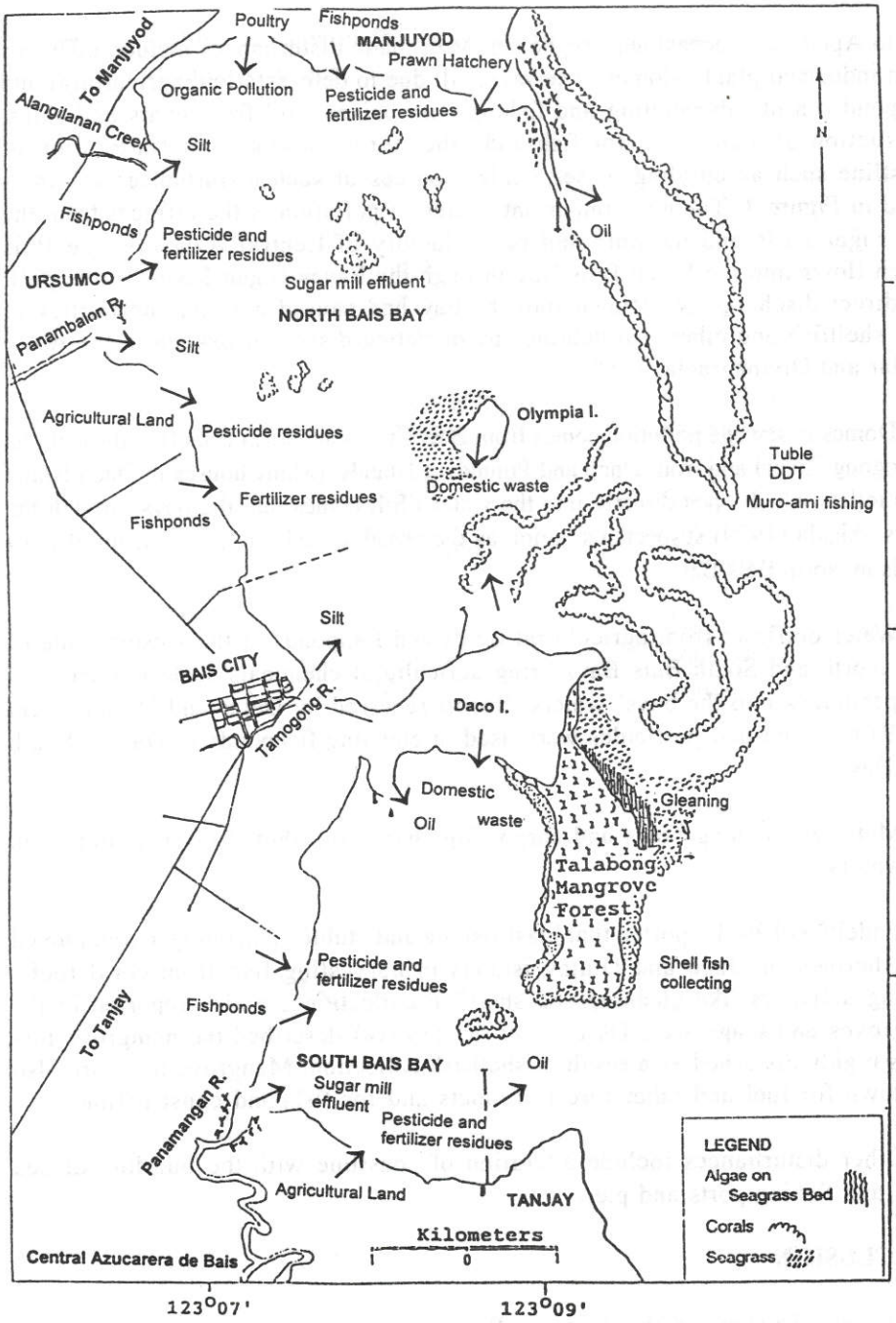

Figure 8. Sources of disturbances in Bais Bay.

ity, stability, sustainability and equitability (Tagarino, *et al.* 1985) are affected positively and negatively by many factors impacting on the bay, both natural and man-made.

Efforts to increase productivity of the bay have been undertaken, which include seaweed, oyster, and mussel farming; installation of fish pen/corrals and mangrove reforestation. However, some factors impact on the Bay that seem to decrease productivity, including siltation; pollution; destructive fishing and the destruction of mangrove, seagrass beds and coral reef. Trends are difficult to discern from the data presented because of the lack of long-term monitoring. For example, in terms of mangrove and seagrass productivity, we cannot show whether these have stayed the same throughout the years or have increased or decreased, as the data gathered were only for a period of one year. The same can be said of the water quality of the bay and the state of the coral reefs and other ecosystems. The most that can be done is compare these ecosystems with undisturbed ones.

More importantly, long-term assessment of the fishery has not been done. Most glaring is the siganid fishery, the most important fishery of the Bay. As of 1993 no data exists as to the total siganid catch from the bay, or more importantly, whether this fishery is over-exploited.

Much data have since been gathered that have added to our knowledge of what exists in Bais Bay. More are needed to help us assess the trends in order that the sustainability and stability of Bais Bay can be maintained.

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THE PEOPLE OF BAIS CITY: SELECTED SOCIAL DIMENSIONS

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This paper has two parts: the first section presents some physical and social characteristics of Bais City taken from available reports[1]; the second part presents primary data taken from interviews conducted in 1989 in three coastal barangays.

PHYSICAL AND SOCIAL CHARACTERISTICS

Bais City is 45 km north of Dumaguete, the capital city of Negros Oriental. With an aggregate land area of 25,109.16 ha, Bais constitutes about 4.35% of the total land area of the province. It is bounded in the north by Mabinay, in the south by Tanjay, in the northeast by Manjuyod, in the west by Bayawan, and in the east by the Tañon Strait. The northern bay of Bais city extends to the municipal waters of Manjuyod and the southern portion of the bay stretches out into the area of Tanjay. The entire marine area, including the bay portions of Manjuyod and Tanjay, is named in this project as the Bais Bay basin.

Based on the land classification data, more than three-fifths (65.59%) of the land of Bais and its 35 barangays is agricultural (Table 1). Less than one-fourth of one percent (0.236%) is considered residential. Not less than one-tenth of one percent (0.152%) is industrial and a seemingly insignificant proportion (0.005%) is classified as commercial. About one-third (33.195%) of the land area is unclassified.

Bais, Ilog, Odiongan, Panamangan, Panala-an, Cambagahan, Tagpo and Tabuac are the eight rivers in the area. Soil type along the two-to-three kilometers inward from the sea coast is generally sandy loam while that in the interior areas is clayish loam.

Based on the May 1990 census of the National Census and Statistics Office, the total population of Bais City and its 35 barangays is 65,980. With a land area in square kilometers of 313.2, the average population density is 210.66 persons per square kilometer.

Table 1. Land classification of Bais.

Agricultural	--	65.59%
Unclassified	--	33.195%
Residential	--	0.236%
Industrial	--	0.152%
Commercial	--	0.005%

Source: Bais City local government data, 1991.

Table 2. Location of landholdings among the landed of Bais City.

Within Bais	--	75%
Outside Bais	--	13%
Outside Neg. Or.	--	12%

Source: Bais City local government data, 1991.

The People and the Land

Agriculture is the principal means of livelihood in the area and farmers constitute 65.7% of the work force. However, the number of landless residents outnumber the landed (57.35% versus 42.64%). Among those who have landholdings, 75.% own land within Bais, 13% outside Bais but within Negros Oriental and the rest own land outside the province (Table 2).

Agricultural land use is primarily for sugarcane covering about 9,056 ha. Coconut occupies 3,307 ha and corn, 2,468 ha.

About 90% of the agricultural land is partly tenanted while about 10% is wholly tenanted. The common crop sharing arrangements, in the order of popular usage, are the 70- 30, 60-40 and 50-50 sharing schemes. Some agricultural lands are tilled under leasehold arrangements.

Agricultural activity in the area is dominated by sugar production. Bais has two sugar mills: the Central Azucarera de Bais (CAB) and the United Robina Sugar Milling Company (URSUMCO). A paper mill is also operated by CAB.

Births, Deaths and Ailments

In 1990, total births in Bais registered 2,189 and deaths, 243. Eighty-nine percent of those born were delivered at home while only 11% were in the hospital. *Hilots* attended to most of the births (79%). Physicians (11%), midwives (8%) and nurses (2%) handled some of the births.

The leading causes of ailments and, subsequently, deaths are pneumonia/bronchopulmonary diseases and PTB. Bronchopneumonia is also reported as the leading cause of deaths among infants.

Community-Based Organizations

Bais and its outlying barangays have a number of organizations that are potential units for networking. Some of these associations are listed below:

List of Associations	*No. of Officers/Members*
A. Farmers' Groups/Fishers' Groups	
Alijes Farmers Association	48
Sab-ahan Farmers Association	40

Mansangaban Farmers Association	52
Tabu-ac Farmers Association	66
Mabunao Farmers Association	42
Cambagiou Farmers Association	29
Dansulan Farmers Association	31
Nagasua Farmers Association	44
Palangging Farmers Association	42
Lowason Farmers Association	29
Tacalan Farmers Association	57
Cambagahan Farmers Association	28
Cabanlutan Farmers Association	38
Halas Farmers Association	30
Tagpo Farmers Association	29
Cambaguio Small Coconut Farmers Assoc. (CASCOFA)	26
Brgy. Okiot Prawn Hatchery Association	57
Capiñahan Fishpond Association	11
Fishermen Association of Canibol	35
Farmers/Fishermen Association of Sitio Combado	46
Dewey Island Swine Raisers Association	30
13 Coops (Consumers, producers, multipurpose)	

B. Other Community Organizations

10 Rural Improvement Club (RIC) - DA initiated	
RIC Quality Circle of Hda. Valencia	30
RIC of Sitio Combado	24
Dewey Island RIC	30
Canlargo 4-H Club	19
26 Womens organization - DSWD initiated	
10 Senior Citizens Organization - DSWD initiated	
10 Pag-asa Youth Movement - DSWD initiated	
Socio-civic clubs	

Constraints to Development

Lack of personnel, physical infrastructure and financial resources are identified as barriers to development. Government agencies have identified some of these constraints in the areas of health and sanitation, education and manpower development, social services, community development and protective services.

Health and Sanitation

-- Lack of health centers in strategic barangays

-- Lack of hospital ambulance and other health facilities to service indigent patients

-- Inadequate financial resources to acquire needed medicines for indigent patients

Education and Manpower Development

-- Lack of school buildings to accommodate the growing school population

-- Lack of tertiary educational institutions offering complete academic courses to accommodate high school students from various secondary educational institutions

Social Services, Community Development and Protective Services

-- The Department of Social Services and Development does not have enough financial resources to finance the various livelihood programs.

-- INP undermanned and very much below the national standard of 1 patrolman for every 1000 inhabitants.

Development Objective and Strategies

The courses of action identified are congruent with the planners' perception of the obstacles to development. In the reports, no development program deliberately takes into account the criterion of project sustainability.

Health and Sanitation

— Construct health centers in at least three strategic barangays in the hinterlands

— Acquire more hospital facilities and increase the bed capacity of Bais Emergency Hospital from 25 beds to 50 and later from 50 to 75 beds

Education and Manpower Development

— Convert Bais City High School and Bais Developmental College into a state college offering complete four-year academic courses

— Bais City Polytechnic college must offer a masteral degree in fisheries

— Construct more buildings and acquire more classroom facilities

Social Services, Community Development and Protective Services

— Request the national government to extend more financial assistance for various livelihood projects of the DSWD

— Request the national government to create 20 additional items for patrolman for assignment at Bais City, to conform with the national standard of 1 patrolman for every 1000 inhabitants

FOCUS ON THREE COASTAL BARANGAYS: BASELINE DATA

To get a glimpse of coastal residents' way of life — their community involvement, recreational activities, health and sanitation practices — as well as to determine their levels of knowledge of sanitation-specific environmental issues, selected variables from interview data taken in 1989 were processed and organized.[2] Seventy-seven household heads from the coastal barangays of Okiot, Looc and Capiñahan participated in the study conducted in August-September 1989. Male and female heads of households were interviewed alternately.

Respondents' Characteristics and Household Data

As shown in Table 3, of the 77 respondents (36 in Okiot, 20 in Looc, 21 in Capiñahan), 45% were males and 55%, females. Majority of the respondents (55%) were 35 years old and above. Most of those interviewed (71%) had at least some elementary education. Only one reported not having gone to school at all. Table 4 shows that the biggest number of households (64%) had between four to six members while about 30 % had between seven to nine. Four households had between 10 to 11 members. The average household size was 5.25. The household population is young, with 62% below 20 years of age.

Majority of those interviewed (56%) earned monthly cash incomes below P600, as shown in Table 5. Sixteen (22%) reported cash incomes above P1000 per month. Thirty-one respondents obtained cash from sea-related activities like fishing and shell collecting. A number (24) were paid for doing work as domestic helpers, salespersons, waiters/waitresses, vendors, mechanic, driver, stone craftsmen, security guard or as masons. Few others (4) earned more as clerks or

Table 3. Respondents' background characteristics, September - August 1989, N = 77.

Background Characteristics	Frequency	Percentage
3.1 Sex of respondents		
Male	35	45.45%
Female	42	54.54%
Both sexes	77	99.99%
3.2 Age levels of respondents		
15 - 19	2	2.98%
20 - 24	2	2.98%
25 - 29	6	8.96%
30 - 34	14	20.9%
35 - 39	6	8.96%
40 - 44	9	13.43%
45 - 49	10	14.92%
50 - 54	8	11.94%
55 - 59	3	4.48%
60 - 64	4	5.97%
65 - 69	2	2.98%
70 - 74	0	-
75 - 79	0	-
80 - 84	1	1.49%
Total reported	67	99.99%
No response	10	-
3.3 Highest school level attained		
Elementary level	15	23.08%
Elementary graduate	31	47.69%
High school level	9	13.84%
High school graduate	5	7.69%
College level	3	4.62%
College graduate	1	1.54%
No schooling	1	1.54%
Total reported	65	1 00%
No response	12	-

Table 4. Respondents' household data, September - August 1989.

	Household Characteristics	Frequency	Percentage
4.1	Household size		
	1 - 3	1	1.3 %
	4 - 6	49	63.64%
	7 - 9	23	29.87%
	10 - 11	4	5.19%
	Total reported	77	1 00%
4.2	Total number of household members	405	
4.3	Average household size	5.25	
4.4	Age levels of household members		
	Below 1 year old	5	1.27%
	1 - 4 years	23	5.84%
	5 - 9 years	40	10.15%
	10 - 14 years	40	10.15%
	15 - 19 years	58	14.72%
	20 - 24 years	29	7.36%
	25 - 29 years	42	10.66%
	30 - 34 years	37	9.39%
	35 - 39 years	29	7.36%
	40 - 44 years	21	5.33%
	45 - 49 years	22	5.58%
	50 - 54 years	16	4.06%
	55 - 59 years	11	2.79%
	60 - 64 years	9	2.28%
	65 - 69 years	8	2.03%
	70 - 74 years	2	0.51%
	75 - 79 years	0	-
	80 - 84 years	2	0.51%
	Total reported	3 94	99.99%
	No response	11	

office employees. Sixteen were engaged in buy-and-sell businesses while two others regularly received money from children working in Manila.

Recreational Activities and Community Involvement

When asked about their favorite forms of recreation, respondents gave multiple responses:

		No.	%
Watching or playing basketball	-	56	72. 73
Attending barangay dances	-	48	62. 34
Cockfighting and other forms of gambling	-	16	20. 78
Watching community presentations (drama, singing contests)	-	20	25. 97
Attending meetings, social activities	-	3	3. 9
Watching or playing volleyball	-	3	3. 9

Community Involvement

When asked whether they participated in community organization activities, 30 (39 %) said they were not members of barangay associations and five (6%) did not make any comment. Among those 42 who claimed membership in community organizations, 19 (45%) reported they were not actively involved, 17 (40%) said they were moderately active and a minority of 6 (14%) claimed they were very actively involved. Data comparisons are shown in Tables 6 and 7.

Health and Sanitation Practices

Garbage disposal

Fifty of the 77 respondents (65%) revealed that they threw garbage daily. Sixteen (21%) threw garbage every other day and 11 (14%) did so only once a week. When asked how they disposed of their garbage, a variety of responses were given:

		No.	%
thrown to river or sea	-	46	59. 74
dumped to a pit	-	11	14. 28

Table 5. Estimated monthly income of respondents, August - September, 1989.

Income levels	Frequency	Percentage
Below P300	14	19.44%
P301 - P400	10	13.89%
P401 - P500	8	11.11%
P501 - P600	8	11.11%
P601 - P700	4	5.56%
P701 - P800	3	4.17%
P801 - P900	2	2.78%
P901 - P1,000	7	9.72%
Above P1,000	16	22.22%
Total reported	72	1 00%
No response	5	

Table 6. Membership in organizations.

	(N=77)
Members	-- 55%
Non-members	-- 39%
No comment	-- 6%

Table 7. Involvement in organizations.

	(N=42)
Very Active	-- 14%
Moderately Active	-- 40%
Not Active	-- 45%

burned	-	27	35. 06
waited for garbage truck	-	1	1. 3

Human waste disposal

How did respondents and their household members handle disposal of human waste? The responses provided were:

		No.	%
use of water-sealed toilet	-	26	33.77
use of *labadora*	-	29	37.66
use of *antipolo*	-	15	19.48
river, seashore, sea	-	4	5.19
bamboo grove	-	2	2.6
open hole	-	1	1.3

Disposal of used water

In the matter of disposing water used for washing dishes and kitchen utensils, the common local practices were:

		No.	%
Used water in basin is thrown anywhere.	-	43	55.84
Water from sink is drained to a hole through a gutter.	-	20	25.97
Water from sink is drained straight to the ground.	-	14	18.18

Sources of water

Where do respondents get water? Drinking water was usually taken from a piped faucet (92.21% or 71 reporting). Two fetched water from a river, four bought by the tins supplied by local water dealers, and one had a water tank.

Water for washing clothes and taking a bath was mostly derived from piped faucets (85.71% or 66 reporting). Six relied on water from the river, two from an open well, and two purchased water from local entrepreneurs.

General perception of family health

When asked of their impressions of family health conditions in their community, respondents said:

		No.	%
Very good	-	40	51. 95

Good	-	10	12. 99
Somewhat good	-	25	32. 47
Not good	-	1	1. 3
No response	-	1	1. 3

Levels of Knowledge on Major Ecological/Environmental Concerns

To find out whether or not respondents are knowledgeable about ecological issues, a dozen items were presented to the respondents. In all items, more than one half of those asked gave correct answers--signifying respondents' high level of knowledge in the matter of basic ecological principles.

The three items that were answered correctly by 52 to 61 percent of those interviewed and, in effect, the items that were answered correctly by relatively fewer respondents were:

		% of respondents who answered correctly
Item 4	The corals died because they were smothered with silt.	- 52%
Item 1	Slash-and-burn farming is harmful to marine life.	- 54%
Item 6	The fish died because their gills were smothered with silt.	- 61%

The items that were answered correctly by most of the respondents were:

Item 11	Industrial pollution is harmful to marine and human life.	- 97%
Item 10	Water and silt flow to the sea through the rivers and streams.	- 94%
Item 2	Soil erosion is caused by the cutting of big trees	- 94%
Item 9	Ground water is used for drinking, washing, and watering the plants.	- 92%
Item 5	Corals and other forms of marine life are destroyed due to illegal fishing methods such as the use of dynamite, *tubli* (a poisonous vine), and others.	- 92%

The four other items were:

Item 12	Talabong is one of the last remaining forests in Negros Oriental/Bais.	- 88%

Item 8	Especially in the forests, water collects under the ground.	- 82%
Item 7	Water from forest and seas goes up to form clouds, then goes back down to the forest and seas as rain.	- 77%
Item 3	Soil erosion kills fish and other forms of marine life.	- 65%

It would appear from the above results that the respondents had a high level of consciousness of the dangers that destruction of ecological balance pose on the survival of living things and human beings. What they do, however, appears to be not consistent with what they know. For instance, the practice of dumping garbage to the river or sea by majority of the respondents is not consistent with their knowledge of ecological concepts.

The discontinuities and discrepancies between ideas and actual behavior may not simply be because of weak public consciousness but also because of the lack of personal resources and reinforcing social structures needed for the people to effect ecologically sound practices.

NOTES

1. Sources of information include the following:
   - Bais City Profile, 1990
   - Health Data, City Information Office
   - Integrated Agricultural Production Program for the City of Bais, 1990
   - DSWD information

2. Trained interviewers from the Silliman University-Social Work Department conducted the interviews. The study was contemplated as a social science input to a project on mangroves handled by Silliman University Marine Laboratory.

Total Population, Household Population and Number of Households by City, Municipality and Barangay as of May 1, 1990
(National Census and Statistics Office)

City, Municipality & Barangay	Total Population	Household Population	No. of Household
BAIS CITY			
Coastal Barangays			
Capiñahan	1214	1194	236
Lo-oc	1601	1601	294
Okiot	2663	2633	523
Olimpia	724	724	133
Lowland Barangays			
Barangay 1	4547	4547	842
Consolacion	241	241	43
Hangyad	178	178	35
Katacgahan	500	500	85
La Paz	283	283	54
Rosario	193	193	35
Tamogong	405	405	71
Valencia	916	916	155
Upland Barangays			
Basak	1340	1340	252
Cabanlutan	1373	1373	272
Cambagahan	4296	4294	809
Cambaguio	1198	1198	225
Cambanjao	1132	1132	189
Dansulan	954	954	167
Lonoy	1811	1811	352
Mabunao	994	994	170
Manlipac	1854	1854	316
Mansangaban	1103	1103	194
Panalaan	3582	3582	661
Panamangan	801	801	160
Sabahan	6147	6147	1081
Tagpo	1716	1716	330

Mixed Terrain			
Coastal/Upland			
Tamisu	2230	2230	402
Coastal/Lowland			
Barangay 2	7341	7341	1 414
Biñohon	969	969	181
Calasga-an	2386	2386	472
Cambuilao	1160	1160	219
Canlargo	1453	1453	267
San Isidro	283	283	55
Talungon	1102	1102	191
Tangculogan	907	907	176
Total	59 ,623	59 ,623	10, 983

NOTES ON SOME SOCIAL CHARACTERISTICS OF BAIS CITY

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Population and Its Distribution

Based on provincial health data, the population of Bais City was 59,623 in 1990. Ten years earlier it was 49,301, an increase of more than 10,000. Of the 35 barangays, 6 barangays registered a population ranging from 3,000 to 7,000. Only four barangays have populations less than 500. Barangay 2 has the largest population (7,341) followed by Sabahan (6,147) while Hangyad has the smallest (178). The male population is slightly bigger (29,710) than the female population (28,242). Population density is 190.88/km2. The average household size is 5.

Figure 1 shows that the population of the adjoining municipalities of Tanjay, Bais and Manjuyod has consistently increased over a five-year interval from 1975 to 1990. The population is relatively young with about 35,000 below 10 and up to 29 years old. Implications of this are the need for more schools and courses to prepare the population for adult and community life as well as the demands for more health facilities. These are addressed by the 1989-1992 development thrust of Bais City which contains the following:

1. Education and Manpower Development

   a. Lack of school buildings to accommodate the growing school population

   b. Lack of tertiary educational institutions offering complete academic courses

2. Health and Sanitation

   a. Lack of health centers

   b. Lack of hospital ambulance and other health facilities

   c. Financial resources to secure needed medicine for indigent patients

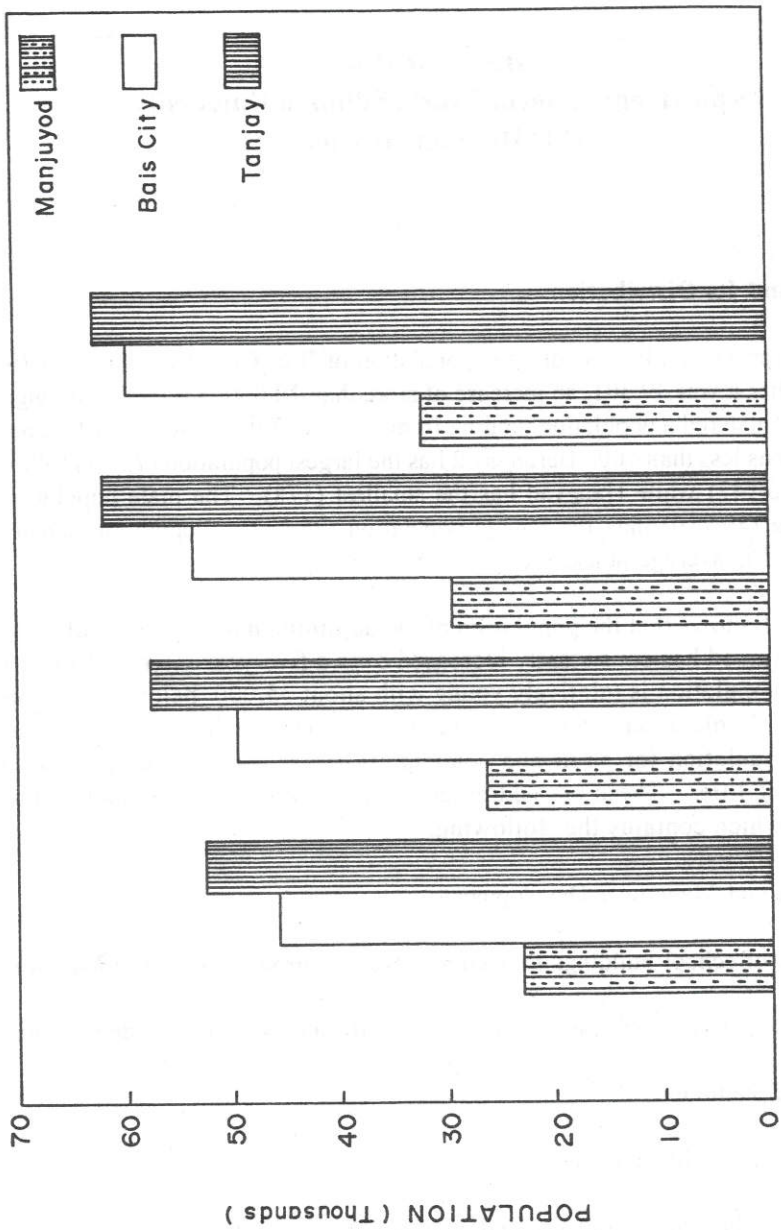

Figure 1. Population growth in three municipalities from 1975 to 1990.

Labor Force, Employment and Income

The labor force is composed of the 10-64 age group. The 1988 census shows a total force of 28,566. Of this labor force, the bulk are fishers and farmers who usually plant rice, corn or sugar cane. Farmers constitute about 34.44% of the workforce. About 66% of the land area is agricultural land.

The bulk of the labor force (22,787) or only 86% have attained elementary education.

The average household monthly income is P8,062 while the per capita income is P1,287. This is a little above the food threshold of P1,261 for a household of six members.

Education and Health Services

Education

The data for school year 1988-89 show that the public school enrollment is as follows: 9,840 in the Elementary, 2,705 in the High School, 30 in College, and 58 in Technology.

There were 258 teachers in the public elementary school, 60 teachers in the high school, 5 in college, and 5 in technology. Thirty public schools, with a total of 234 classrooms, served the elementary pupils.

Only 483 are enrolled in the private elementary school as against 9,840 in public schools. There are 303 private high school students as against 2,705 in public schools.

The teacher-student ratio in the elementary public school is 1:38 and 1:45 in the secondary level. The DECS standard ratio is 1:36.

Health

As of 1988, the mortality data reveal that PTB is the top killer (with 35% of the total cases dying from it), followed by congestive heart failure (25%), hypertension (20%) and multiple stab wounds, (20%).

To serve the health needs of people are 12 public doctors, 23 public nurses and 2 public dentists.

In addition, there are 4 private doctors in 4 different private clinics.

There is also one Rural Health Unit (RHU), 12 Barangay Health Stations and one Public Hospital.

The standard ratio of health personnel to the population is 1:5,000 for doctors and dentists; 1:2,500 for nurses and midwives ; and 1:5000 for number of hospital beds.

The Bais data reveal that the ratio of doctors to the population is 1:1,987; the ratio of nurses to the population is 1:2,592; the ratio of dentists to the population is 1:29,811; and of midwives to the population is 1:1,064

The ratio of doctors, nurses and midwives to the population is adequate. The ratio of dentists and hospital beds, however, is far from adequate.

The Characteristics of Depressed Barangays of Bais City (DSWD Data 1991)

According to the DSWD data of 1991, five barangays are classified as depressed, based on the low level of income, high population rate, high reproductive age and high rate of malnutrition. These are in Cabanlutan, Mabunao, Tamisu, Calas-gaan, and Talungon.

There are few women in the household of these barangays because many of the young women have gone to the neighboring cities for employment.

As to educational attainment, the females have higher educational attainment than the males:

	Male	Female
College graduates	21	35
High School graduates	45	53
Elementary graduates	4 36	5 09
Schooling	9 54	1,0 00

Employment

The bulk of the families earn a monthly income of P500 - 1,000 as derived from the data provided by 130 individuals who are employed, 314 who are self-employed, and 670 who are not regularly employed.

Majority of the population do farming (613), followed by livestock raising (222), fishing (159), and vending (107).

Civil Status

Majority of the adults are married (560). There are, however, more widows (54) than widowers (23).

Health Condition

Most of the children are underweight (298). A number are suffering from physical defects, like blindness (35). A number of children have also been submitted for immunization.

Four-hundred and sixty nine have no toilet facilities while 364 have water-sealed toilets.

Housing Conditions

Houses are made of light materials (397) or made of wood (212).

Water Supply

The common sources of water are from:

Faucet	403
Spring, river	277
Deep well	201
Artesian well	261

Perceived Problems of Families and the Community

1. Majority in the depressed areas are unemployed due to lack of opportunities (700). There is underemployment among the 579 labor force members, which implies that the income is too small for their basic needs.

2. Most women are not able to earn because of household responsibilities and taking care of young children.

3. Malnutrition is perceived to be a common problem.

Respondents identified people who can provide solutions to these problems in the family:

1. Individual efforts 674

2.	Ask help from others	
	family or relatives	444
	barangay leaders	327
	friends and neighbors	277
	church	159
	social workers	388

To the respondents, community problems can be solved by embarking on a project to solve the unsanitary conditions and by helping victims of natural calamities and other disasters through monetary contribution or service.

THE WATERSHED OF BAIS CITY

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INTRODUCTION

One of the two most highly biodiversified ecosystems of the earth is the tropical moist forest. The forest as an ecosystem supports millions of species (IUCN 1990). Its severe alteration by man brings about the most disastrous effects to the entire earth's ecosystem, including the marine ecosystem. The loss of species diversity due to habitat disappearance on account of anthropogenic activities is tremendous, not counting the effects on climate, shelter, water and food supply.

A Critical Ecosystem

From the information given by a staff of the Department of Agriculture (DA), the Bais City watershed is one of the most critical watersheds in the country today. The original watershed occupied an area of approximately 13,500 ha with coordinates of 9°30' - 9° 40' N latitude and 123°01' - 123°06' E longitude. The present watershed protected area is reported to be a much reduced area of 1,129 ha with coordinates of 9°33' - 9°36.5' N latitude and 123° 01' - 123° 02.4' E longitude.

The truth of this observation is reflected in the fact that the municipalities surrounding this particular watershed, have people buying water in plastic gallon containers. A common sight in Okiot is teen-age boys and girls pedalling 4 or 5 big containers of water bought at 25 centavos per gallon (from houses supplied by the Bais City Waterworks System) and sold at 2 pesos per gallon to the consumers. At this writing, water-vending is a booming business among young people of the Bais City suburbs. Demand for this scarce resource is intensified as river water is directed to impoundments for irrigation of plantation crops. Competition for this important commodity is just one of the many problems of the watershed's loss of integrity. Erosion of topsoil due to flash floods resulting from absence of water absorbing system of the roots necessitates heavier demand for soil fertilizers. Eutrophication of bodies of water and siltation may also result from erosion of topsoil (with fertilizers) endangering the life of river and bay organisms used by the townspeople for food.

From unstructured interviews of the waterworks superintendent, there are three major uses of water in Bais City: 1. domestic, 2. irrigation, and 3. industrial.

Domestic Uses

At this writing, there are 1,700 subscribers that are supplied by the waterworks system. There are about 14,430 households in Bais City. Therefore, the number of subscribing household is only 12%. Yet the discharge rate of the waterworks water source in the Panamangan impoundment which is 600 gpm can hardly meet the demands of even the subscribers. Therefore, those households which do not own any private water system rely mainly on rain and water bought from water vendors.

The waterworks intake box at Katangkatang is filled from the spring water of Panamangan River, tributary of the headwaters in Tindug Bato, Lighi, Mabunao.

Irrigation Source

To irrigate 12,000 ha of sugar land is a water-intensive activity that needs a systematic impoundment of water. According to a key informant, about 10 major farms are supplied from the river water. This is especially active during the planting season from May to October.

Industrial Uses

The two most heavy users of water are the sugar milling plants and the prawn pond industry. The sugar mills' water supply comes from the deep well drilling made by the plant.

The prawn ponds draw water from the Tamogong river which in turn draws water from the same headwaters.

The single most important cause of the watershed reduction is the intensive conversion of the secondary and perhaps primary growth forest to sugarlands, according to a source at the Department of Environment and Natural Resources (DENR). Most of the small-time sugar planters are encouraged to utilize every nook and cranny of the Alienable & Disposable (A & D) lands (even those with 30-40% slope) of the watershed area for sugar farming by loans from the Land Bank of the Philippines, according to the DENR and DA sources. Within the DENR watershed rehab area though, A & D lands constitute only 5% (this figure is however increasing rapidly) and 95% are non-A & D. Outside the watershed rehab area all lands are presumed to be 100% A & D, except those converted to

land areas for schools, roads, and houses. But even inside the rehab area one could find several patches of A&D lots planted to sugar cane.

So critical has the situation become (the remaining forest cover is only 10%) that the DENR thought it wise to establish the present watershed rehabilitation project at Lighi, Mabunao, Bais City. The watershed area comprises 1,129 hectares. The project aims to protect the remaining vegetation cover and to rehabilitate the watershed through the following measures:

a. introducing exotic species such as:

1. Mahogany (*Swietenia macrophyla*)	55, 434 trees
2. Gmelina (*Gmelina arborea*)	56, 955 trees
3. African Tulip (*Spathodea campanulata*)	730 trees
4. Fire tree (*DelOnix regia*)	730 trees
5. Giant Ipil-ipil (*Lucaena leucocephala*)	51, 000 trees
6. Kakawete (*Gliricida sepium*)	51, 000 trees
7. Pink Shower (*Cassia javanica*)	5, 000 trees
8. Jackfruit (*Artocarpus heterophylus*)	1, 700 trees
9. Wild Sun Flower (*Helianthus annuus*)	17, 000 plants

b. introducing agroforestry scheme

c. establishing watershed rehabilitation structures, like:

1. checkdams -- to slow down the water flow. There are 40 such checkdams erected along Tamogong river, Sayao-sayao and Manakit creeks.

2. rockwall/retaining wall -- to prevent erosion and increase the water absorption capacity of the root system of trees. There are 2,800 cubic meters of these structures established.

Upon ocular inspection, one finds a greater number of trees along creek banks and watercourses as one goes closer to the headwaters. The riparian zone's rehabilitation (as well as its flood plains) is very important to avert the erosion problem and siltation process in streams and rivers, which can be exacerbated by frequent flooding during heavy rainfall. Irrigation water can cause bodies of water to undergo eutrophication and algal bloom as mentioned earlier.

The farther one is from the headwaters, the sparser are the stands of forest trees until only sugar cane plants can be found even in about 30-43% slope.

Few patches of vegetable and flower gardens can be found in areas where there are houses. From personal communications, a DA personnel claimed these gardens are part of the livelihood project for the baranggay residents.

No evaluation of the rehabilitation's structural efficiency has been done yet, according to the former information officer of the Bais City Watershed Rehabilitation Project, Ariston Cardano.

Lake Mangganay/Lake Manticanon

The health of the watershed area is most often determined by the health of the bodies of water in its midst, i.e. the lakes, the rivers and streams. When referring to an ecological system, this health is popularly called "biotic integrity." It is defined by Karr and Dudley (1981) as the "ability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitat of the region".

For example, the watershed degradation will also mean its lake's degradation. There are a number of indicators to reflect the latter's loss of biotic integrity: algal bloom, predominance of exotic species, damaged fishes, decrease in number of species, etc. (Karr et al., 1986). Therefore, looking at the health of the fish communities will give one an indication of the health of the larger ecosystem where the body of water habitat of these fish belongs.

At Sitio Mangganay, around 4 km from the headwaters, one can find a fairly big lake, which is estimated by a local informant as one hectare in size during the peak of the rainy season. During the height of the dry season, the size is reduced to one half, the same informant claimed.

The lake is an important habitat for the protein source of the surrounding sitios (a political sub-unit of the baranggay).

There are native and introduced species in the lake. The introduced species include goldfish, gurami, tilapia, carp, catfish, and rainbow trout. The native species comprise the eel, mudfish, and mullet. All the information given by the informant Sotero Tamundo, should be confirmed. He claimed that a few of the sitio households constructed man-made lakes and stocked them with fish fry from the natural lake. Pollution may be a hazard to reckon with to sustain the biotic integrity of the lake but drying up is the worst thing that can happen when the watershed loses its identity as an ecosystem. There are only 1,199.00 ha of forest left (Table I). When the watershed ceases to be, the catchment area (after a heavy rainfall) becomes useless as waterflow velocity tends to be unchecked, carrying silt, sediment, and nitrates to the different bodies of water jeopardizing aquatic life.

Table I. Land use statistics of Bais City

Land use vegetation	*Area(ha)*	*Percent(%)*
Industrial	38.02	0.15
Residential	58.88	0.23
Commercial	1,247.80	4. 97
Fishpond	5 03.00	2. 00
Forest	1,1 99.00	4. 78
Paddy rice irrigated	5.00	0. 02
Paddy rice non-irrigated	87.88	0. 35
Banana	738.00	2. 94
Corn	3,1 20.00	12. 43
Coconut	3,0 60.46	12. 19
Sugarcane	9,0 56.00	36. 07
Mango	11.00	0. 04
Pineapple	7.00	0. 03
Grasses/Shrubs	5,1 63.78	20. 56
Ipil-ipil	5.00	0. 02
Bamboo	79.00	0. 31
Mangrove	2 83.00	1. 13
Pasture Land	1 61.90	0. 64
Nipa	29.00	0. 09
Rootcrops	82.00	0. 03
Vegetables	21.00	0. 08
Build-up	1 57.44	0. 65
TOTAL	29,1 09.16	100.00

(Source: DA, Bais City)

SUMMARY AND RECOMMENDATIONS

On the whole, an efficient water management system is imperative for the equitable allocation of water to various end users: farmers, cultivators, household consumers, plantation owners, prawn-pond operators and the like.

But the efficiency of such a system hinges on the reliability of the water supply which in turn depends on the stability and sustainability of the water-absorbing capacity of the root system of the forest in the watershed. Only then can run-off water and soil from the fertilized fields be checked and the damage done by the erosion, siltation, and sedimentation of the bodies of water arrested.

Therefore, a recommendation seeking to study ways to reach an optimum balance between rehabilitating the watershed and sustaining the productivity of farmers and wage earners in plantation crops is in order.

ACKNOWLEDGMENT

I would like to acknowledge the following key informants for the invaluable information they have kindly supplied in the field: Sotero Tanundo - Lighi farmer; Mrs. Riorita Quinones of Bais City Watershed Rehabilitation Project; and Mr. Alex Divinagracia of the Department of Agriculture.

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BAIS BASIN COORDINATING BODY

Executive Committee

Bais City Mayor	:	Hon. Francisco Villanueva
Tanjay Mayor	:	Hon. Arturo Regalado
Manjuyod Mayor	:	Hon. Jose Baldado
Non-Govt.-Org.	:	Roberto Raymundo
Government Org.	:	Alfredo Maturan
Community-base	:	Fernando Eregil
Silliman University	:	Dr. Betty C. Abregana

TASKS

1. The executive committee will look at the priorities identified in terms of research agenda and development agenda.

2. The members of the executive committee will invite other agencies both government and non-government as well as people's organization to join in the development effort.

3. Convene the Executive Committee so that they can review the documents - the result of the workshop and so Silliman University may consult with the other members of the Executive Committee as to the best time to meet with the Coordinating Body.

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PRODUCTIVITY EFFORTS IN BAIS BAY BASIN

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INTRODUCTION

During the first year of implementation of this project, we focused on the facilitation of the formation of associations of residents in the project site, the beginning of agricultural projects managed by the newly organized group of residents, and the enhancement of learning by the residents about the environmental concerns. As facilitators in the community, we maintain the view that the associations we helped organize are learning organizations and we are therefore co-learners throughout the process of project implementation. It is our belief that through conscious organizational learning, informed actions and decisions can be made; and particularly for this project, this would help us achieve the goals and objectives defined both by the members of the associations and by us.

This report presents a narrative description of the activities during the first year of the project (November 1991 to October 1992), the strategies used and their underpinnings, and finally our reflections about the project goals and the strategies used.

PROJECT GOALS AND OBJECTIVES

This project was conducted as an action research. It was aimed towards the identification and development of a conceptual model (and its validation in real world situation) of a specific appropriate farming system that will raise the awareness of the farmers about resources management and sustainability as they adopt and adapt improved farming technologies and practices viewed by them as leading to increased productivity and economic growth. Specifically, this project aims to:

1. develop a strategy to enhance a local community's capacity for resource management as new and improved technology and practices in farming are adopted and adapted by the farmers in the community;

2. identify and develop a conceptual model of an appropriate sustainable farming system for specific farming communities;

3. identify and develop a conceptual model of some existing farming systems and understand their impact on resource management and sustainability; and

4. improve agricultural productivity in the project area as consciousness for resource management and sustainability are being enhanced or developed among the people in the community.

IDENTIFICATION OF PROJECT SITES

To identify project sites, it was decided that the development of micro-watersheds would have a better impact and would clearly establish the link between our upland undertakings and environmental studies being done by the marine studies group at the Bais Bay basin. Barangay Tagpo, and sitio Amalao within it, were chosen as our pilot project sites. Tagpo and Amalao were the identified micro-watersheds. Both have water tributaries to Tamogong river, a major river that drains into Bais Bay. We planned that following our establishment of productivity activities together with fitting environmental management practices and reforestation, we would monitor soil erosion, water quality and quantity along the tributaries of Tamogong river that drain from our project sites. The environmental monitoring at the above-mentioned points would be matched with the environmental monitoring data that would be gathered at the project sites and Bais Bay basin.

BRIEF PROFILE OF BARANGAY TAGPO

An Overview of Barangay Tagpo

Tagpo is one of the 35 barangays in Bais City. It became a barangay in the early 1960s as a response to the petition made by its residents. Tagpo is approximately 17 km north of Bais City. It has an elevation of approximately 300 to 600 m above sea level. The total land area of Barangay Tagpo is 2800 ha. There are 15 sitios within Barangay Tagpo which accounts for a total population of 1,716 (May 1990 census). The residents are engaged mostly in agricultural farming. The main crops produced are sugarcane, corn and rootcrops.

Access from the provincial road to Tagpo is poor. The existing roads leading to and within Tagpo are usually passable only during the dry months of the year. A four-wheel drive vehicle is necessary when driving through these roads during wet season. The residents normally walk 4.5 km to reach the Bais - Mabinay highway where they take a ride on public utility vehicles going to Bais City. It is in Bais City where the residents sell their produce and buy their basic needs such as salt, soap, kerosene and dried fish. A few families in Tagpo use horses or carabaos to carry loads to the Bais-Mabinay highway.

The Biophysical Conditions in Tagpo

Tagpo is one of the watershed areas of Bais City. It falls within the climatic Type C of two pronounced seasons. Dry season is from December to March, and the rest of the year is considered wet season. The peak rainfall is during the months of July to November (200 mm). Tagpo is exposed to both Northwest and Southeast wind. Water sourced from the creeks is very limited.

The area is a sloping hilly terrain with an average slope of 35%. There are areas with very steep terrain which are not suitable even to contour farming. These areas, which are too steep for terracing, are a limiting factor to the expansion of farms and are left unattended by the residents of the area. There are numerous patches of eroded areas and gullies formed due to run-off water during rainy season. Some rocky and steep terrain with occasional flat areas are planted to sugarcane and food crops. In these areas there are evidences of attempts to put up rockwalls and hedgerows. The results of these efforts, however, are minimal. In areas where the soil type is clay-loam, rootcrops are usually planted to serve as supplementary food during lean months.

Animal production is of secondary importance to crop production among the residents of Tagpo. The animal raised by the residents are mostly draft animals. Some chickens and pigs are being raised under a backyard raising scheme. Chickens account for the highest number in animal population, followed by hogs. These animals are sold when an emergency need for money arises (i.e. sickness in the family) and are also used as food during festivities, particularly fiestas.

For each household, land use is a function of household resource access and food procurement. The steep fields far from homes have low soil fertility and are usually left barren. However, some farmers can manage to grow rootcrops in these areas, such as *karnabal* and sweet potato. The land areas with gentle to level topography are planted with sugarcane and corn which is the main source of livelihood.

The Socioeconomic Condition in Tagpo

The average household size in Tagpo is six (6) and the average educational attainment is grade four in the elementary school. From this data we tentatively conclude that population migration from the area could be low. One implication of a low educational attainment is less chance to move outside the community to seek employment, and we suggest insufficient skills for employment as a reason. The effect of the population increase together with little mobility towards outside communities could be an additional pressure on land use.

A typical farmer resident owns an average of 1/2 ha of land. From this piece of land the farmer aims to produce the food for household consumption. We observe that there is an abundance of laborers in all stages of production in the farms. All the household members in a family are involved in working on their land. Practically the whole household is engaged in every stage of farm production. In instances where a farmer has a "large" (more than five ha.) farm land, an added source of labor are members of other households in the area.

To add to their meager earning from their own farms, some of the farmers seek employment as workers in sugarcane plantations especially during the sugar cane milling season. Other off-farm income comes from working as skilled labor, i.e., as carpenter or driver operator.

April to June are called "lean months" because it is the time when not much could be produced in the farms due to the very dry weather conditions. It is not uncommon at this time for some of the farmers' children, especially the teen-age and adult females, to move out of their farms and work as househelp in the city. However, they try their best to go back to their farms during the planting season. It is also during the "lean months" when the farmers sell their animals, and the income is used to buy food and other necessities. It was observed that rootcrops become more of the staple diet during "lean months".

Very few subscribe to bank loans. The farmers are afraid that since their land would be used as collateral for their loan, they might lose their land because they are not sure and confident about their productivity and their capacity to pay loans. Informal loans from friends and relatives are more common.

Some Observations and a Tentative Analysis of Tagpo

The farmers in Tagpo are engaged in sugarcane production in spite of low productivity in their farms as compared to productivity in lowland areas. They belong to the low-income group of sugarcane planters. We have yet to find a validated explanation of why, in spite of the low income from sugarcane farming in Tagpo, the residents have not looked at other options in farming.

It is a challenge upon us to help these farmers learn more about other options in farming and at the same time raise their consciousness about sustainable farming practices. The farmers in Tagpo tend to grow sugarcane even in steep sloping areas as long as the site can be reached by trucks that would haul their cane harvest. There are cases where sugar cane is planted in areas that could not be reached by hauling trucks. Most of these farmers do not practice land terracing. Undoubtedly, there is a

significant soil loss even during the cultivation of the land. The resulting soil run-off during rainy season could account for the loss of the top soil in about 20% of the area. The areas with very steep slopes remain uncultivated and are covered with cogon grass. Many of the tree seedlings are destroyed by spontaneous fires that occur in cogonal areas during the summer months.

The Department of Agriculture (DA) and other non-government organizations have initiated some programs to improve the residents' understanding of farming. Technicians from the DA are available to give assistance in the technical aspects of farming and also in some other livelihood activities. However, we have yet to find valid indications of the effectiveness and impact of the above mentioned activities.

During our initial contacts with some members of the community, we noticed that they were reluctant to attend the meetings we organized. They were suspicious about our presence in their community. We discovered later a possible explanation for such attitude. We learned from one of our key informants that there was a time when a certain non-governmental organization offered them some help. All of the residents were very enthusiastic about a proposed organization of residents. Every time a meeting was called everybody was present, even during meetings held at night time. After a while, the residents realized that they were being introduced to ideologies which they perceived to be against the government and the Constitution. Such experience caused anxiety and posed threats to their security. This experience on the part of some of the residents was a factor we had to reckon with during the planning of our strategies in the area.

BRIEF PROFILE OF SITIO AMALAO

An Overview of Sitio Amalao

Amalao is one of the many sitios of Barangay Tagpo. It has a total land area of 92 ha. The residents are mostly engaged in agriculture. Sugarcane, corn and some rootcrops are the main crops being produced. Amalao was once a portion of a cattle grazing land and ranch (an unclassified public forest) managed by a certain Don Gaspar Vicente.

Amalao has better roads compared to Tagpo. The roads are passable to public jeepneys even without a 4-wheel drive. However, public transportation does not reach Amalao. The residents have to walk to the national highway to take a ride to Bais City, where they sell their products and buy their needs.

In 1970, a group of workers of Hacienda La Paz and Hanyad staged a strike against the management of the hacienda. They demanded an increase in their salary,

free hospitalization, and other benefits from their employer. The members of the group that staged the strike lost their jobs in the hacienda. They were then re-settled in the cattle ranch mentioned above and the place was called Amalao. As surveyed under G.S.S. No. 114, Amalao is within a forest zone. It accommodated 84 families with undefined land tenure. Some of the local residents call their area "LAPAHAWA". The name stands for displaced workers from Hacienda La Paz and Hanyad; LAPA for La Paz; HA- for Hanyad; and WA- for "gipapahawa" (ejected).

Biophysical Conditions of Amalao

Amalao has an elevation of 300 to 600 feet above sea level. The soil is generally clay-loam with a depth ranging from 30 cm. to 150 cm. Cultivation of the soil by plow and carabao is quite difficult in some areas due to rocks protruding on the surface.

The slash-and-burn procedure was a common land clearing practice used in the mountain slopes. These clearings were originally grass/shrub lands converted to agricultural use by uprooting the grass/shrubs while simultaneously loosening the topsoil for planting. Rocky and steep terrain with occasional flat areas are planted with sugarcane, corn, and rootcrops.

Some Socio-economic Data from Amalao

The data gathered and presented here were taken from a random sampling of 36 households which represent 40% of the total of 84 households in the area.

1.) Sex Distribution of Household Head

Sex	Frequency	Percentage
Male	35	97.25%
Female	1	2.75%

2.) Age Distribution of Household Heads

Age	Frequency	Percentage
Below 20	none	0%
21-30	9	25%
31-40	9	25%
41-50	8	22.2%
51-60	5	13.9%
Above 60	5	13.9%
Total	36	100%

3.) Distribution of Household Head's Highest Educational Attainment

Education Attained	Frequency	Percentage
Have not gone to school	5	13.9%
Primary	16	44.44%
Intermediate	12	33.33%
Secondary	3	8.33%
Vocational	0	0%
College Level	0	0%

4.) Distribution of Household Heads Based on Occupation

Occupation	Frequency	Percentage
Farming	34	94.44%
Carpentry	1	2.78%
Others	1	2.78%
Total	36	100%

Based on the interviews made with 36 households, the average family size is five (4.97) and the total household members are 143.

With regard to the division of labor and responsibility in farming, the men do the land clearing. plowing, and large animal husbandry. Practically all other responsibilities are shared by both men and women. These activities are: planting, weeding, harvesting, and the care of smaller livestock. Both men and women are in control of agricultural activities once the land is ready for planting. Decision making regarding farming is shared responsibility between the men and women.

5.) Land Use Data (based on actual survey and interviews)

Cultivated: 34% = 31.96 ha

Crops	%	Area (ha)
Sugarcane	20	18.8
Corn	10	9.4
Rootcrops	2.0	1.88
Forest Trees	1.5	1.41
Fruit Trees	0.5	.47
Total	34%	31.96

Idle/Fallow: 60% = 56.4 ha

Vegetation	%	Area (ha)
Cogonal	30	28.2
Shrubby	20	18.8
Other Grasses Grazing	10	9.4
	60%	56.4

6. Infrastructures: 6% (5.6 ha)

Structure	Area (ha)
House and Lot	3.4
Com. Plaza	0.8
School and Ground	0.5
Road/Trail	1.3

Land ownership problematic. When the residents were resettled in Amalao following the settlement of their problems with Hacienda Lapaz and Hanyad, the 92 hectares of Amalao was divided among 84 households. However, the entire area was classified as corporate land under a cooperative which was registered with the Securities and Exchange Commission. In actual practice the residents till the land individually and there is no semblance at all of a cooperative undertaking. A lot of issues pertaining to control over specific areas by specific households has arisen from this situation.

Some Observations and a Tentative Analysis of Amalao

We rated the quality of life in Amalao low. The residents are not engaged in income-generating activities other than sugarcane farming. However, the income from sugarcane farming in Amalao is very poor compared to production and income from sugarcane farming in lowland areas. Due to Amalao's distance from the urban centers, education, health, and other government and non-government services barely reach the residents.

In analyzing their present farming practices, we took into consideration the farmers' historical background (resettled striking workers from a hacienda). We propose the theory that the residents of Amalao are not prepared to be independent farmers. They have been used to being farm workers, thus their skills in farm planning, management, decision- making and marketing need to be fully developed. Their poverty has led them to become survivalist and the "here-and-now" issues of surviving make them less sensitive to community concerns and future planning. Our talks with them indicated that they are aware of environmental degradation resulting from their farming practices, but they seem to take its long-term effects as a reason for putting environmental concerns in the bottom of their life priorities. According to them, they do not have many options for their day-to-day survival.

The farmers of Amalao seem to understand the role of trees and tree planting in environmental conservation. However, most poor farmers do not plant trees because they do not see its immediate benefits to them. They usually use their time and their land for activities that will give more immediate cash returns, however small the amount.

Some do not want to plant trees in their field because they have heard that the presence of plenty of trees on their land would put it under the category of forestal (public land) thus denying them of its ownership. The residents of Amalao are still wrestling with the issue of land ownership. They are well aware of the fact that the land they are cultivating is public land, but since they were resettled there by the City government and were organized as a cooperative, they are hoping that someday a more defined ownership of areas within the cooperative will be granted to them by the government.

AMALAO AND TAGPO: THE LAST 10 MONTHS RE-VISITED

Preparation for Action

Our team's structured interactions with the residents of Amalao and Tagpo cover a span of 10 months. The first two months following the approval of our project proposal was spent in establishing linkage with the local government technicians working in upland Bais. Much care was taken in the choice of the project sites, of which the micro-watershed development concept was a predominant factor. After two months of exploratory discussions with many informants and ocular surveys of the areas, we began a more structured program in Tagpo and Amalao. We began to hire a field technician who would stay most of the time in the project sites. We made formal linkages with the government technicians assigned in Tagpo and Amalao and a program of participation by senior students in agriculture was put in place. The establishment of rapport with the community was the biggest task at hand and it was the cornerstone of our project. Our experiences in the process will be discussed at the later part of this report.

An Inventory of Activities

An inventory of activities during the past 10 months shows the following:

1. The formation of Amalao Landscaper Association Incorporated (ALAI) by residents of Sitio Amalao. The residents of Tagpo likewise organized the Tagpo, Cambayungon, and Malucani Association (TACAMA). These organizations are the core group of residents that interact with the productivity component of the Silliman University Bais Bay Basin - Development Action Program. The formation of the farmers associations was a necessary preliminary step for the conduct of the project.

2. Conduct of seminars/workshops/trainings among the members of the organizations. These covered the following areas of concern raised by the residents:

a. Leadership training and community organization
b. Women in development
c. Tree planting and environmental concerns
d. Agricultural skills
e. Soil and water conservation

3. Conduct of cross-visitations by our farmer-cooperators to different existing ISF projects identified as progressive projects within the area.

4. Animal dispersal for income-generating projects. Goats and swine were distributed in Amalao and cattle and swine were distributed in Tagpo.

5. Distribution of forest trees and fruit trees seedlings. The intention was to encourage the residents to plant trees around their residential lots and farms. This was the beginning of their experience in caring for trees.

5. Organization of *alayon* groups in Amalao and Tagpo. These groups undertake a mutual-help program in building contours, rockwalls and hedgerows in the respective farms of the participants in *alayon.*

OBSERVATIONS, REFLECTIONS AND PROVISIONAL THEORIES

Historical Grounding and Community Entry

The residents of Tagpo and Amalao manifested a distinct contrast in response to the project during our initial contacts with them and also during the organization of their respective associations. The residents of Amalao were able to organize much earlier than the residents of Tagpo. We observed that the residents of Amalao were quick to respond to our request for group meetings while it was difficult to gather together a group of residents of Tagpo.

We propose the following reasons for this distinction:

1. The residents of Amalao are a group of resettled strikers from a hacienda. They shared this common experience which could be the unifying factor among them. Their previous experiences as strikers could be the reason why they could easily organize (they were able to organize before as strikers). They were also more active in interactions and negotiation activities as they organize their group and interact with our project staff.

The residents of Tagpo have had an unpleasant experience with an organization which offered them developmental assistance. Their suspicion of such groups was a

hindrance we had to overcome before we were able to facilitate the formation of an association of the Tagpo residents.

2. The residents of Amalao are more closely knit as a group than the residents of Tagpo. The residents of Amalao behave more as a community, probably because when they were resettled in the area, they built their houses close to one another and cultivated farms far from their houses. In contrast, the Tagpo residents built their houses usually in the middle of their farms, thus their houses are relatively far from one another and meeting each one everyday is not a normal occurrence. It is also for this reason that calling for a meeting was difficult.

Strategy in Facilitating the Formation of Tagpo Farmers' Association (TACAMA)

Very few people showed up for the first meeting called by the project through one of the community leaders. We sensed that the residents then prefered to assume a "look-and-see" attitude.

A second meeting was called in the hope of getting more participants, at which time the few who were present were informed about the project. They were then asked to suggest a more convenient date and time for a third meeting -- so that more people might be able to attend. Again, it turned out that the attendance was unsatisfactory. So we told those who were present that we could not work with only a few people in the community. If they wished to see what benefits they could gain from the project, they were invited to join the seminars we were conducting in Amalao.

Seven persons from Tagpo trekked four kilometers to attend the workshop in Amalao. After they had gone back to Tagpo and told the others about the workshop, we began to receive requests from Tagpo residents to organize them and put up a project in the area. So we tried for another meeting of Tagpo residents, and this time we got satisfactory attendance. We began to learn about their concerns and apprehensions in dealing with development assistance groups. Subsequently, we were able to help them organize their own association.

The first association formed by the residents was short-lived. They had problems with attendance; there were concerns about officers not being able to live up to the members' expectations. Some members said officers were neither approachable nor available when the members needed them.

We let them alone to sort out the problem in their association. For a period of three months, the association was slowly "dying". Then a group of 10 residents approached us again, asking that we help them reorganize and elect a new set of officers. It was

with this new set of officers that we were able to implement active projects in the area. The *alayon* was revived and reorganized in the area.

In retrospect, we think that we had to leave them alone first to think, following our presentation of our program to the few persons that we first had contact. We did not push our agenda during our first contact with them. We did not promise any material assistance and we consistently emphasized that we were there to extend technical assistance in farming and that we were also concerned about environmental protection.

Working with Government Technicians

We consider it advantageous on our part to work closely with the technicians of the DA and DENR assigned in the area. We had to discuss with the city agriculturists our plans, particularly when it involved an activity parallel to what they were doing. An example was our intention to assist the residents of Amalao in swine production. We approached the city agriculturist and we informed him about our plan because we knew that the city agriculturist's office was conducting a swine dispersal project in the area. During our discussion, we realized that our proposed terms of agreement regarding a swine dispersal project would be looked upon by personnel of the city agriculturist's office as a competition to their work. We finally agreed to just deliver technical assistance in swine raising but not deal with the mechanics of a swine dispersal program. The field technicians however were always working with us. The field technicians of the government assigned in the area were also invited in our project staff meetings.

Organizing Field Activities in Conjunction with Farmer's Activities

During the last two months of our project time table we found out that our farmer cooperators were very active in their *alayon* and that we had to double our time allocation with them because they were having a lot of activities which needed our presence and support. Upon reflection we concluded that during the last two months they had nothing much to do outside of their routine farming activities and had much time to work with the concerns of the association. We then decided to consider the "farming calendar" of our cooperators and to spend more time in the educating process during weekends of the months when they were too busy working in their fields.

A Model Micro-watershed Farmer's Community

We considered looking at an urban subdivision homeoners' association as a possible model for our micro-watershed farmers' community.

A subdivision homeowner's association is a group of persons in a community with specific boundaries. The members of an urban subdivision homeowner's association are concerned about the preservation of a clean and pleasant environment to live in. There are officers of the association who manage the affairs of the community, which range from social functions, cleanliness and security in the subdivision. The association has rules and regulations pertaining to the well-being of the community and its residents. It would, therefore, be worth trying to model the farmers' association in Tagpo and Amalao along that of our perceived model of an urban subdivision homeowner's association.

The members of an urban subdivision homeowners' association are economically stable who do not earn their living from their place of residence. Our farmers' association members are not comparatively economically stable and they earn their living from their place of residence. We would then try to test whether the farmers would be able to appreciate the fact that they should protect their community because it is where they live in and from where they get their economic needs. We would try to test whether increased productivity would increase the farmers concern for their community or whether they would be encouraged to exploit the area some more and transfer to urban centers. As we looked forward to the coming years of our project life, we hope to continue to learn more about the community we are working with and learn more about theories and strategies in our effort to develop and enhance a farming community's ability to manage natural resources and protect their environment from degradation.

WATER QUALITY OF BAIS BAY

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INTRODUCTION

Secondary data on Bais Bay, and information derived from consultations with the Bais Bay community made apparent the issue of the Bay's siltation and pollution problem. Information gaps regarding the Bay were identified and these included the absence of data on the sedimentation rate as well as the lack of information on the water quality and the nutrients in the sediment. The research activities on the water quality aspect of the marine component were geared toward addressing these gaps.

SPECIFIC OBJECTIVES

This aspect of the project was undertaken with the following specific objectives:

1) to measure the sedimentation rate of Bais Bay and its rivers;

2) to assess the water quality of the Bay; and

3) to determine the nutrient content, specifically the nitrate and the phosphate in the sediment.

MATERIALS AND METHODS

Site Selection

Four major rivers which empty into the Bais Bay basin were located and identified. These were Alangilanan, Panambalon, and Tamogong River which empty into North Bais Bay and Panamangan River which discharges into South Bais Bay.

Based on a preliminary ocular survey, three sampling stations were established at specific points along each river. The sites selected are indicated in Figure 1. The stations were set up at points which were approximately at the rivermouth,100 - 200 m upstream and 100 - 200 m offshore.

In order to obtain an estimate of the river discharge, the width and depth of each river were measured along different points of the riverbed using a calibrated line. The

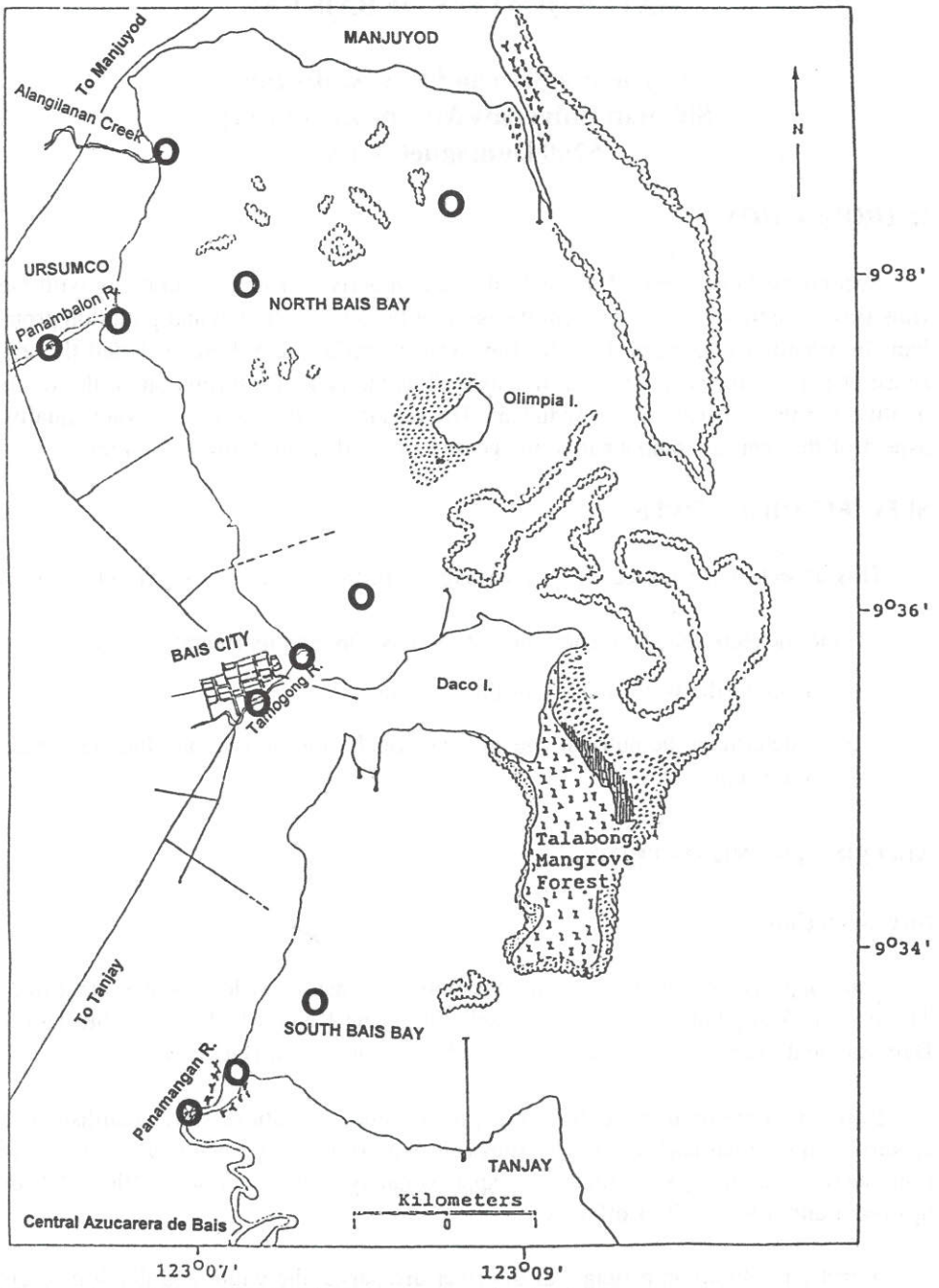

Figure 1. Map of Bais City showing study sites (O).

water velocity was calculated, based on repeated measurements of the rate of movement of paper floats which were allowed to flow along the surface of the water. River discharge was then calculated according to the formula (modified from Dunne and Leopold, 1978):

$$Q\ (m^3/min) = \text{width (m)} \times \text{depth (m)} \times \text{velocity (m/min)} \times c$$

where c = 0.9 for mud/silt/slate substrates
0.8 for rock/boulder/gravel substrates

Fabrication of Sediment Traps

Sediment traps (Figure 2), with a dimension of 11 x 5 cm (height/weight ratio of 2:2, as suggested in Gardner 1980), were fabricated out of whole lengths of 5-cm diameter PVC pipes which were sawed off into 11-cm sections. One end of each 11-cm PVC cylinder was sealed off with a plastic cap using epoxy adhesive. Rough edges were smoothened and each fabricated trap was checked for leakage before these were deployed in the field.

Measurement of Sedimentation Rate

To measure sedimentation rates, sediment traps were deployed in sets of three with three replicates per set at each sampling station. Rubber strips were used to secure the traps to bamboo stakes which were embedded in the substrate. The traps were positioned in such a way that the bottom of the traps were elevated about 30 cm above the substrate. Upon deployment and retrieval, care was taken to ensure that there was minimal agitation of the substrate.

Two sets of traps were deployed monthly. During sampling, a set of traps were deployed and were immediately retrieved following a 24-hour exposure in the field. Upon retrieval, the contents of the traps were poured into sampling containers for subsequent filtration in the laboratory. After the contents were poured out, the traps were returned underwater to be retrieved during the next sampling. This allowed a month-long exposure of the traps in the field.

In the laboratory, the samples were filtered using pre-weighed Whatman filter paper #1. After filtering the samples, the filter paper which contained the sediments were oven-dried to constant weight. Sedimentation rate was then calculated, based on the number of days during which the traps were exposed in the field.

Physicochemical Characteristics

A cursory check of the temperature during sampling was done using the built-in thermometer of the D.O. meter while salinity was determined using a temperature-

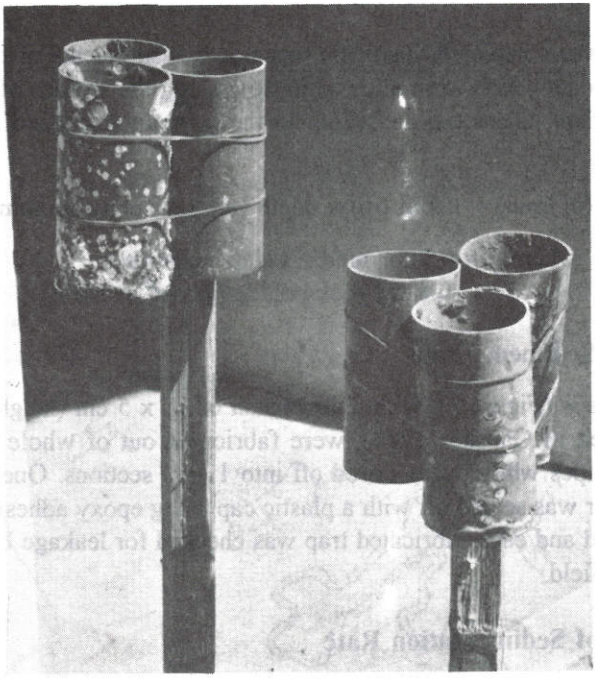

Figure 2. Sediment traps.

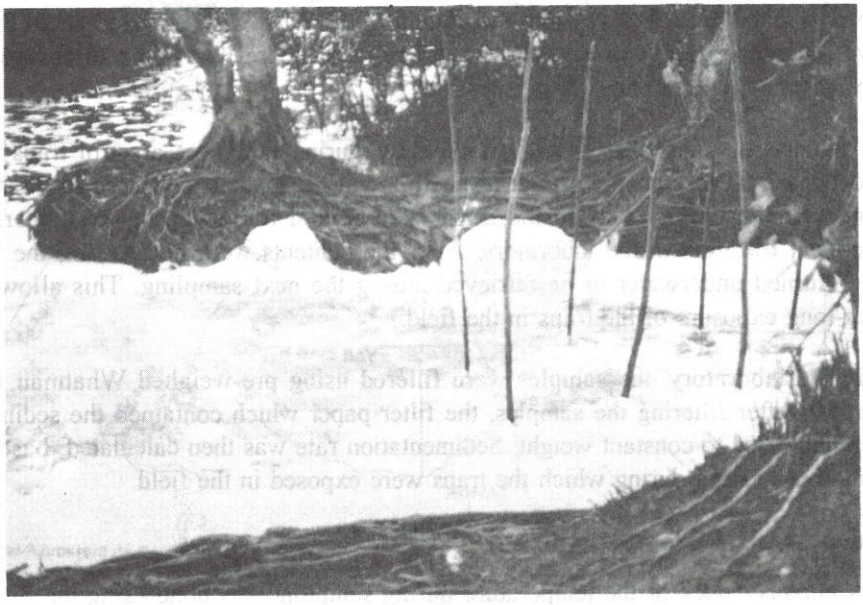

Figure 3. Mouth of Panamangan Creek.

compensated refractometer. Dissolved oxygen levels were monitored using a D.O. meter. The secchi disc was not used in measuring turbidity since the water in the sites was shallow and the readings often coincided with the maximum depth of the water at the time of sampling. Color of the water was determined visually.

Nutrient Analysis

Available nitrogen and phosphorus in the water were determined using the standard methods for analysis in Grasshoff (1983). Because of the amount of time and money involved in analyzing samples for nutrient content, only two samplings were done for this aspect of the study. Initial samples were collected in April and a second sampling was carried out in July.

Sampling Procedure

Sampling Site. Water samples were collected in north and south Bais Bay where the effluents of two sugar mills, namely: URSUMCO (United Robina Sugar Milling Co.) in the north and and CAB (Central Azucarera de Bais) in the south, are discharged. In each area, five sampling stations were established. Each station was approximately 500 meters apart from the other, three of which were oriented parallel to the shore at an approximate distance of 500 meters. A fourth station was established 500 meters away from the three parallel stations while the fifth station was situated at the mouth of the river where the effluents were discharged (Figure 3).

Sample Collection - Frequency and Preservation. Three replicate water samples were collected from each station using a Nansen bottle at the maximum depth but not quite reaching the sea floor. The samples were stored in an icebox during transport. Upon reaching the laboratory, the samples were kept frozen.

Samples for B.O.D. determination were fixed *in situ*. Titration of the samples was done in the laboratory.

Laboratory Procedure

Determination of Phosphate in Seawater - Ascorbic Acid Method (Colorimetric Method).

1) Reagents

a) Sulphuric Acid (4.5M)- Add 125 ml concentrated H_2SO_4 and dilute to 500 ml. Store in a plastic bottle.

b) Ascorbic Acid- Dissolve 5.0 g ascorbic acid in 25 ml water, then add 25 ml sulphuric acid solution (4.5M) solution. Refrigerate in an amber glass bottle.

The solution should be stable for at least a week or as long as it remains colorless. Prepare as needed.

c) Mixed reagent- Dissolve 6.25 g $(NH_4)6Mo7024.4H_2O)$ in 62.5 ml water. Dissolve 0.25 g potassium antimony tartrate to the molybdate solution. Add the molybdate solution to 175 ml dilute sulphuric acid. Add the tartrate to the molybdate and mix. Store in a glass bottle. This reagent is stable for several months.

d) In a scintillation vial or volumetric flask, add the following: 10 ml filtered sample, 0.2 ml ascorbic acid reagent, and 0.2 ml of the mixed reagent.

Measure extinction at 880 nanometers within 30 minutes after mixing. Treat the standard solutions with the sample.

Nitrate plus nitrite in seawater - Cadmium Reduction Method

1) Reagents

a) Ammonium Chloride - Dissolve 10 g NH_4Cl in water and dilute to 1000 ml, adjust the pH to 8.5 with concentrated NH_4OH.

b) Sulphanilamide reagent- Add 10 ml HCl to about 50 ml water, add 4 g sulphanilamide and dilute to 100 ml. Store in a plastic bottle.

c) N-1-naphthyl-ethylene Dihydrochloride- Dissolve 0.1 g of the amine in water and dilute to 100 ml. Refrigerate in a plastic bottle.

2) Preparation of Cadmium Column

Wash 20 g of cadmium fillings with 10% HCl and rinse copiously with distilled water. Stir the fillings with 100 ml of 2% copper sulphate solution until all the blue tartar has left the solution. Rinse with distilled water until all the colloidal copper have been removed. Pack the column under ammonium chloride solution.

3) Determination of Column Efficiency

Run both nitrate and nitrite standards at 10 ug-at/l concentration through the column and measure for nitrite. Correct extinction values and compute for efficiency of nitrate conversion. The cadmium columns should be reconditioned or regenerated if the conversion efficiency is below 85%.

Procedure:

Add to the scintillation vial or test tube the following: 10 ml filtered sample, 10 ml buffer reagent. Pour into the cd column. Collect the remainder and adjust the final

volume to 10 ml. Add 0.4 ml sulphanilamide reagent (allow to react for 60 seconds). Add 0.4 ml N-1-napthylethylenediamine dihydrochloride. Measure the extinction at 540 nm within 15 minutes to one hour. Treat standards as in sample.

Dissolved Oxygen - Winkler Titration

1) Reagents

a) Fixing Reagent #1- Dissolve 14.6 g $MnSO_4$ in a little water and dilute to 100 ml.

b) Fixing Reagent #2- Dissolve 25 g NaOH in 125 ml distilled water. Dissolve 15 g KI in 112.5 ml distilled water. Combine the two solutions at room temperature after these have settled.

c) Soluble starch:- Dissolve 0.5 g of soluble starch in 350 ml boiling distilled water. Boil for 5 minutes. Dilute the solution to 1.25 liters.

d) Thiosulphate titrant- Dissolve 11.6 g $Na_2S_2O_3$ and 0.4 g Na_2CO_3 in distilled water and dilute to 4 liters.

e) Primary standard- Dilute 0.1784 g KIO_3 in distilled water and dilute to 500 ml.

f) Dilute acid (1+4) ml- Mix 20 ml concentrated H_2SO_4 with 80 ml distilled water.

Procedure

1) Standardization of the titrant: Add 1 ml of dilute acid to the B.O.D. bottle. Add 1 ml fixing reagent #2 to B.O.D. bottle filled with water, cap and mix. Allow the flock to settle halfway down the bottle. Add 1 ml fixing reagent #1, cap and mix. Empty entire flask into 125 ml erlenmeyer flask. Add 5 ml of primary standard solution. Titrate using 5 ml soluble starch. Repeat standardization three times. Run several blanks without adding the primary standard.

2) Fill the sample B.O.D. bottle by inserting a piece of tubing into the bottom of the bottle and filling from the bottom up, allowing about one bottle to overflow.

3) Inject 1 ml of each fixing reagent (in either order), cap and mix. Exclude all air bubbles before mixing.

4) Allow the flock to settle halfway down the bottle then remix and allow to settle a second time.

5) Add 1 ml dilute acid, cap and mix the bottle to dissolve the precipitated flock. Empty the entire flask into 125 ml erlenmeyer flask. Titrate up to standard end point.

Biological Oxygen Demand (B.O.D.)

1) Reagents- same as in D.O.

2) Procedure

a) Pipette 100 ml unfiltered sample and dilute to 250 ml in a 250-ml volumetric flask. Mix by inverting the flask.

b) Slowly pour the diluted sample into 2 B.O.D. bottles. Exclude all air bubbles before capping with its stopper.

c) Titrate the first bottle for initial D.O. Treat with reagents for D.O. Incubate the other bottle for 5 days at 20 ° in the dark. After five days do as in D.O. analysis.

RESULTS

Sedimentation Rate for Samples Collected After 24 Hours

Preliminary samples collected from rivermouth stations in December showed high values of 7.65, 6.67, and 5.36 g/day for Alangilanan, Panambalon, and Panamangan River. No data were collected from Tamogong River. An offshore sample collected off Alangilanan River showed a lower accumulation rate of 2.52 g/day.

Figure 4 is a graph of the sedimentation rates based on monthly samples which were deployed for 24 hours in the field. Sedimentation rates were consistently high for Panamangan River in January and March with respective values of 7.76 and 11.45 g/day. Samples which were collected from Alangilanan ranked second, with sedimentation rates of 6.15 and 3.49 g/day recorded for the same period. Except for the relatively higher sedimentation rate recorded in December, samples collected from the rivermouth of Panambalon was consistently low from February to August. Traps deployed in Tamogong were particularly high in March at 9.98 g/day whereas previous samples collected in January and March yielded 2.04 and 2.54 g/day. Samples collected in April showed lower sediment accumulation at 2.81 g/day, which increased to 4.2 g/day in May and June but decreased to 0.73 g/day in July.

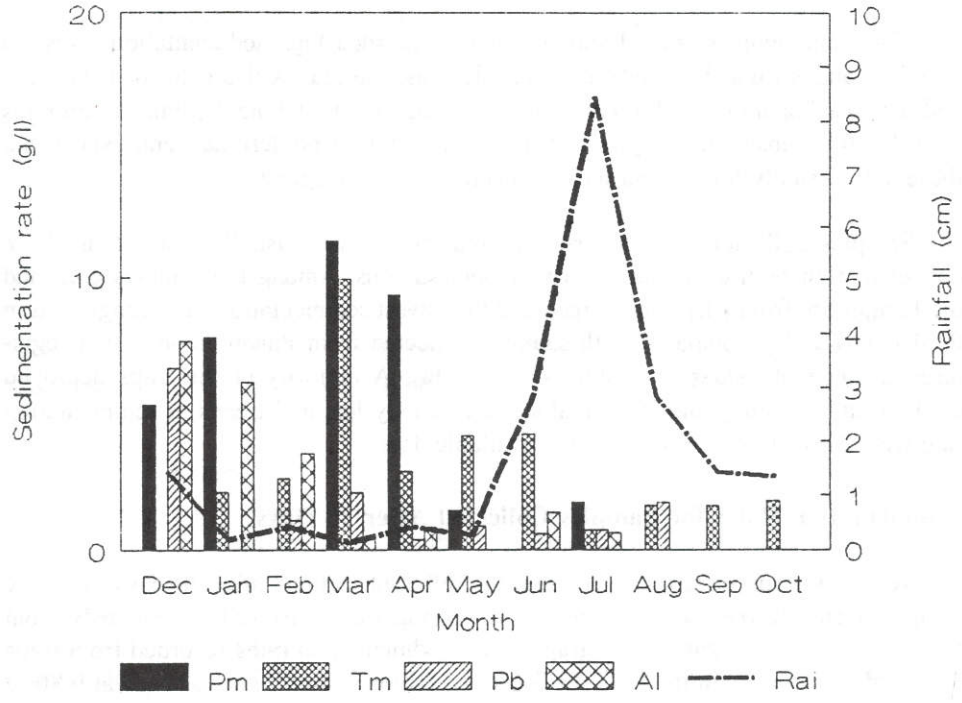

Figure 4. Sedimentation rate, 24 hrs.

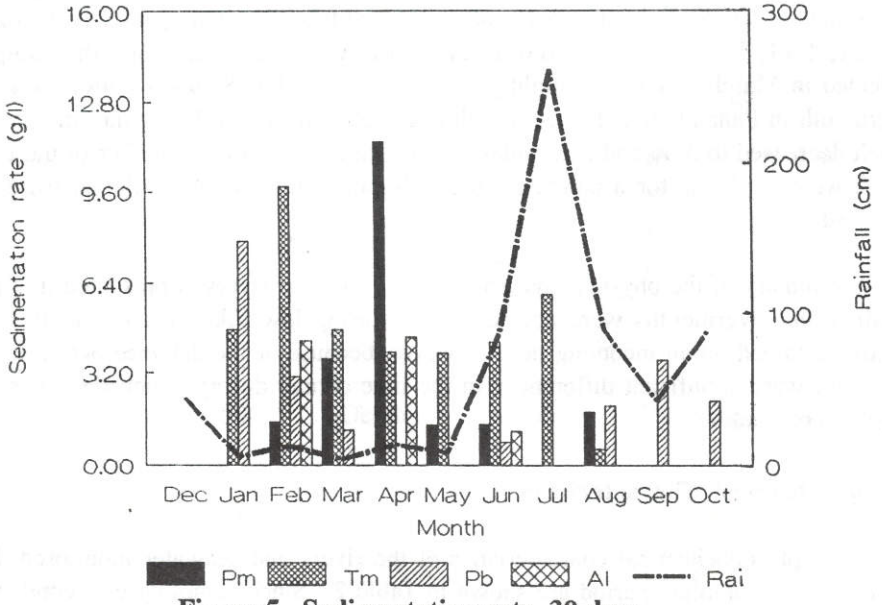

Figure 5. Sedimentation rate, 30 days.

Upstream samples from Tamogong River recorded high sedimentation rates in February and April at 4.23 and 4.62 g/day, decreased in May with a value of 1.98 g/day and increased again to 4.94 g/day in the following month of June. Sedimentation rates recorded from upstream samples in Panambalon showed no definite trend except that these were usually lower than those collected from Tamogong.

Samples collected offshore from all four rivers were usually lower than those collected from both upstream and rivermouth stations. Among the samples collected offshore, those from Alangilanan recorded the lowest sedimentation rates ranging from 0.30 - 0.67 g/day compared with samples collected from Panambalon which registered a range of values from 0.67 - 3.25 g/day. A majority of the traps deployed offshore in Tamogong and Panambalon were usually lost and trends in sedimentation rate were difficult to discern from the available data.

Sedimentation Rates for Samples Collected After 30 Days

Very few traps were retrieved from the different stations after 30 days and only samples from the rivermouth station in Tamogong were retrieved continuously from January to August. Figure 5 is a graph of the sedimentation rates recorded from traps deployed for 30 days in the field. In February, sedimentation rate was high at 9.80 g/day but leveled off to 4.74 g/day in March, comparable to the 4.73 g/day recorded in January. Sedimentation increased slightly in July to 6.02 g/day but decreased again to 0.56 g/day in August. Rivermouth samples collected from Panamangan River averaged at 1.51, 1.44, 1.41 and 1.43 g/day from February to June, excluding the samples collected in March which was slightly higher at 3.66 g/day. Samples collected at the rivermouth in Panambalon showed a high accumulation rate at 7.89 g/day in January which decreased to 3.06 and 2.22 g/day in succeeding samples. A number of the traps which were deployed for a month in the different stations in Alangilanan were not retrieved.

A summary of the physical characteristics of the four rivers is presented in Table 1. Since the rivermouths were not accessible during low tide, measurements were usually obtained on an incoming tide. However, because of the distance between rivers, there were significant differences in the time of day during which the measurements were made.

Physico-chemical Characteristics

Some physicochemical characteristics of the rivers and seawater monitored during the whole sampling period are shown in Table 2. Since sampling was conducted from mid-morning to mid-afternoon, temperature recorded during sampling fluctuated

Table 1. Physical characteristics and estimated discharge of the four rivers which empty into Bais Bay.
[width (m); depth (m); velocity (m/min); discharge (m^3/min)]

Month December

River	Width	Depth	Velocity	Discharge	*C
Panamangan	10.00	1.00	4.29	34.32	0.80
Tamogong	15.66	1.20	2.14	32.17	0.80
Panambalon	14.00	0.50	5.45	30.52	0.80
Alangilanan	11.33	0.80	3.33	24.15	0.80

Month January

River	Width	Depth	Velocity	Discharge	*C
Panamangan	10.00	1.00	4.15	33.20	0.80
Tamogong	15.66	1.20	2.20	33.07	0.80
Panambalon	14.00	0.50	5.30	29.68	0.80
Alangilanan	11.33	0.80	3.15	22.84	0.80

Month February

River	Width	Depth	Velocity	Discharge	*C
Panamangan	10.00	0.90	4.20	30.24	0.80
Tamogong	15.66	1.10	2.30	31.70	0.80
Panambalon	14.00	0.60	5.20	34.94	0.80
Alangilanan	11.33	0.50	3.20	14.05	0.80

Month March

River	Width	Depth	Velocity	Discharge	*C
Panamangan	10.00	0.70	4.00	22.40	0.80
Tamogong	15.66	1.10	2.10	29.94	0.80
Panambalon	14.00	0.50	5.10	28.56	0.80
Alangilanan	11.33	0.40	3.00	10.88	0.80

Table 1. (Continued)

Month April

River	Width	Depth	Velocity	Discharge	*C
Panamangan	10.00	0.80	4.20	26.88	0.80
Tamogong	15.66	1.20	2.10	31.57	0.80
Panambalon	14.00	0.50	4.80	26.88	0.80
Alangilanan	11.33	0.40	2.80	10.15	0.80

Month May

River	Width	Depth	Velocity	Discharge	*C
Panamangan	10.00	0.80	4.00	25.60	0.80
Tamogong	15.66	1.00	2.50	31.32	0.80
Panambalon	14.00	0.40	5.20	23.30	0.80
Alangilanan	11.33	0.30	3.50	9.52	0.80

Month June

River	Width	Depth	Velocity	Discharge	*C
Panamangan	10.00	1.00	3.20	25.60	0.80
Tamogong	15.66	1.50	2.50	46.98	0.80
Panambalon	14.00	1.10	4.80	59.14	0.80
Alangilanan	11.33	0.80	3.50	25.38	0.80

Month July

River	Width	Depth	Velocity	Discharge	*C
Panamangan	10.00	0.90	3.50	25.20	0.80
Tamogong	15.66	1.30	2.30	37.46	0.80
Panambalon	14.00	1.00	5.25	58.80	0.80
Alangilanan	11.33	0.60	3.00	16.32	0.80

Table 1. (Continued)

Month	August				
River	Width	Depth	Velocity	Discharge	*C
Panamangan	10.00	0.80	3.50	22.40	0.80
Tamogong	15.66	1.00	2.15	26.94	0.80
Panambalon	14.00	0.50	4.50	25.20	0.80
Alangilanan	11.33	0.30	3.00	8.16	0.80
Month	September				
River	Width	Depth	Velocity	Discharge	*C
Panamangan	10.00	0.90	3.20	23.04	0.80
Tamogong	15.66	1.00	2.30	28.81	0.80
Panambalon	14.00	0.70	4.50	35.28	0.80
Alangilanan	11.33	0.50	3.20	14.50	0.80
Month	October				
River	Width	Depth	Velocity	Discharge	*C
Panamangan	10.00	0.90	4.29	30.89	0.80
Tamogong	15.66	1.00	2.14	26.81	0.80
Panambalon	14.00	0.70	5.45	42.73	0.80
Alangilanan	11.33	0.50	3.33	15.09	0.80

somewhere between 29 - 33 °C. Salinity in the upstream and rivermouth stations approximated those which were recorded in offshore stations which ranged from 35 - 36 ppt. Similarly, average readings in dissolved oxygen levels varied little between 6.9 and 7.3 ppm.

Secchi disc readings for Tamogong, Panambalon, and Alangilanan approximated the maximum depth at the time of sampling.

The color of the water, generally green-brown in rivermouth and upstream stations, became clearer and more transparent in offshore stations.

The pH of water samples collected in April and July (Table 3) were not significantly different and these fall within the range of 8.33 - 8.46 which are well within the normal range of seawater pH.

Salinity varied little between 32 and 35 parts per thousand. Dissolved oxygen levels of the samples collected in April were slightly lower than those which were collected in July but none were below 5 mg O_2/l. Biological oxygen demand values, ranging from 0.94 - 2.22 mg O_2/l were much lower than the maximum allowable limit for coastal and marine waters set by the DENR, indicating minimal organic matter content in the samples.

Nutrients

Shown on Table 3 are the results of the nutrient analyses of water samples collected from the Bay suggesting minimal organic content in the samples. However, these determinations were from one sampling, before the onset of the milling season. Another sample taken after the milling season is still being analyzed.

DISCUSSION

Most of the traps which were deployed in the field were either stolen or washed away, so that less than fifty percent of the traps were retrieved during sampling. Consequently, with the patchy data on hand, it is difficult to compare sedimentation rates among the different sampling stations of the four rivers. Nevertheless, the values obtained for sedimentation rates provide baseline information on the amount of accumulated sediments which were collected at specific points in the Bay. Although no distinction can be made as to the source of the sediments which are deposited into the Bay, problem sites can be identified. Due to a major oversight in the sampling design, no measurements of total suspended solids was carried out in this study.

The high rates of sedimentation recorded in December, January, and March for samples collected from Panamangan River coincided with the onset of the sugar mill-

Table 2. Environmental data collected from the sampling stations of the four rivers in Bais Bay.

Station	Temp. (°C)	Salinity (o/oo)	D.O. (ppm)	Depth (m)	Color
Panamangan					
upstream	26.9-32.5	2-31	7.0-7.1	0.5-1.5	gray to brown
rivermouth	26.9-35.5	31-35	7.0-7.6	0.5-1.5	green-brown
offshore	29.7-31.5	31-35	7.1-7.5	0.5-1.5	green-brown
Tamogong					
upstream	28.4-29-0	0-25	7.0-7.7	0.2-0.5	opaque green
rivermouth	29.7-32.0	31-35	7.0-7.8	0.3-0.8	clear green
offshore	29.0-30-8	31-35	7.5-7.9	0.5-1.5	clear green
Panambalon					
upstream	29.3-31.1	2-31	7.0-7.2	0.5-1.5	green-brown
rivermouth	29.3-31-1	31-35	7.2-7.8	0.5-1.5	green-brown
offshore	32.0-32.2	31-35	7.1-7.4	0.5-1.5	green-brown
Alangilanan					
rivermouth	30.8-32.2	32-36	6.9-7.3	0.4-1.0	green-brown
offshore	29.0-29.7	32-36	7.0-7.6	0.5-1.7	green-brown

Table 3. Chemical characteristics of the waters of Bais Bay.

Station	ph	Salinity ppt	D.O. mgO_2/l	BOD_5 mgO_2/l	NO_3-N ug-at N/l	PO_4-P ug-at P/l
CAB	8.39	33.73	6.75	2.22	0.01	0.04
	8.35	32.47	8.76	0.94	0.01	0.02
URSUMCO	8.46	34.83	7.22	0.94	0.02	0.01
	8.33	32.60	8.57	1.11	0.01	0.01
Lag-it	8.41	33.80	7.76	1.17	0.02	0.01
	8.62	32.07	9.12		0.00	0.01

ing season when increased activity in the sugar mill resulted in the use of this river as a stream channel to convey the discharge from the mill into the open sea (Figure 6). In cane sugar manufacture, cane crushing water contains a substantial amount of soil and impurities, especially where harvesting is done manually, as is the case in Bais. The cane wash water also contains sugar and may appear colored. Other waste waters that cause pollution problems include those from washing floors and equipment. Effluents from sugarcane processing plants are characterized by high biological demand and high suspended solids. The solid trash remaining contains nutrients including nitrate and phosphate, and its disposal near or in estuaries may lead to eutrophication problems. The return of the mill mud and mill ash to the cane fields is highly recommended (Carpenter and Maragos 1989).

The high rates of sedimentation recorded for Alangilanan River which is the smallest among the four rivers, may be explained by the fact that terrigenous inputs from the steep slope of a nearby mountain drain heavily into this river. Traps retrieved from Tamogong after 24 hours and after 30 days in the field showed respective average sediment accumulation rates of 3.52 g/l^{-day} and 4.70 g/l^{-day} throughout the monitoring period.

Tamogong River, the largest among the four rivers, traverses several sites of human activity before it empties into the north Bais Bay basin. Changes in the vegetative cover of adjacent sugar cane fields together with urban run-off contribute towards sediment deposition in the area. Land run-off contribute significant amounts of suspended solids, BOD, nitrates, phosphates, as well as fecal coliforms and toxic metals (Viessman and Welty 1985)

IMPLICATION OF RESULTS

Effects of sedimentation include the following:

1) physical impact - moderate to severe damage to corals on the shelf; reduced light penetration in the water column; frequently dirty seawater

2) biological effects - reduced coral fauna diversity and reduced numbers and diversity of fish

3) effects on fishing - reduced catch of fish

Based on the available information, sedimentation rate is lower in offshore stations, which would indicate a settling out of the sediments in areas close to the rivermouth stations or a dispersal of the sediments to other parts of the bay.

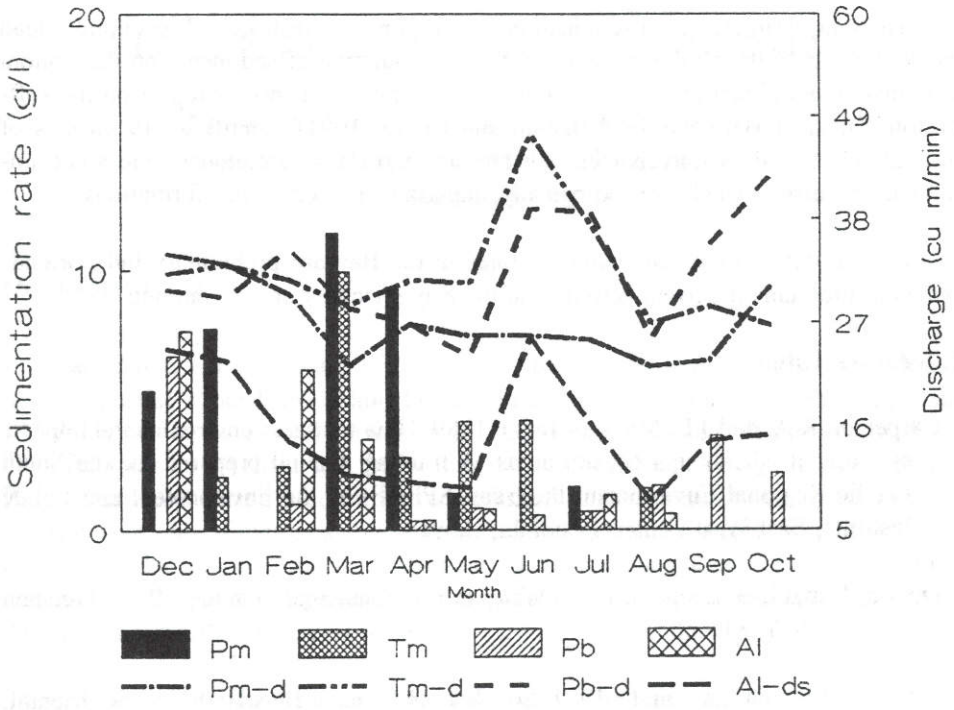

Figure 6. Sedimentation and river discharge.

The long-term effects of sediment deposition on the substrate will eventually lead to shallowing of the Bay. Furthermore, the accumulation of sediments on the bottom can have a significant effect on the bottom-dwelling organisms. A report on the soft-bottom fauna of Bais Bay by Estacion and Oñate (1991) identified 119 species of animals classified as polychaetes, crustaceans, molluscs, nematodes, and some unknown organisms which are ecologically important in energy transformations.

Present data on the sedimentation rates in the Bay are preliminary but portends potential problems if current activities in the Bay's vicinity are to continue.

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FISHERIES PROFILE OF BAIS BAY, NEGROS ORIENTAL

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INTRODUCTION

Bais Bay is a major source of fish and shellfish for Bais and nearby towns. It has been supporting about 1,463 fishing families in the coastal barangays of Bais and about 151 fishermen in the coastal barangays of Manjuyod and Tanjay, all surrounding Bais bay. The issue on overfishing in the bay and the lack of fish catch data was raised by the Bais community during a consultative workshop with community members and the Silliman University-Environment and Resource Management Project (SU-ERMP). Thus, a study to address this problem was organized. Its primary objective was to provide information for the development of a management scheme for sustainable fisheries in the Bay. The specific objectives were:

1. to collect additional secondary information about the Bay including
   a) coastal population statistics, i.e. the number of fishermen in the area and
   b) the number of registered commercial fishing operators as well as the average annual catch of their commercial fishing boats;
2. to identify the different fishing activities in the bay and to describe the quantity and the gear types actively in use;
3. to determine the composition and the relative abundance of the various fish species harvested;
4. to determine the average size and the length frequency distribution of economically important species;
5. to identify the areas associated with specific fishery resources;
6. to know the extent of distribution ("export") of fish captured from the Bay;
7. to assess how the exploiting population perceive the resources;
8. to identify the problems related to management and conservation of the bay's resources; and
9. to train field workers in collecting relevant data.

In this report, the results of ten months' primary catch data monitored from January to October 1992 are presented.

METHODOLOGY

The fishery team visited the coastal barangays surrounding the bay to collect data on its fishery profile, fish species caught, possible index of fishing pressure and the fishermen's perception of the fishery resources. Barangay captains were interviewed to collect more data on fishery profile. Existing secondary data from the Department of Agriculture Office of Bais, Manjuyod and Tanjay were gathered. Fish landing sites were identified and ten of these were chosen as study sites (Figure 1). The group also went to the Bais City Public Market to take individual photographs of each abundant species to form an identification manual for use in the monitoring of fish catch.

Coordination was made with some fishermen and the president of the Fishermen's Association. From December 27 to 29, 1991, ten residents were trained as enumerators for the daily fish catch monitoring.

Daily fish catch monitoring was conducted for ten months from January 1, 1992 to October 31, 1992. This was done by ten trained enumerators coordinated by a hired resident (the president of the Fishermen's Association in Pulong Daco) and supervised by the study leader and research assistant. The enumerators were assigned landing sites which they visited daily. They weighed the landed catch by species, identified the species and took the length and weight of each of at least 30 samples for each abundant species. The study leader and research assistant visited the field workers at least once a month to supervise the proper collection of data especially the identification of species. The coordinator helped convene the enumerators for emergency meetings called by the study leader, distributed catch data forms to the enumerators, collected and deposited data in the SU Marine Laboratory. The collected data were encoded using the software Lotus 123. Fish specimens were identified, using Schroeder (1980), Masuda *et al* (1984) and Randall *et al.* (1990); cephalopods, using Voss (1963); crustaceans, using Grey *et al.* (1983); and sea shells, using Eisenberg (1981).

The fishermen's perceptions of the Bais Bay fisheries were gathered by the SU-ERMP fishery team from interviews of some fishermen in the landing sites as well as from comments by fishermen living around the Bay regarding the Coastal Resources Management proposed under the Coastal Living Resources Project.

RESULTS

Table 1 shows 16 barangays -- 10 in Bais, five in Manjuyod and one in Tanjay -- surrounding Bais Bay. Within these barangays, there are 13 fish landing sites. Among

the 13, only Canibol pier in Okiot is the major landing site which receives the great number of fishermen from Olympia. Fishermen from Pulong Daco (Okiot, Capiñahan and Looc) bring their catch directly to their homes.

The ten fish landing sites chosen for the study were Opao and Dawis in Canlargo; Capiñahan; Sanlagan, Lag-it and Canibol in Barangay Okiot; Tavera Dike in Barangay II; Batugan in Biñohon; Dunggu-an and Campuyo in Manjuyod.

There is no report on commercial fishing in Bais Bay.

Fishing Gears

In a survey done by the fishery team, 19 gear types (Table 2 and Figure 2) and four fishing techniques were observed in the bay area. The fishing techniques are *gango* (miracle hole), *pamusaw/panamal* or *sikop* (fishing with bare hands), *panulo* (fishing with the use of torches) and *panginhas* (gleaning). Of the fishing gears, the most widely used is *pukot* or gill net (408 units) followed by *bunsod* or fish corral (205 units), *panggal* or crab pots (2,439 smaller units) *pasol* or hook & line (192 units), *pana* or spear (71 units) and *sahid* or beach seine (49 units). *Hulbot* or modified Danish seine (45 units), are used in Capiñahan, Looc, Okiot and Dungguan. Other less commonly used gears are *bubo* (fish trap), which are used only in Lo-oc and Okiot; *katay* (multiple hook and line) in Capiñahan, Lo-oc and Okiot; *sudsud* (push net) in Tangculogan and Luca; *handok* (muro-ami), only in Campuyo; *target or sabay* and *sabinet* (fish nets) in Capiñahan, Okiot, Campuyo and Maaslum; *pangkulabutan* (squid trap) only in Olympia; *pangnokos* (squid jigger) in Capiñahan, Okiot and Olympia; *sikpaw and sibot* (dip nets) in Okiot; *pamasayan* (screen net) only in Maaslum; and *tapsay* (mullet net) in Capiñahan, Okiot and San Jose.

Fish Catch Distribution

Fish and shellfish harvested from the bay are brought by the fishermen's wives to fish markets in Tanjay, Bais and Manjuyod, and sold to vendors. Bais market receives most of the harvested fish and shellfish since this area is more accessible to most fishermen. Some fish and shellfish, however, reach the Dumaguete fish market but empty seashells are sold in sacks to the shellcraft industry in Cebu.

Species Composition of Catch

Primary catch data collected from January to October 1992 showed that 159 fish species belonging to 52 families, 13 crustacean species belonging to four families, 39 mollusks species (6 cephalopods, 1 sea hare and 32 seashells) and an undetermined species of sea cucumbers (Table 3 and Figures 3-4) are harvested from Bais Bay using

17 types of gear and 4 fishing techniques. Table 4 lists the species caught by each type of gear and fishing technique.

Among the fishing gears used, *pukot* or gill net harvested the most number of species (140), followed by *bunsod* or fish corral (123), *sahid* or beach seine (92), *hulbot* or modified Danish seine (75), *pana* or spear (74), *katay* or multiple hook and line (56), *handok* or muro-ami (43), *bubo* or fish trap (28), *pasol* or hook & line (25), *target/sabay* or fish nets (24), *tapsay* or mullet net (18), *panggal* or crab pot (11), *sabinet* or fish net (10), *sikpaw* and *sibot* (dip nets), 7 and 4 species, respectively.

Of the fishing techniques, *sikop* (fishing with barehands) caught 26 species, *panginhas* (gleaning) 40, *gango* (miracle hole) 20, and *sulo* (torch) 13. Major species caught from the Bay vary with gear type and fishing techniques. Fish comprise from 1-100% of catch of the 15 types of fishing gear, namely: *bubo* (100%), *bunsod* (76%), *handok* (98%), *hulahop or hulbot* (92%), *katay* (100%), *pana* (88%), *panggal* (1%), *pukot* (94%), *pasol* (94%), *sabinet* (99%), *sahid* (73%), *sibot* (85%), *sikpaw* (91%), *tapsay* (99%), and *target* (99%); and 23-99% of the harvest of three fishing techniques: *gango* (99%), *sulo* (23%) and *sikop* (43%) (Table 5).

Cephalopods (squids, cuttlefishes and octopus) make up 100% of catch of *pangnokos and pangkulabutan* (Table 5) and only 19% of *sahid*, 12% of *sikpaw*, 8% of *hulahop* or *hulbot*, 7% of *pana*, 6% of *pasol*, 2% of *handok* and 24% of *sulo* (Figure 6). Portunid crabs compose 99% of *panggal* harvest, 5% of *pana*, 4% of *pukot*, 14% of *sulo* and 9% of *bunsod*; penaeid shrimps, 9% of *bunsod* and 28% of *sulo*; sergestid shrimps 19% of *sibot* (Figure 6). Lukot (egg masses of seahares of the Family Aplysiidae) comprises 68% of *sikop* harvest and 36% of *panginhas* or gleaning (Figure 6).

The siganids (Family Siganidae) appear to be most exploited among the fish groups comprising 56 % of *pana* harvest, 55% of *gango*, 37% of *bunsod*, 26% of *sikop*, 14% of *tapsay*, 10% of *sulo* and 2% of *handok* (Figure 6).

Table 6 lists 26 species of gastropods and bivalves harvested from the bay with *litub* composing 33% of the total sample harvest. This appears to be an underestimate because other shell areas (Cambuilao, Talungon and San Isidro), where most shells were reported, were not monitored. Table 6 also shows that gastropods and bivalves (or pelecypods) which are primarily harvested by gleanings are also collected by other fishing gears and techniques such as *hulbot* , *sahid*, *sulo* and *sikop*.

Composition and volume of seashells harvested from culture in Dawis, Canlargo from January to October 1992 is shown in Table 7.

Catch Per Unit Effort (CPUE)

Catch per unit effort was estimated for each of the seventeen fishing gears and four fishing techniques used in the area. Table 10 summarizes the results. *Hulbot* ranks first with an average of 8.28 kg/trip; followed by *handok* 7.57 kg/trip; *sahid* 5.73 kg/trip; *sabinet* 5.20 kg/trip; *tapsay* 4.27 kg/trip; *target/sabay* 4.19 kg/trip; *bunsod* 3.62 kg/trip; *pukot* 3.60 kg/trip; *pana* 3.21 kg/trip; *katay* 2.68 kg/trip; *sibot* 2.23 kg/trip; *pasol* 1.98 kg/trip; *pangkulabutan* 1.87 kg/trip; *bubo* 1.85 kg/trip; *sikpaw* 1.60 kg/trip; *pangnokos* 0.86 kg/trip; and *panggal* 0.05 kg/trip. CPUE for *panginhas* is 4.93 kg/trip; *gango* 4.54 kg/trip; *sikop* 3.28 kg/trip; and *sulo* 2.43 kg/trip.

An estimated total catch by gear is given in Table 9 and monthly income per trip per gear is shown in Table 11. Income from seashell harvest of shell cultures in Dawis is given in Table 8. The important marine fisheries are shown in Figure 7A and their respective peso values in Figure 7B.

Length Frequency Distribution

In general, six of the abundant species harvested from the bay show that at least 10% to as high as 35% were in the 8-18 cm TL size range for *Siganus canaliculatus*; 8-14.5 cm for *Gazza minuta*; 9-16.5 cm for *Upeneus sulphureus*; 8-14.5 cm for *Gerres* sp. (oyena); 7-13.5 cm for *Leiognathus splendens;* 11-18.5 cm for *Nemipterus* sp. (hexodon); and a 4-7.5 cm carapace length (CL) size range for *Portunus pelagicus* (Figures 8A-G). It can be noted that generally, the sizes of the fish harvested from the bay are not only small as compared with those commonly caught throughout Philippine waters, but they are also much smaller than their maximum sizes (Table 13). Only *Siganus canaliculatus* had sizes ranging beyond 20 cm (Figure 8A). Except for *Siganus canaliculatus* most fish samples were harvested by hulahop or hulbot in the Dungguan fishing areas.

In the size frequency distribution of these species collected for 10 months from January to October 1992, only two species showed a shift in their modes, with a slight increase in their general sizes; e.g., *Upeneus sulphureus* (Figure 8B). This shift suggests a possible growth of as slow as 1 cm monthly from February to March and March to April for *Upeneus sulphureus* (Figure 8B) and from January to February, February to March, and March to April for *Siganus canaliculatus* (Figure 8A). This inference was based on the assumption that the samples belonged to one cohort. The other species--*Gazza minuta* (Figure 8C), *Gerres* sp. (Figure 8D), *Leiognathus splendens* (Figure 8E), *Nemipterus* sp (Figure 8F), *Portunus pelagicus* (Figure 8G) -- did not show a shift in their modes. This can be interpreted to mean that these species may not get bigger in the fisheries; that is, they were fished out as soon as they reached their particular size ranges.

Reproductive/Gonad Stages

Ten out of eleven species sampled from January to July were found to have gonads at stages V to VI (ripe to running ripe) (Figures 9A-L). These were *Siganus canaliculatus* (danggit) where 52% of the population were actually spawning in February, 33% in March and 53% in June; *Terapon jarbua* (buga-ong) with 55% in February, 37% in April and 4% in May; *Liza* sp. (gisaw) with 2% in January, 7% in March, 7% in April and 13% in June; *Leiognathus splendens* (danglay) with 40% in February; *Gerres abbreviatus* (bag-angan) with 13% in March; *Gerres* sp. (kasbo) with 12% in March, 3% in April; *Gazza minuta* (piampe) with 3% in January, 55% in March, 7% in May and 79% in June; *Gerres filamentosus* (lawihan) with 5% in July; *Sardinella* sp. (malangsi) with 50% in January; *Stolephorus* sp. (bolinao) with 20% in January.

Taking the length distribution and the gonadal stages together it can be inferred that these species at Bais Bay fisheries tend to mature at relatively small sizes. Table 13 shows that *Siganus canaliculatus* were mature at 10.6-19.8 cm (TL), *Terapon jarbua* at 15.5-24.8 cm, *Liza* sp. at 15.7-22.8 cm, *Leiognathus* splendens at 10.0-13.2 cm, *Gerres abbreviatus* at 17.0-19.5 cm, *Gerres* sp. at 14.5-16.5 cm, *Gazza minuta* at 11.0-16.5 cm, *Gerres filamentosus* at 14.9-15.4 cm, as evidenced by the presence of gonads at stages V to VI. Dolar, *et al* (Unpub Report) reported that fishes which attain sexual maturity at an earlier time (and are therefore smaller in size) have been observed in many fisheries that are experiencing heavy fishing pressures, which can be explained as the fishes' way of adapting to tremendous pressure.

Alcala and Alcazar (1979) reported that sexual maturity of *Siganus canaliculatus* in the coastal areas of Dumaguete was attained at standard lengths of 100-105 mm (males) (TL= 13.5-14.2 cm) and 111-115 mm (females) (TL=15.2-15.5 cm).

Fishermen's Perceptions

The fishermen's perceptions can be summarized as follows:

1. The fisheries habitats are degraded. The major causes are:

   a) the direct discharge of wastes from the sugar mills polluting the water which kill fish and other species;

   b) destruction of mangroves by cutting for wood and disturbing the roots by *embao* gleaners, thereby decreasing the nursery area for juvenile species;

   c) coral gathering and sand mining in the bay area which decrease the habitat of fishes and disturb their spawning ground;

d) shallowing of the bay by the volume of sediment deposits from river discharges that reduce fishing areas;

e) use of dynamite and poison in catching fish by gleaners from upland barangays. Dynamiting destroys corals and poison kills the coral organisms.

2. Decreasing catch is the result of the degraded fisheries, too many fishermen, and the use of destructive fishing methods such as beach seine, fine meshed gill nets, and *hulbot*, which catch more juvenile fish and invertebrates.

DISCUSSION

Fishing Pressure

Data on fisheries profile in Bais Bay (Table 1) show that fishing effort, as measured by the number of fishermen and number of boats, appears to be higher in Dewey I. (Brgy. Okiot, Capiñahan and Looc) than in Olympia I. However, in Table 1, the number of fishermen in Bais City was given as the number of fishing families, as this was the only data available from the Department of Agriculture, Bais City. Cadeliña (1983) reported that in Olympia I., 95% of the fishermen were fulltime, suggesting a high use-intensity of the Bay by these fishermen throughout the whole fishing cycle. Personal observations gave an estimate of an average of two fishermen in a fishing family, giving a total of 2,926 fishermen in Bais City. Taking together the 151 fishermen in the coastal barangays of Tanjay and Manjuyod (Table 1) and the 2,926 fishermen in Bais City would bring a total of 3,077 fishermen exploiting the Bay. The average density, i.e., the number of fishermen per sq km of the Bay area would be 57. With an estimated annual harvest of 951,549.4 kg, the annual extraction rate is estimated at 17,621.3 kg/km^2 or about 17.6 MT/km^2. This is higher compared to that reported in Lingayen Gulf (Calud *et al.*, 1989) which is 10.1 MT/km^2 which suggests that Bais Bay is still relatively more productive than Lingayen Gulf.

Fishing Gears

Among the 19 types of fishing gears used in Bais Bay, *hulbot* (Table 10) is the most efficient, catching 8.28 kg/trip, followed by *handok*, which catches 7.57 kg/trip and *sahid* (5.73 kg/trip). *Hulbot* and *sahid* are more efficient compared to gill net (3.6) as they use finer nets (mesh size = 1 cm) compared to gill net (>3 cm). *Handok* is small-scale muroami type of fishing method which pulverizes corals to catch the fish.

Cath Per Unit Effort (CPUE)

Catch per unit effort values in Bais Bay are relatively lower compared with those obtained from other areas. Catch per unit effort data from Bindoy, Bayawan, Bohol,

Ronda, and Siquijor using *pukot, pana, katay* and *pasol* were higher than those of Bais Bay (Table 12, Luchavez unpublished data). The lower catch per unit effort values in Bais Bay is indicative of overfishing in the area.

Fish Size and Reproduction

It is obvious that for some species of fish caught in Bais Bay, e.g., *Siganus canaliculatus* (see Table 13), the sizes are much smaller than their maximum size, which is indicative of overfishing. It can also be gleaned from the data (Table 13) that some species, e.g., *Siganus canaliculatus*, exhibit seasonality in their reproduction. For such species, management by declaring open and closed fishing seasons may be feasible. In the case of *Siganus canaliculatus*, this species has been found to be reproductive during the months of January to July. Since it is one of Bais Bay's major exploited species (Figure 7) and one that is showing overexploitation, such management option is highly favored.

SUMMARY & RECOMMENDATIONS

Results of the ten-month primary data monitored from January to October 1992 show that Bais Bay is exploited by 1,463 fishing families in the coastal barangays of Manjuyod and Tanjay -- all surrounding Bais Bay. A total of 159 fish species belonging to 52 families, 13 crustacean species and 39 mollusks species -- 32 of which are seashells -- are harvested from Bais Bay using 17 types of gear and 4 fishing techniques. Of the fishing gears, the most widely used is *pukot* or gill net (408 units). However, *hulbot/hulahop* or modified Danish seine got the highest value for catch per unit effort (8.28 kg./trip). The CPUE values in Bais Bay are relatively lower compared with those obtained from other areas. Generally, the sizes of the commonly caught fish in Bais Bay are smaller compared with their maximum size which can be attained by the species. They also tend to mature at relatively small sizes as evidenced by the presence of gonads at stages V-VI.

The evidently small sizes of fish caught from Bais Bay and the low catch per unit effort are indeed indicative of overfishing in the area. This confirms the fishermen's claim of decreasing catch which they themselves believe is the result of degraded fisheries because of too many fishermen, use of poison and destructive fishing methods in the Bay, waste discharges from sugar mills, mangrove conversion into fishponds and siltation. These constitute the problems in the management and conservation of the Bay's resources.

It is obvious that fishing pressure at Bais Bay is high and there are strong indications of growth overfishing (i.e., harvesting before the fish reaches sexual maturity). The following are therefore recommended to decrease fishing pressure:

1. Strict enforcement of laws prohibiting illegal fishing practices in the Bay, most especially the ban on the use of small (1 cm) mesh-sized nets.

2. Encouragement and/or strengthening of community organizations to help monitor illegal fishing practices in the Bay.

3. Seasonal regulation of fishing activities, like the closed fishing season for siganids during their breeding/spawning season.

4. Provision of alternative livelihood projects to fishermen who are totally dependent on fishing.

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Table 1. Bais bay fisheries profile.
(Data on number of fishermen in coastal barangays were taken from DA, May 1990; others were supplied by the barangay captains.)

Municipality	Coastal barangays surrounding Bais Bay	No. of landing sites	No. of fishermen	Estimated No. of boats Motorized	Non-Motorized	Total
			Fishing Families			
Bais						
	Barangay II	1	22	0	7	7
	Binohon	1	1 00	0	70	70
	Cambuilao	1	61	0	37	37
	Canlargo	2	13	0	65	65
	Capinahan	catch landed	1 84	1 0	63	73
	Looc	directly to	3 68	7	1 00	1 07
	Okiot	fishermen's	495	2 4	1 82	2 06
	Olympia	house	132	12	1 50	1 62
	Talungon	1	55	0	60	60
	Tangculogan	1	33	0	40	40
SUBTOTAL	10	7	1463 fishing families	53	774	827
Manjuyod						
	Alangilanan	1	16	0	16	16
	Campuyo	1	27	2	30	32
	Dunggu-an	1	33	0	47	47
	Maaslum	1	19	0	19	19
	San Jose	1	30	0	50	50
SUBTOTAL	5	5	1 25	2	1 62	164
Tanjay						
	Luca	1	26	0	45	45
TOTAL	16	13	1 51 fishermen + 1463 fishing families	55	981	1036

Table 2. **Total number of gears in all coastal barangays surrounding Bais Bay.** (Data obtained from surveys and from interviews with barangay captains. Numbers in parentheses are dimensions (in meters) of gear. ND means number not determined.

COASTAL BARANGAYS

Gear	Brgy II	Bino	Camb	Canl	Capinh	Lo-oc	Okiot	Olym	Talu	Tang	Ala	Camp	Dung	Maas	S.J.	Luca	Total
1.Bubo (fish trap)						4	8										12
2.Bunsod (fish corral)	26	5	ND	23	10	14	21	50		4	16	1	8	3	8	16	205
3.Handok (muro-ami)												2					2
4.Hulbot (modified Danish seine) (mesh s.=2.5 cm) (LxW)					5 (7.5-10x1.5)	10	2						21 (200x5)	1	6		45
5.Katay (multiple hook & line) (27-850 hooks)					8	ND	23										31
6.Pana (speargun)		1					56	4		4						6	71
7.Panggal (crab pot)	50	292		65	50		50	500				110	482		840	2	439
8.Pangkulabutan (squid trap)								3									3
9.Pangnokos (squid jigger)					10		1	6									17
10.Pasol (hook & line)		3	ND	2	10	150			3	3				1		20	192
11.Pukot (gill net)	2	25	ND	10	30	107	40	86	15	20	16	24	14	6	11	2	408
(range of lengths)	(56-234)	(104-1000)	(200-600)	(400-1200)		(1000)			(45-300)	(600)	(600)	(600)	(100-1000)	(200-1000)	(500)		
12.Pamasayan (shrimp screen)														4			4
13.Sibot (dip net)							2										2
14.Sahid (beach seine)		8	ND		4		17		9	3		1	2	4	1		49
(range of lengths)									(18)	(18)							
15.Sud-sud (push net)										17						6	23
16.Sabinet (fish net)							2					2		1			5
17.Sikpaw (dip net)							3										3
18.Tapsay (mullet net)					2		3 (20x20)								2 (20x20)		7
19.Target/Sabay (fish net) (range of lengths) (mesh s.=1.0 cm)					6 (300)							2	(120-320)				8
TOTAL Number	78	334	ND	100	135	285	228	649	27	51	32	142	527	20	868	50	3,526
Number of types	3	6	4	4	10	6	13	6	3	6	2	7	5	7	6	5	

Table 3. List of fish, crustacean, and mollusk species harvested from Bais Bay.

Species	Local Name
A. Fish	
Family Acanthuridae (surgeonfishes)	
1. *Acanthurus* sp.	Indangan
2-3. *Naso* spp.	Bagis
Family Ambassidae (glassyfishes)	
4. *Ambassis* sp.	Palangan
Family Apogonidae (cardinalfishes)	
5. *Cheilodipterus macrodon* (Lecepede)	Ibis/Mongaw
6-7. *Apogon* spp.	Ibis
8. *Sphaeramia nematoptera* (Bleeker)	Ibis
Family Atherinidae (silversides)	
9. *Atherina* sp.	Guno
Family Balistidae (triggerfishes)	
10. *Balistapus undulatus* (Mungo Park)	Pugot
11. *Balistapus* sp.	Pakol
12. *Stephanolepis* sp.	Bulaknitan
13. *Psuedotriacanthus* sp.	Bulaknitan
Family Belonidae (needlefishes)	
14. *Strongylura* sp.	Balo
Family Blenniidae (blennies)	
15. *Salarias fasciatus* (Bloch)	Palog
16. *Salarias* sp.	Palog
Family Carangidae (scads & jacks)	
17. *Megalaspis cordyla* (Linnaeus)	Bakulan
18. *Alepes vari* (Cuvier)	Kabalyas
19. *Alectis indicus* (Ruppel)	Samin-samin
20. *Alectis ciliaris* (Bloch)	Samin-samin
21. *Carangoides armatus* (Ruppel)	Badlon
22. *Carangoides* sp.	Malapati
23. *Selar* sp.	Tamarong
24. *Scomberoides tol* (Cuvier)	Lapis
25. *Caranx* sp.	Baha-ulo
26. *Decapterus* sp.	Pulag-ikog
27. *Atule mate* (Cuvier)	Lambayawan
28. unidentified sp.	Tulukitok
Family Caesionidae (fusiliers)	
29. *Caesio erythrogaster* (Cuvier)	Ulan-ulan
30. *Caesio caerulaureus* (Lacepede)	Solid

Species	Local Name
31. *Pterocaesio pisang* (Bleeker)	Lokihok
Family Chaetodontidae (butterfly fishes)	
32. *Chaetodon octofasciatus* (Bloch)	Kulampiros
Family Chanidae (milkfish)	
33. *Chanos chanos* (Forsskal)	Awa
Family Chirocentridae (wolf herring)	
34. *Chirocentrus dorab* (Forsskal)	Balila
Family Cichlidae (cichlids)	
35. *Tilapia* sp.	Tilapia
Family Clupeidae (sardines and herrings)	
36. *Sardinella albella* (Valenciennes)	Lilang
37. *Sardinella* sp.	Malangsi
38. *Nematalosa come* (Richardson)	Kabase
39. *Spratelloides* sp.	Bolinabid
40. *Dussumieria elopsoides* (Bleeker)	Balantiyong
41. Unidentified sp.	Malobgas
42. Unidentified sp.	Hawol-hawol
Family Dasyatidae (stingray)	
43. *Dasyatis* sp.	Kiampao
Family Engraulidae (anchovies)	
44. *Stolephorus* sp.	Bolinao
45. *Thrissina baelama*	Tigue
46. Unidentified sp.	Tugnos
Family Elopidae (tarpons)	
47. *Megalops cyprinoides* (Brousonet)	Bulan-bulan
48. *Elops* sp.	Bid-bid
Family Ephippidae (batfishes)	
49. *Platax orbicularis* (Forsskal)	Dalapugan
Family Fistularidae (flutemouths)	
50. *Fistularia petimba* (Lacepede)	Tubo-tubo
Family Gerreidae (mojarras)	
51. *Gerres* sp.	Kasbo
52. *G.abbreviatus*	Bag-angan/Samulok
53. *G. filamentosus* (Cuvier)	Bag-angan/Lawihan
Family Gobiidae (gobies)	
54. *Ptereleotris* sp.	Ananambo
55. *Cryptocentrus* sp.	Balanghutin
56. *Oxyurichthys* sp.	Wakli-wakli
57. Unidentified sp.	Watlay-watlay
58-59. Unidentified spp.	Bunog

Species	Local Name
Family Haemulidae (sweetlips & grunts)	
60. *Pomadasys hasta* (Bloch)	Ulibalay
61. *Plectorhyncus pictus* (Thunberg)	Lipte
62. *P. chaetodontoides* (Lacepede)	Lipte
Family Hemiramphidae (halfbeaks)	
63. *Hemiramphus* sp.	Balanban/Salasa
Family Holocentridae (squirrelfishes)	
64. *Adioryx ruber*	Ganting
65. *Myripristis berndti* (Jordan & Evermann)	Ganting
Family Kyphosidae (sea chubs)	
66. *Kyphosus* sp.	Ilac
Family Labridae (wrasses)	
67. *Cheilinus celebicus* (Bleeker)	Ipos-ipos
68. *C. trilobatus* (Lacepede)	Ananapan
69. *Halichoeres scapularis* (Bennett)	Labayan
70. *Choerodon* sp.	Lupit
71. *Thalassoma lunare* (Linnaeus)	Labayan
72. *Cheilio inermis* (Forsskal)	Tanlaron
Family Leiognathidae (slipmouths)	
73. *Leiognathus splendens* (Cuvier)	Danglay
74. *L. fasciatus* (Lacepede)	Dagoldol
75. *L. elongatus* (Gunther)	Tabilos
76. *L. bindus* (Valenciennes)	Sap-sap
77. *Gazza minuta* (Bloch)	Piampe
78. *Gazza achlamys*	Piampe
79. *Secutor ruconius* (Hamilton-Buchanan)	Palotpot
80. *S. insidiator* (Bloch)	Palotpot/Sape-sape
Family Lethrinidae (emperor breams)	
81. *Lethrinus lentjan* (Lacepede)	Katambak
82. *Lethrinus ornatus* (Valenciennes)	Katambak
83. *Lethrinus* sp.	Dogso
Family Lobotidae (tripletails)	
84. *Lobotes surinamensis* (Bloch)	Ligad
Family Lutjanidae (snappers)	
85. *Lutjanus argentimaculatus* (Forsskal)	Mangagat
86. *L. fulviflamma* (Forsskal)	Lalagan
87. *L. rivulatus* (Cuvier)	Panta-an
88. *L. monostigma* (Cuvier)	Aluman
89. *L. russelli* (Bleeker)	Labungan
90. *L. gibbus* (Forsskal)	Maya-maya

Species	Local Name
91. *L. caeruleovittatus* (Valenciennes)	Bangalao
92. *Lutjanus* sp.	Kalambangis
Family Mugilidae (mullets)	
93. *Liza* sp. 1	Gisaw
94. *Liza* sp. 2	Balanak
95. *Liza* sp. 3	Yakmo
Family Mullidae (goatfishes)	
96. *Upeneus sulphureus* (Cuvier)	Hinok 1
97. *U. vittatus* (Forsskal)	Hinok 2
98. *U. tragula* (Richardson)	Hinok 3
99. *Parupeneus barberinus* (Lacepede)	Timbungan
100. *Upeneus* sp.	Salmonete
Family Muraenidae (moray eels)	
101. *Evenchelys macrurus* (Bleeker)	Ubod
102-103. *Gymnothorax* spp.	Bakasi
Family Nemipteridae (threadfin breams & spinecheeks)	
104-105. *Nemipterus* spp.	Bakay
106. *Scolopsis cancellatus* (Valenciennes)	Budlat
107. *Scolopsis ciliatus* (Lacepede)	Gapas-gapas
108-109. *Pentapodus* spp.	Sulong/Salinggukod
Family Platycephalidae (flatheads)	
110. *Platycephalus* sp.	Sunogan
Family Plotosidae (marine catfishes)	
111. *Plotosus lineatus* (Thunberg)	Ito
Family Priacanthidae (big eyes)	
112. *Priacanthus* sp.	Bungo/Bulgan
Family Pomacentridae (damselfishes)	
113. *Dischistodus fasciatus*	Palata
114. *Chrysiptera* sp.	Palata
115-116. *Chromis* spp.	Kibang
117-118. *Dascyllus* spp.	Bica-bica
119-120. *Abudefduf* spp.	Kapal
121. *Amphiprion clarkii* (Bennett)	Bantay bot-bot
Family Rachycentridae (cobia)	
122. *Rachycentron canadum* (Linnaeus)	Halo-antasik
Family Scaridae (parrotfishes)	
123-125. *Scarus* spp.	Mol-mol/Kuyog-kuyog
Family Scatophagidae (scats)	
126. *Scatophagus argus*	Kikilo

Species	Local Name
Family Scombridae (mackerels and tunas)	
127. *Rastrelliger kanagurta* (Cuvier)	Anduhaw
128. *Scomberomorus* sp.	Tangige
129-130. Unidentified spp.	Pirit-pirit/Ihalason
Family Scorpaenidae (scorpion fishes)	
131. *Pterois volitans* (Linnaeus)	Lalong
132. *Sebastes* sp.	Bantol
Family Serranidae (groupers)	
133. *Cromileptis altivelis* (Valenciennes)	Milo-milo
134. *Epinephelus suillos* (Valenciennes)	Manalhog
135. *E. macrospilus* (Bleeker)	Lapu-lapu
136. *E. caeruleopunctatus* (Bloch)	Manan-aw
137. *E. fuscoguttatus* (Forsskal)	Bantolon
138. *E. microdon* (Bleeker)	Bantolon
139. *E. summana* (Forsskal)	Pugapo
140. *Cephalopholis boenack* (Bloch)	Pugalo
141. *C. pachycentron* (Valenciennes)	Tangka-an
142. *Anyperodon leucogrammicus* (Valenciennes)	Lapu-lapu
Family Siganidae (rabbitfishes)	
143. *Siganus canaliculatus* (Park)	Danggit
144. *S. guttatus* (Bloch)	Kitong
145. *S. punctatus* (Forster)	Lalap
146. *S. virgatus* (Valenciennes)	Talagbago
147. *S. vulpinus* (Schlegel and Muller)	Talagbago
148. *S. spinus* (Linnaeus)	Ngisi-ngisi
Family Sillaginidae (whitings)	
149. *Sillago* sp.	Aso-os
Family Soleidae (soles)	
150. *Dexillichthys* sp.	Dali-dali/Palad
Family Sphyraenidae (barracudas)	
151. *Sphyraena barracuda* (Walbaum)	Rompe/Tabangko
152. *Sphyraena* sp.	Bat-og
Family Synodontidae (lizardfish)	
153. *Synodus variegatus* (Lacepede)	Tambod
154-155. *Saurida* spp.	Tambod
Family Teraponidae (tigerfishes)	
156. *Terapon jarbua* (Forsskal)	Buga-ong
157. *Pelates quadrilineatus* (Bloch)	Gong-gong

Species	Local Name
Family Tetraodontidae (pufferfishes)	
158. *Chelonodon patoca* (Hamilton)	Botete
Family Trichiuridae (hairtails)	
159. *Trichiurus haumela*	Diwit
B. Crustaceans (crabs, prawns, shrimps & lobsters)	
Family Portunidae (Portunid crabs)	
1. *Scylla serrata* (Forskal)	Alimango
2. *Portunus pelagicus* (Linnaeus)	Lambay
3. *Thalamita* sp.	Kasag
4. *Charybdis cruciata* (Herbst)	Krusan
5. *Podophthalmus vigil* (Fabricius)	Kasway
Family Penaeidae (Penaeid shrimps)	
6. *Penaeus monodon* (Fabricius)	Pantat
7. *P. japonicus* Bate	Pantat
8. *P. merguiensis* de Man	Boktutay
9. *Trachypenaeus fulvus* Dall	Bagulan
10. *Metapenaeus ensis* (de Haan)	Mestisa
11. *M. endeavouri* (Schmitt)	Mestisa
Family Sergestidae	
12. *Acetes* sp.	Uyap
Family Palinuridae (lobsters)	
13. *Panulirus* sp.	Banagan
C. Mollusks	
Cephalopoda (squids, cuttlefish, octopi)	
Sub-order Decapoda	
1. *Sepioteuthis* sp.	Nokos
2. *Loligo* sp.	Talostos
3. *Sepia* sp. 1	Kulabutan
4. *Sepia* sp. 2	Buko-buko
Sub-order Octopoda	
5. *Octopus* sp. 1	Kugita
6. *Octopus* sp. 2	Tabugok/Tamala
Pelecypoda	
Family Lucinidae (lucines)	
7. *Phacoides philippinarum* (Reeve)	Embao
Family Mytilidae (mussels)	
8. *Modiolus metcalfei* (Hanley)	Tahong

Species	Local Name
Family Ostreidae (oysters)	
9. *Crassostrea* sp.	Talaba
10. *Crassostrea cucullata* (Born)	Sisi
11. *Ostrea* sp.	Kuya
Family Arcidae (ark Shells)	
12. *Anadara* sp.	Litub
Family Corbiculidae	
13. *Geloina suborbicularis* Philippi	Tuway
Family Veneridae (Venus clams)	
14. *Tapes litterata* Linnaeus	Kandiis
15. *Paphia sulcosa* Philippi	
16. *Circe scripta* (Linnaeus)	Pisos-pisos
17. *Grafrarium tumidum* (Roding)	Bisala
18. *Periglypta* sp.	Bug-atan
19. *Pitar citrina* (Lamark)	Tikod-tikod
20. Unidentified sp.	Punao
21. Unidentified sp.	Punao
22. Unidentified sp.	Puti-an
23. Unidentified sp.	Punyete
Family Cardiidae (cockles or heart shells)	
24. *Vepricardium* sp.	Sulod-sulod
Family Mactridae (surf clams)	
25. *Mactra* sp.	Bulok-bulok
Family Anomiidae (jingle shells)	
26. *Placuna placenta*	Lampirong/Tipay
Family Pinnidae (fan mussels)	
27. *Atrina* sp.	Talab/Atsa-atsa
Family Malleidae (hummer oyster)	
28. *Malleus* sp.	
Family Pteriidae (pearl oysters)	
29. *Pinctada* sp.	
Gastropoda	
Family Aplysiidae (seahares)	
30. *Dolabella auricularia* (Lightfoot) (eggs)	Lucot
Family Strombidae (true conch)	
31. *Strombus canarium* (Linnaeus)	Bungkawil
32. *S. urceus* (Linnaeus)	Aninikad
Family Potamididae (mud whelks)	
33. *Telescopium telescopium* (Linnaeus)	Bagongon

Species	Local Name
34. *Terebralia* sp.	Dalu-dalu
Family Volutidae (volutes)	
35. *Melo* sp.	Bilong
36. *Voluta* sp.	Kibol
Family Muricidae (murex or rock shells)	
37. *Murex* sp.	Sangka-sangka
Family Haliotidae (Abalones)	
38. *Haliotis* sp.	Kapinan
Family Trochidae (topshells)	
39. *Trochus* sp.	Tandok-tandok
D. Sea Cucumber	
1. Unidentified spp.	Balat

Table 4. List of fish, crustacean, mollusk and sea cucumber species harvested from Bais Bay.

Species	Type of gear and fishing techniques used to harvest the species.																					TOTAL
	Bubo	Buns	Gang	Hand	Hulb	Kata	Pana	Pagl	Puko	Pank	Pakb	Paso	Pahs	Sahi	Sabi	Sibt	Sikp	Sulo	Siko	Taps	Tar	
A. Fish																						
Family Acanthuridae																						
1. Acanthurus sp.	+	+		+			+		+													5
2-3. Naso spp.		+					+		+													3
Family Ambassidae																						
4. Ambassis sp.		+				+			+					+							+	5
Family Apogonidae																						
5. Cheilodipterus macrodon	+	+				+	+		+					+								6
6-7. Apogon spp.	+	+	+	+	+				+					+	+	+	+	+	+		+	13
8. Sphaeramia nematoptera	+	+				+	+		+					+								6
Family Atherinidae																						
9. Atherina sp.		+							+					+	+					+	+	6
Family Balistidae																						
10. Balistapus undulatus	+					+	+															3
11. Balistapus sp.							+		+			+										3
12. Stephanolepis sp.		+			+		+		+					+							+	6
13. Psuedotriacanthus sp.					+									+								2
Family Belonidae																						
14. Strongylura sp.		+		+	+	+	+		+					+						+	+	9
Family Blenniedae																						
15. Salarias fasciatus									+													1
16. Salarias sp.									+												+	2
Family Carangidae																						
17. Megalaspis cordyla		+			+	+			+			+		+								6
18. Alepes vari		+			+	+			+			+		+								6
19. Alectis indicus		+			+	+			+													4
20. A. ciliaris					+									+								2
21. Carangoides armatus		+		+	+	+	+		+			+		+								8
22. Carangoides sp.		+							+													2
23. Selar sp.		+							+													2
24. Scomberoides tol		+				+																2
25. Caranx sp.		+			+				+													3
26. Decapterus sp.									+													1
27. Atule mate						+			+			+		+							+	5
28. unidentified sp.					+				+													2
Family Caesionidae																						
29. Caesio erythrogaster		+		+			+		+					+								5

Table 4. (Continued)

Type of gear and fishing techniques used to harvest the species.

Species	Bubo	Buns	Gang	Hand	Hulb	Kata	Pana	Pagl	Puko	Pank	Pakb	Paso	Pahs	Sahi	Sabi	Sibt	Sikp	Sulo	Siko	Taps	Tar	TOTAL
30. C. caerulaureus		+		+		+	+		+					+								6
31. Pterocaesio pisang		+		+					+					+								4
Family Chaetodontidae																						
32. Chaetodon octofasciatus		+		+	+		+		+													5
Family Chanidae																						
33. Chanos-chanos		+					+		+													3
Family Chirocentridae																						
34. Chirocentrus dorab						+			+			+										3
Family Cichlidae																						
35. Tilapia sp.		+							+													2
Family Clupeidae																						
36. Sardinella albella		+	+		+	+			+					+							+	7
37. Sardinella sp.		+			+	+			+			+		+							+	7
38. Nematalosa come									+					+								2
39. Spratelloides sp.		+												+								2
40. Dussumieria elopsoides									+													1
41. Unidentified sp.		+			+				+					+	+						+	6
42. Unidentified sp.									+													1
Family Dasyatidae																						
43. Dasyatis sp.		+			+																	2
Family Engraulidae																						
44. Stolephorus sp.		+				+			+			+		+							+	6
45. Thrissina baelama		+							+													2
46. Unidentified sp.									+						+							2
Family Elopsidae																						
47. Megalops cyprinoides		+							+													2
48. Elops sp.									+													1
Family Ephippidae																						
49. Platax orbicularis	+	+		+										+								4
Family Fistularidae																						
50. Fistularia petimba		+			+																	2
Family Gerreidae																						
51. Gerres sp.		+	+	+	+	+	+		+					+					+	+	+	11
52. G. abbreviatus		+			+	+			+					+								5
53. G. filamentosus		+			+				+					+								4
Family Gobiidae																						
54. Ptereleotris sp.		+							+					+								3
55. Cryptocentrus sp.		+							+					+								3

Table 4. (Continued)

Type of gear and fishing techniques used to harvest the species.

Species	Bubo	Buns	Gang	Hand	Hulb	Kata	Pana	Pagl	Puko	Park	Pakb	Paso	Pahs	Sahi	Sabi	Sibt	Sikp	Sulo	Siko	Taps	Tar	TOTAL
56. Oxyurichthys sp.		+			+				+					+								4
57. Unidentified sp.		+			+				+					+							+	5
58-59. Unidentified spp.		+	+	+	+	+			+					+		+	+	+	+			11
Family Haemulidae																						
60. Pomadasys hasta		+																				1
61. Plectorhynchus pictus		+				+	+		+													4
62. P. chaetodontoides							+															1
Family Hemiramphidae																						
63. Hemiramphus sp.		+							+					+						+		4
Family Holocentridae																						
64. Adioryx ruber	+	+	+	+		+	+															6
65. Myripristis berndti	+	+		+			+		+					+					+			7
Family Kyphosidae																						
66. Kyphosus sp.		+																				1
Family Labridae																						
67. Cheilinus celebicus	+			+					+													3
68. C. trilobatus		+																				1
69. Halichoeres scapularis	+	+		+		+			+													5
70. Choerodon sp.		+		+					+													3
71. Thalassoma lunare	+			+					+					+								4
72. Cheilio inermis		+							+													2
Family Leiognathidae																						
73. Leiognathus splendens		+			+	+	+		+					+								6
74. L. fasciatus					+				+													2
75. L. elongatus		+			+				+					+								4
76. L. bindus		+			+				+													3
77. Gazza minuta		+			+		+							+							+	5
78. G. achlamys		+			+				+					+								4
79. Secutor ruconius		+			+		+							+								4
80. S. insidiator		+	+		+	+	+		+					+						+	+	9
Family Lethrinidae																						
81. Lethrinus lentjan	+	+		+	+		+		+			+										7
82. L. ornatus	+	+		+	+	+	+		+													7
83. Lethrinus sp.	+	+							+					+								4
Family Lobotidae																						
84. Lobotes surinamensis		+							+													2
Family Lutjanidae																						
85. Lutjanus fulviflamma	+	+	+		+	+	+		+			+		+								9

Table 4. (Continued)

Type of gear and fishing techniques used to harvest the species.

Species	Bubo	Buns	Gang	Hand	Hulb	Kata	Pana	Pagl	Puko	Pank	Pakb	Paso	Pahs	Sahi	Sabi	Sibt	Sikp	Sulo	Siko	Taps	Tar	TOTAL
86. L. argentimaculatus	+	+	+		+	+			+			+		+								8
87. L. rivulatus						+	+		+			+										4
88. L. monostigma		+							+			+										3
89. L. russelli						+	+		+			+										4
90. L. gibbus																						
91. L. caeruleoguttatus																						
92. Lutjanus sp.				+	+	+																3
Family Mugilidae																						
93. Liza sp. 1		+	+		+		+		+					+			+	+	+	+	+	11
94. Liza sp. 2		+							+											+		3
95. Liza sp. 3									+					+						+	+	4
Family Mullidae																						
96. Upeneus sulphureus		+		+	+	+	+		+					+								7
97. U. vittatus		+		+	+	+	+		+					+							+	8
98. U. tragula		+			+		+		+					+				+	+	+		8
99. Parupeneus barberinus	+	+	+	+	+	+	+		+					+						+		10
100. Upeneus sp.														+								1
Family Muraenidae																						
101. Evenchelys macrurus		+	+		+	+	+	+	+					+					+	+		10
102-103. Gymnothorax spp.	+					+	+		+					+								5
Family Nemipteridae																						
104-105. Nemipterus spp.		+			+	+			+					+								5
106. Scolopsis cancellatus		+			+		+		+					+	+				+			7
107. S. ciliatus	+	+		+	+	+			+					+								7
108-109. Pentapodus spp.		+		+		+	+							+					+			6
Family Platycephalidae																						
110. Platycephalus sp.		+			+	+	+		+					+							+	7
Family Plotosidae																						
111. Plotosus lineatus		+	+				+		+						+	+	+			+		8
Family Priacanthidae																						
112. Priacanthus sp.		+			+				+													3
Family Pomacentridae																						
113. Dischistodus fasciatus	+	+		+			+		+					+								6
114. Chrysiptera sp.	+			+			+		+					+								5
115-116. Chromis spp.		+																				1
117-118. Dascyllus spp.				+					+													2
119-120. Abudefduf spp.	+	+					+		+					+								5
121. Amphiprion clarkii				+																		1

Table 4. (Continued)

Type of gear and fishing techniques used to harvest the species.

Species	Bubo	Buns	Gang	Hand	Hulb	Kata	Pana	Pagl	Puko	Pank	Pakb	Paso	Pahs	Sahi	Sabi	Sibt	Sikp	Sulo	Siko	Taps	Tar	TOTAL
Family Rachycentridae																						
122. Rachycentron canadum	+					+			+					+								4
Family Scaridae																						
123-125. Scarus spp.	+	+		+			+		+			+		+								7
Family Scatophagidae																						
126. Scatophagus argus		+	+		+		+		+					+					+			7
Family Scombridae																						
127. Rastrelliger kanagurta	+	+			+		+		+					+							+	6
128. Scomberomorus sp.						+			+													2
129-130. Unidentified spp.									+													1
Family Scorpaenidae																						
131. Pterois volitans					+				+			+										3
132. Sebastes sp.		+					+		+					+								4
Family Serranidae																						
133. Cromileptis altivelis		+				+			+													3
134. Epinephelus suillos	+	+				+	+		+			+		+					+			8
135. E. macrospilus	+	+	+	+	+		+	+	+			+										9
136. E. caeruleopunctatus						+	+															2
137. E. fuscoguttatus						+	+															2
138. E. microdon							+															1
139. E. summana	+	+	+		+	+	+		+			+		+								9
140. Cephalopholis boenack	+	+		+		+			+			+										6
141. C. Pachycentron	+			+		+	+		+													5
142. Anyperodon leucogrammicus																						
Family Siganidae																						
143. Siganus canaliculatus		+	+	+	+		+		+				+	+			+	+	+	+		12
144. S. guttatus		+	+	+	+		+		+				+	+			+	+	+	+		12
145. S. punctatus		+		+			+		+				+						+			6
146. S. virgatus		+		+			+		+				+	+								6
147. S. vulpinus				+			+						+									3
148. S. spinus									+				+	+								3
Family Sillaginidae																						
149. Sillago sp.		+			+	+	+		+			+		+								7
Family Soleidae																						
150. Dexillichthys sp.		+			+		+		+					+								5
Family Sphyraenidae																						
151. Sphyraena barracuda		+		+	+	+			+					+								6
152. Sphyraena sp.		+	+	+	+		+		+					+								7

Table 4. (Continued)

Type of gear and fishing techniques used to harvest the species.

Species	Bubo	Buns	Gang	Hand	Hulb	Kata	Pana	Pagl	Puko	Pank	Pakb	Paso	Pahs	Sahi	Sabi	Sibt	Sikp	Sulo	Siko	Taps	Tar	TOTAL
Family Synodontidae																						
153. Synodus variegatus				+		+			+												+	4
154-155. Saurida sp.		+			+		+		+			+		+	+							7
Family Teraponidae																						
156. Terapon jarbua		+			+	+	+	+	+			+		+						+		9
157. Pelates quadrilineatus		+			+	+	+	+	+					+						+		8
Family Tetraodontidae																						
158. Chelonodon patoca	+	+			+				+					+								5
Family Trichiuridae																						
159. Trichiurus haumela		+			+				+					+								4
B. Crustaceans																						
Family Portunidae																						
1. Scylla serrata		+							+				+									3
2. Portunus pelagicus		+	+		+	+	+	+	+			+	+	+	+			+	+			13
3. Thalamita sp.		+	+		+			+	+				+	+				+	+		+	10
4. Charybdis cruciata					+	+		+	+													4
5. Podophthalmus vigil		+						+	+										+			4
Family Penaeidae																						
6. Penaeus monodon		+			+		+		+					+					+			6
7. P. japonicus		+					+		+													3
8. P. merguiensis		+							+				+									3
9. Trachypenaeus fulvus		+			+				+				+	+				+	+			7
10. Metapenaeus ensis		+			+				+				+	+								5
11. M. endeavouri		+			+				+				+	+								5
Family Sergestidae																						
12. Acetes sp.																+						1
Family Palinuridae																						
13. Panulirus sp.							+		+													2
C. Mollusks																						
Cephalopoda																						
Suborder Decapoda																						
1. Sepioteuthis sp.		+		+	+	+	+		+	+		+		+				+	+	+		12
2. Loligo sp.		+			+				+													3
3. Sepia sp. 1		+		+	+		+	+	+		+			+	+		+		+			11

Table 4. (Continued)

Type of gear and fishing techniques used to harvest the species.

Species	Bubo	Buns	Gang	Hand	Hulb	Kata	Pana	Pagl	Puko	Pank	Pakb	Paso	Pahs	Sahi	Sabi	Sibt	Sikp	Sulo	Siko	Taps	Tar	TOTAL
4. Sepia sp. 2		+			+		+		+					+								5
Suborder Octopoda																						
5. Octopus sp. 1		+					+	+	+									+				5
6. Octopus sp. 2		+					+	+	+					+				+	+		+	8
Pelecypoda																						
Family Lucinidae																						
7. Phacoides philippinarum													+									1
Family Mytilidae																						
8. Modiolus metcalfei																						
Family Ostreidae																						
9. Crassostrea sp.																						
10. Crassostrea cucullata													+						+			2
11. Ostrea sp.													+									1
Family Arciidae																						
12. Anadara sp.													+									1
Family Corbiculidae																						
13. Geloina suborbicularis													+									1
Family Venereidae																						
14. Tapes litterata													+									1
15. Paphia sulcosa													+									1
16. Circe scripta													+									1
17. Grafrarium tumidum													+									1
18. Periglypta sp.													+									1
19. Pitar citrina													+									1
20. Unidentified sp.													+									1
21. Unidentified sp.																						
22. Unidentified sp.													+									1
23. Unidentified sp.													+									1
Family Cardiidae																						
24. Vepricardium sp.													+									1
Family Mactridae																						
25. Mactra sp.													+									1
Family Anomiidae																						
26. Placuna placenta					+									+								2
Family Pinnidae																						
27. Atrina sp.							+						+									2

Table 4. (Continued)

Type of gear and fishing techniques used to harvest the species.

Species	Bubo	Buns	Gang	Hand	Hulb	Kata	Pana	Pagl	Puko	Pank	Pakb	Paso	Pahs	Sahi	Sabi	Sibt	Sikp	Sulo	Siko	Taps	Tar	TOTAL
Family Malleidae																						
28. Malleus sp.																						
Family Pteriidae																						
29. Pinctada sp.																						
Gastropoda																						
Family Aplysiidae																						
30. Dolabella auricularia		+							+				+	+	+					+	+	7
Family Strombidae																						
31. Strombus canarium							+		+				+					+				4
32. S. urceus													+									1
Family Potamididae																						
33. Telescopium telescopium													+									1
34. Terebralia sp.													+									1
Family Volutidae																						
35. Melo sp.													+									1
36. Voluta sp.																			+			1
Family Muricidae																						
37. Murex sp.									+				+									2
Family Haliotidae																						
38. Haliotis sp.													+						+			2
Family Trochidae																						
39. Trochus sp.													+									1
D. Sea cucumbers																						
Unidentified spp.													+						+			2
TOTAL	28	123	20	48	75	56	74	11	140	1	1	25	40	92	10	4	7	13	26	18	24	

Table 5. Summary of percentage composition of fish, crustacean and mollusks caught by each gear type from January to October 1992.

Gear Type and Fishing Techniques	Month	Fish		Crustaceans		Mollusks		TOTAL
		Weight (kg)	% Comp	Weight (kg)	% Comp	Weight (kg)	% Comp	Weight (kg)
1. bubo (fish trap)	Sept., 1992	16.62	100.0	-	-	-	-	16.62
	October	197.72	100.0	-	-	-	-	197.72
	TOTAL	214.34	$\bar{X}$=100.0	-	-	-	-	214.34
2. bunsod (fish corral)	Jan., 1992	971.66	76.53	224.39	17.67	73.65	5.80	1 269.70
	February	463.49	76.51	94.80	15.65	47.53	7.84	605.82
	March	481.96	79.38	83.38	13.73	41.82	6.89	607.16
	April	476.09	78.34	99.27	16.33	32.37	5.33	607.73
	May	1047.54	81.52	167.68	13.05	69.78	5.43	1 285.00
	June	1 143.81	79.52	206.81	14.38	87.84	6.10	1 438.46
	July	1 253.56	76.03	294.39	17.85	100.89	6.12	1 648.84
	August	1 007.36	72.05	310.24	22.19	80.56	5.76	1 398.16
	September	955.38	74.32	286.87	22.32	43.13	3.36	1 285.38
	October	1434.09	73.54	462.0	3.69	53.95	2.77	1 950.13
	TOTAL	9,234.94	$\bar{X}$=76.77	2,229.92	$\bar{X}$=17.69	631.52	$\bar{X}$=5.54	12,096.38
3. gango (miracle hole)	January, 1992	36.57	99.95	0.02	0.05	-	-	36.59
	February	25.10	100.00	0.0	0.0	-	-	25.10
	March	12.00	92.31	1.00	7.69	-	-	13.00
	April	2.40	100.00	0.0	0.0	-	-	2.40
	May	3.20	100.00	0.0	0.0	-	-	3.20
	June	23.50	100.00	0.0	0.0	-	-	23.50
	July	4.50	100.00	0.0	0.0	-	-	4.50
	August	20.70	100.00	0.0	0.0	-	-	20.70
	September	14.40	100.00	0.0	0.0	-	-	14.40
	October	9.00	100.00	0.0	0.0	-	-	9.00
	TOTAL	151.37	$\bar{X}$=99.23	1.02	$\bar{X}$=0.77	-	-	152.39
4. handok (muro-ami)	January, 1992	-	-	-	-	-	-	-
	February	35.77	100.00	-	-	0.0	0.0	35.77
	March	46.15	95.45	-	-	2.02	4.55	48.35
	April	27.66	100.00	-	-	0.0	0.0	27.66
	May	-	-	-	-	-	-	-
	June	-	-	-	-	-	-	-
	July	20.00	100.00	-	-	0.0	0.0	20.00
	August	-	-	-	-	-	-	-
	September	17.60	100.00	-	-	0.0	0.0	17.60
	October	18.37	93.72	-	-	1.23	6.28	19.60
	TOTAL	165.55	$\bar{X}$=98.20	-	-	3.43	$\bar{X}$=1.80	168.98
5. hulbot/hulahop (modified Danish seine)	January, 1992	504.83	92.83	1.15	0.21	37.85	6.69	543.83
	February	773.33	93.01	7.66	0.92	50.45	6.07	831.44
	March	792.43	94.46	2.36	0.28	44.10	5.26	838.89

Table 5. (Continued)

Gear Type and Fishing Techniques	Month	Fish Weight (kg)	Fish % Comp	Crustaceans Weight (kg)	Crustaceans % Comp	Mollusks Weight (kg)	Mollusks % Comp	TOTAL Weight (kg)
	April	576.93	90.37	1.98	0.31	59.50	9.32	638.41
	May	971.80	94.85	0.20	0.02	52.60	5.13	1024.60
	June	11 03.01	86.64	3.70	0.29	166.43	13.07	1273.16
	July	13 77.65	90.12	1.80	0.12	149.14	9.76	1528.59
	August	13 92.17	99.71	1.10	0.08	2.90	0.21	1396.17
	September	12 76.15	92.04	2.40	0.17	108.00	7.79	1386.55
	October	1448.05	94.19	1.70	5.70	87.60	0.11	1537 35
	TOTAL	10,2 16.35	X=92.82	24.05	X=0.81	758.59	X=6.37	10,9 98.99
6. katay/salabay (multiple hook & line)	January, 199	88.13	99.69	0.25	0.28	0.03	0.03	88.41
	February	25.77	100.00	0.0	0.0	0.0	0.0	25.77
	March	20.29	100.00	0.0	0.0	0.0	0.0	20.29
	April	34.74	100.00	0.0	0.0	0.0	0.0	34.74
	May	18.40	100.00	0.0	0.0	0.0	0.0	18.40
	June	18.90	100.00	0.0	0.0	0.0	0.0	18.90
	July	50.99	100.00	0.0	0.0	0.0	0.0	50.99
	August	25.00	100.00	0.0	0.0	0.0	0.0	25.00
	September	14.00	100.00	0.0	0.0	0.0	0.0	14.00
	October	9.10	100.00	0.0	0.0	0.0	0.0	9.10
	TOTAL	305.32	X=99.99	0.25	0.028	0.03	0.003	305.60
7. pana (spear)	Jan.,1992	103.77	87.86	6.17	5.22	8.17	6.92	118.11
	February	271.92	90.25	10.29	3.42	19.08	6.33	301.29
	March	281.16	86.27	21.14	6.49	23.61	7.24	325.91
	April	502.12	96.91	8.67	1.67	7.33	1.42	518.12
	May	458.22	97.19	5.04	1.07	8.21	1.74	471.47
	June	346.81	95.91	3.59	0.99	11.21	3.10	361.61
	July	611.28	87.23	48.55	6.93	40.90	5.84	700.73
	August	344.62	84.03	16.95	4.13	48.54	11.84	410.11
	September	391.24	77.71	66.75	13.26	45.45	9.03	503.44
	October	318.64	77.87	21.75	5.32	68.80	16.81	409.19
	TOTAL	3,6 29.78	X=88.12	208.90	X=4.85	281.30	X=7.03	4,119.98
8. panggal (crab pot)	January, 1992	7.71	2.49	299.18	96.81	2.15	0.70	309.04
	February	4.81	0.93	512.82	99.07	0.0	0.0	517.63
	March	4.95	1.39	349.80	98.44	0.60	0.17	355.35
	April	1.55	0.70	220.08	99.30	0.0	0.0	221.63
	May	1.45	0.92	155.74	99.08	0.0	0.0	157.19
	June	0.90	0.44	203.88	99.56	0.0	0.0	204.78
	July	1.05	0.62	168.58	99.15	0.40	0.23	170.03
	August	2.15	0.97	218.33	98.53	1.10	0.50	221.58
	September	3.25	2.25	140.96	97.54	0.30	0.21	144.51
	October	1.20	0.62	192.36	98.81	1.10	0.57	194.66
	TOTAL	29.02	X=1.13	2,461.73	X=98.63	5.56	X=0.24	2,496.40

Table 5. (Continued)

Gear Type and Fishing Techniques	Month	Fish Weight (kg)	Fish % Comp	Crustaceans Weight (kg)	Crustaceans % Comp	Mollusks Weight (kg)	Mollusks % Comp	TOTAL Weight (kg)
9. pukot (gill net)	Jan., 1992	1148.89	90.48	39.79	3.14	81.05	6.38	1269.73
	February	1215.49	96.59	38.58	3.06	4.39	0.35	1258.46
	March	1507.38	97.52	24.68	1.60	13.62	0.88	1545.68
	April	1942.49	94.40	91.49	4.45	23.71	1.15	2057.69
	May	1467.99	96.49	14.32	0.94	39.06	2.57	1521.37
	June	1789.54	94.07	98.32	5.17	14.37	0.76	1902.23
	July	3855.69	94.07	113.73	2.77	129.54	3.16	4098.96
	August	3328.73	91.18	259.66	7.11	62.20	1.71	3650.59
	September	6489.52	95.65	273.64	4.03	21.47	0.32	6784.53
	October	1645.65	92.07	127.97	7.16	13.75	0.77	1787.37
	TOTAL	24,391.27	$\bar{X}$=94.25	1,082.18	$\bar{X}$=3.94	403.16	$\bar{X}$=1.81	25,876.61
10. pangnokos (squid jigger)	Jan., 1992		-	-	-	11.51	100.0	11.51
	February	-	-	-	-	4.46	100.0	4.46
	March	-	-	-	-	4.95	100.0	4.95
	April	-	-	-	-	13.60	100.0	13.60
	May	-	-	-	-	7.00	100.0	7.00
	June	-	-	-	-	8.40	100.0	8.40
	July	-	-	-	-	14.30	100.0	14.30
	August	-	-	-	-	9.70	100.0	9.70
	September	-	-	-	-	8.60	100.0	8.60
	October	-	-	-	-	14.10	100.0	14.10
	TOTAL	-	-	-	-	96.62	$\bar{X}$=100.0	96.62
11. pangkulabutan (squid trap)	January, 1992	-	-	-	-	2.50	100.0	2.50
	February	-	-	-	-	-	-	-
	March	-	-	-	-	1.27	100.0	1.27
	April	-	-	-	-	-	-	-
	May	-	-	-	-	-	-	-
	June	-	-	-	-	-	-	-
	July	-	-	-	-	-	-	-
	August	-	-	-	-	3.70	100.0	3.70
	September	-	-	-	-	-	-	-
	October	-	-	-	-	-	-	-
	TOTAL	-	-	-	-	7.47	$\bar{X}$=100.0	7.74
12. pasol (hook & line)	January, 1992	-	-	-	-	-	-	-
	February	-	-	-	-	-	-	-
	March	-	-	-	-	-	-	-
	April	9.75	74.71	0.80	6.13	2.50	19.16	13.05
	May	-	-	-	-	-	-	-
	June	11.60	94.31	0.0	0.0	0.70	5.69	12.30
	July	26.07	100.0	0.0	0.0	0.0	0.0	26.07
	August	3.26	100.0	0.0	0.0	0.0	0.0	3.26
	September	2.50	100.0	0.0	0.0	0.0	0.0	2.50
	October	12.90	100.0	0.0	0.0	0.0	0.0	12.90
	TOTAL	66.08	$\bar{X}$=94.84	0.80	$\bar{X}$=1.02	3.20	$\bar{X}$=4.14	70.08

Table 5. (Continued)

Gear Type and Fishing Techniques	Month	Fish Weight (kg)	Fish % Comp	Crustaceans Weight (kg)	Crustaceans % Comp	Mollusks Weight (kg)	Mollusks % Comp	TOTAL Weight (kg)
13. panginhas (gleaning)	January, 1992	-	-	1.16	0.15	755.63	99.85	756.79
	February	-	-	0.40	0.10	379.32	99.90	379.72
	March	-	-	2.00	0.49	401.81	99.51	403.81
	April	-	-	0.0	0.0	292.79	100.0	292.79
	May	-	-	0.0	0.0	62.20	100.0	62.20
	June	-	-	0.0	0.0	66.93	100.0	63.93
	July	-	-	5.00	3.18	152.27	96.82	157.27
	August	-	-	2.00	1.45	135.76	98.55	137.76
	September	-	-	0.0	0.0	98.16	100.0	98.16
	October	-	-	0.0	0.0	192.03	100.0	192.03
	TOTAL	-	-	10.56	$\bar{X}$=0.54	2,53 6.90	$\bar{X}$=9 9.46	2,547.46
14. sahid (beach seine)	January, 1992	83.17	66.57	6.26	5.01	35.50	28.42	124.93
	February	394.36	90.17	3.52	0.81	39.45	9.02	437.53
	March	153.55	82.66	2.40	1.30	29.80	16.04	185.75
	April	129.86	71.09	7.50	4.11	45.31	24.80	182.67
	May	432.47	81.81	25.02	4.73	71.16	13.46	528.65
	June	298.70	71.98	33.15	7.98	83.15	20.04	415.00
	July	483.98	73.22	57.73	8.73	119.35	18.05	661.06
	August	309.27	62.76	46.70	9.51	136.19	27.73	492.16
	September	337.95	72.10	34.32	7.32	96.45	20.58	468.72
	October	387.37	64.45	62.97	10.48	150.66	25.07	601.00
	TOTAL	3,0 10.68	$\bar{X}$=7 3.68	279.57	$\bar{X}$=6.00	807.02	$\bar{X}$=2 0.32	4,097.27
15. sabinet (fish net)	Jan., 1992	7.00	100.0	0.0	0.0	0.0	0.0	7.00
	February	16.86	95.58	0.50	2.83	0.28	1.59	17.64
	March	18.62	100.0	0.0	0.0	0.0	0.0	18.62
	April	9.50	100.0	0.0	0.0	0.0	0.0	9.50
	May	3.00	100.0	0.0	0.0	0.0	0.0	3.00
	June	1.90	100.0	0.0	0.0	0.0	0.0	1.90
	July	27.00	100.0	0.0	0.0	0.0	0.0	27.00
	August	16.10	100.0	0.0	0.0	0.0	0.0	16.10
	September	1.50	100.0	0.0	0.0	0.0	0.0	1.50
	October	5.00	100.0	0.0	0.0	0.0	0.0	5.00
	TOTAL	106.48	$\bar{X}$=9 9.56	0.50	$\bar{X}$=0.28	0.28	$\bar{X}$=0.16	107.26
16. sibot (dip net)	Jan., 1992	0.0	0.0	9.00	100.0	-	-	9.00
	February	9.50	100.0	0.0	0.0	-	-	9.50
	March	8.30	100.0	0.0	0.0	-	-	8.30
	April	3.50	100.0	0.0	0.0	-	-	3.50
	May	5.50	100.0	0.0	0.0	-	-	5.50
	June	3.00	100.0	0.0	0.0	-	-	3.00
	July	6.60	100.0	0.0	0.0	-	-	6.60
	August	-	-	-	-	-	-	-
	September	-	-	-	-	-	-	-
	October	-	-	-	-	-	-	-
	TOTAL	36.40	$\bar{X}$=8 5.71	9.00	$\bar{X}$=1 4.29	-	-	45.40

Table 5. (Continued)

Gear Type and Fishing Techniques	Month	Fish Weight (kg)	Fish % Comp	Crustaceans Weight (kg)	Crustaceans % Comp	Mollusks Weight (kg)	Mollusks % Comp	TOTAL Weight (kg)
17. sikpaw	Jan., 1992	2.40	100.0	-	-	0.0	0.0	2.40
	February	3.10	100.0	-	-	0.0	0.0	3.10
	March	4.30	100.0	-	-	0.0	0.0	4.30
	April	3.40	58.62	-	-	2.40	41.38	5.80
	May	-	-	-	-	-	-	-
	June	-	-	-	-	-	-	-
	July	4.10	100.0	-	-	0.0	0.0	4.10
	August	-	-	-	-	-	-	-
	September	-	-	-	-	-	-	-
	October	-	-	-	-	-	-	-
	TOTAL	17.30	$\bar{X}$=9 1.72	-	-	2.40	$\bar{X}$=8.28	19.70
18. sulo (torch)	Jan., 1992	2.80	27.18	7.5	72.82	0.0	0.0	10.30
	February	6.50	20.63	25.00	79.37	0.0	0.0	31.50
	March	8.00	39.41	7.30	35.96	5.00	24.63	20.30
	April	9.70	29.48	13.20	40.12	10.00	30.40	32.90
	May	4.50	14.38	20.60	65.81	6.20	19.81	31.30
	June	2.90	5.42	41.70	77.94	8.90	16.64	53.50
	July	45.10	52.26	21.60	25.03	19.60	22.71	86.30
	August	9.90	18.50	14.40	26.92	29.20	54.58	53.50
	September	8.50	18.68	14.80	32.53	22.20	48.79	45.50
	October	5.80	7.80	46.30	62.50	22.00	29.70	74.10
	TOTAL	103.70	$\bar{X}$=2 3.37	212.40	$\bar{X}$=5 1.90	123.10	$\bar{X}$=2 4.73	439.20
19. sikop (barehands)	Jan., 1992	31.70	74.24	11.00	25.76	0.0	0.0	42.70
	February	33.71	58.38	0.0	0.0	24.03	41.62	57.74
	March	62.72	32.16	0.78	0.40	131.50	67.44	195.00
	April	209.20	80.52	19.10	7.35	31.50	12.13	259.80
	May	87.25	43.93	1.10	0.55	110.30	55.52	198.65
	June	48.40	39.48	2.20	1.79	72.00	58.73	122.60
	July	184.00	98.66	0.50	0.27	2.00	1.07	186.50
	August	4.85	3.43	0.0	0.0	136.42	96.57	141.27
	September	1.00	0.76	0.0	0.0	129.90	99.24	130.90
	October	2.65	2.39	0.70	0.63	107.33	96.98	110.68
	TOTAL	665.48	$\bar{X}$=4 3.40	35.38	$\bar{X}$=3.67	744.98	$\bar{X}$=5 2.93	1,44 5.84
20. tapsay (mullet net)	Jan., 1992	122.81	100.0	-	-	0.0	0.0	122.81
	February	55.95	100.0	-	-	0.0	0.0	55.95
	March	55.30	100.0	-	-	0.0	0.0	55.30
	April	71.10	99.30	-	-	0.50	0.70	71.60
	May	47.00	100.0	-	-	0.0	0.0	47.00
	June	58.50	100.0	-	-	0.0	0.0	58.50
	July	112.03	100.0	-	-	0.0	0.0	112.03
	August	44.75	100.0	-	-	0.0	0.0	44.75
	September	37.75	100.0	-	-	0.0	0.0	37.75
	October	45.50	100.0	-	-	0.0	0.0	45.50
	TOTAL	650.69	$\bar{X}$=9 9.93	-	-	0.50	$\bar{X}$=0.07	651.19

Table 5. (Continued)

Gear Type and Fishing Techniques	Month	Fish		Crustaceans		Mollusks		TOTAL
		Weight (kg)	% Comp	Weight (kg)	% Comp	Weight (kg)	% Comp	Weight (kg)
21. target/sabay (fish net)	Jan., 1992	91.53	99.68	0.0	0.0	0.29	0.32	91.82
	February	119.50	99.22	0.0	0.0	0.94	0.78	120.44
	March	98.09	94.57	0.58	0.56	5.05	4.87	103.72
	April	160.20	100.0	0.0	0.0	0.0	0.0	160.20
	May	50.84	100.0	0.0	0.0	0.0	0.0	50.84
	June	44.22	100.0	0.0	0.0	0.0	0.0	44.22
	July	118.00	100.0	0.0	0.0	0.0	0.0	118.00
	August	28.10	100.0	0.0	0.0	0.0	0.0	28.10
	September	25.40	100.0	0.0	0.0	0.0	0.0	25.40
	October	17.70	99.83	0.0	0.0	0.03	0.17	17.73
	TOTAL	753.58	X=9 9.33	0.58	X=0.06	6.31	X=0.61	760.47

Table 6. Composition and volume of gastropod and pelecypod harvest monitored from January to October 1992.

Local Name	Species	Volume (kg)	%	Fishing Technique
1. litub	*Anadara* sp.	4172.0	33.7	panginhas (cultured in Dawis)
2. lucot	*Dolabella auricularia* eggs	2048.9	16.5	sikop, sulo, pukot, bunsod, target, sabinet, sahid, & panginhas
3. punao	Venerid clam	1828.0	14.8	cultured in Dawis
4. tahong	*Modiolus metcalfei*	1485.5	12.0	cultured in Dawis
5. talaba	*Crassostrea* sp.	1432.5	11.6	cultured in Dawis and in Hindungawan
6. aninikad	*Strombus urceus*	606.0	4.9	panginhas
7. lampirong/tipay	*Placuna placenta*	321.5	2.6	pukot, hulbot,sahid & panginhas
8. embao	*Phacoides philippinarum*	129.9	1.1	panginhas
9. punyete	Venerid clam	112.0	0.9	panginhas
10.sulod-sulod	*Vepricardium* sp.	69.2	0.6	panginhas
11.bungkawel	*Strombus canarium*	59.7	0.5	pukot, sikop, sulo, pana
12.dalu-dalu	*Terebralia* sp.	26.0	0.2	panginhas
13.pesos-pesos	*Circe scripta*	22.5	0.2	panginhas
14.piyong-piyong	*Anadara* sp.	22.0	0.2	panginhas
15.bisala	*Grafrarium tumidum*	14.9	0.1	panginhas
16.talab	*Atrina* sp.	14.1	0.1	pana & sikop
17.sisi	*Crassostrea cucullata*	5.8		sikop & panginhas
18.sangka-sangka	*Murex* sp.	3.5		pukot & panginhas
19.bug-atan	*Periglypta* sp.	3.4		panginhas
20.bilong	*Melo* sp.	3.4		panginhas & sikop
21.kandiis	*Tapes litterata*	2.4		panginhas
22.bulok-bulok	*Mactra* sp.	2.3		panginhas
23.tandok-tandok	*Trochus* sp.	1.8		panginhas & sikop
24.kibol	*Voluta* sp.	1.0		sulo
25.kapinan	*Haliotis* sp.	1.0		sulo
26.tikod-tikod	*Pitar citrina*	0.3		panginhas
	TOTAL	12,389.6	100.0	

Table 7. Volume of seashells cultured in Dawis, Canlargo from January to October 1992.

Species	Volume (kg)										
	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	TOTAL
Talaba	440.0	112.5	175.0	—	—	—	—	15.0	315.0	180.0	1237.5
Tahong	27.0	96.0	181.5	40.0	—	—	90.0	660.0	175.0	60.0	1329.5
Litub	889.0	1032.0	1313.0	242.0	172.5	—	60.0	42.0	249.0	140.0	4132.5
Punao	1157.0	237.0	215.5	32.0	34.0	—	23.0	35.0	29.0	—	1762.5
TOTAL	2513.0	1477.5	1885.0	314.0	206.5	—	173.0	752.0	768.0	380.0	8462.0

Table 8. Income in pesos from seashells cultured in Dawis, Canlargo from January to October 1992.

Species	Volume (kg)										
1992	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	TOTAL
Talaba	1173.30	300.00	466.65	—	—	—	—	40.00	840.00	480.00	3,299.95
Tahong	54.00	192.00	544.50	120.00	—	—	270.00	1980.00	525.00	120.00	3,805.50
Litub	1778.00	2050.00	2626.00	484.00	345.00	—	120.00	84.00	498.00	280.00	8,265.00
Punao	6942.00	1185.00	1293.00	192.00	204.00	—	138.00	210.00	174.00	—	10,338.00
TOTAL	9,947.30	3,727.15	4,930.15	796.00	549.00	—	528.00	2,314.00	2,037.00	880.00	25,708.45

Table 9. Estimated total catch by fishing gear in Bais Bay from January-December 1992.

Gear	# gears	Catch/trip/gear (kg)	Average # trips/mo.	Total # of trips/year (12 months)	Total Catch (kg)
1. bubo (fish trap)	12	1.85	15	180	3,996.0
2. bunsod (fish corral)	205	3.62	15	180	133,578.0
3. handok (Muro-ami)	2	7.57	10	120	1,816.8
4. hulbot (modified Danish seine)	45	8.28	25	300	111,780.0
5. katay (multiple H & L)	31	2.68	15	180	14,954.4
6. pana (speargun)	71	3.21	20	240	54,698.4
7. panggal (crab pot)	2439	0.05	25	300	36,585.0
8. pangkulabutan (squid trap)	3	1.87	10	120	673.2
9. pangnokos (squid jigger)	17	0.86	10	120	1,754.4
10.pasol(hook&line)	192	1.98	10	120	45,619.2
11.pukot (gill net)	408	3.60	25	300	440,640.0
12.sabinet (fish net)	5	5.20	10	120	3,120.0
13.sahid (beach seine)	49	5.73	25	300	84,231.0
14.sibot (dip net)	2	2.23	10	120	535.2
15.sikpaw (dip net)	3	1.60	10	120	576.0
16.tapsay (mullet net)	7	4.27	25	300	8,967.0
17.target/sabay (fish net)	8	4.19	20	240	8,044.8
TOTAL					951,549.4

Table 10. Catch per unit effort (CPUE) in kg/trip for each gear type and fishing technique used in Bais Bay.

1992		January		February		March		April		May	
A. Fishing Gear											
Rank	Geartype	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
1.	hulbot (modified Danish seine)	7.74±1.46	2	6.80±1.83	2	6.92±0.21	2	6.09±0.7	2	7.05±4.31	2
2.	handok (muro-ami)	—		7.15	1	6.04	1	6.90	1	—	
3.	sahid (beach seine)	6.97±3.76	7	6.67±2.81	4	5.32±3.66	3	4.68±2.63	4	7.57±1.78	4
4.	sabinet (fish net)	3.50±2.12	2	2.03±0.29	2	2.87±2.08	3	2.63±2.30	2	3.0	1
5.	tapsay (mullet net)	10.02±6.1	2	4.47±2.17	2	2.51	1	6.29±4.81	2	3.20±0.28	2
6.	target/sabay (fish net)	4.14±1.05	2	3.69±2.26	2	5.30±4.49	2	6.30±7.62	2	4.70±4.31	2
7.	bunsod (fish corral)	3.41±1.57	10	2.75±1.05	10	2.38±0.79	8	3.03±0.97	7	3.99±1.29	8
8.	pukot (gill net)	2.71±1.35	12	3.83±2.76	12	2.59±1.08	10	4.69±2.81	7	3.35±1.53	8
9.	pana (spear)	2.88±0.82	4	3.57±1.77	3	2.49±2.0	4	2.58±0.3	5	3.50±1.22	4
10.	katay (multiple hook and line)	2.75	1	3.22	1	3.38	1	2.67	1	2.04	1
11.	sibot (dip net)	2.25	1	1.58	1	2.08	1	1.75	1	2.75	1
12.	pasol (hook & line)	—		—		—		2.18±0.60	2	—	
13.	pangkulabutan (squid trap)	2.50	1	—		1.27	1	—		—	
14.	bubo (fish trap)	—		—		- —		- —		- —	
15.	sikpaw (dip net)	1.20	1	1.55	1	1.43	1	1.77±0.90	2	—	
16	pangnokos (squid jigger)	1.33±0.81	3	0.68±0.28	2	0.84±0.72	2	0.86±0.51	2	0.83±0.53	2
17.	panggal (crab pot)	0.53±0.02	3	0.06±0.01	3	0.04±0.01	3	0.004±0.01	3	0.06±0.03	4
Mean CPUE for all geartypes		3.71		3.43		3.03		3.49		3.5	
B.											
Rank	Fishing Techniques										
1.	gango (miracle hole)	4.05±0.23	2	3.76±1.75	2	4.33	1	2.40	1	2.10±0.14	2
2.	panginhas (gleaning)	7.29±9.05	8	7.79±7.81	5	4.52±2.23	7	5.87±5.53	6	2.22±0.56	3
3.	sikop (use of barehands)	2.55±0.91	3	2.58±2.92	3	2.32±1.20	3	2.39±1.30	5	3.43	1
4.	sulo (torch)	3.45	1	3.50	1	1.45	1	5.88±0.54	2	1.49	1
Mean CPUE for all fishing techniques		4.34		4.41		3.16		4.14		2.31	

Table 10. (Continued)

June		July		August		September		October		AVERAGE
Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	
8.33±2.0	2	11.49±1.85	3	9.13±3.01	2	10.27±2.50	2	8.98±5.38	2	8.28±1.70
—		10.00	1	—		8.80	1	6.53	1	7.57±1.51
6.63±3.14	4	5.38±3.06	4	5.75±1.45	4	3.63±2.34	3	4.93±2.20	5	5.73±1.19
1.90	1	13.50	1	16.1	1	1.50	1	5.00	1	5.20±5.19
4.18	1	3.45±0.74	2	2.98	1	2.55	1	3.03	1	4.27±2.32
3.86±2.43	2	4.00±1.37	2	4.93±2.93	2	2.97	1	1.97	1	4.19±1.22
5.11±4.39	9	4.02±2.01	9	3.91±2.03	9	3.67±1.94	10	3.92±2.09	9	3.62±0.77
3.42±1.61	10	4.32±2.78	14	4.08±2.29	14	3.89±1.69	13	3.13±1.30	11	3.60±0.68
2.90±1.34	5	3.77±2.18	4	3.78±1.51	4	3.47±1.17	6	3.17±1.42	4	3.21±0.48
2.10	1	2.88	1	3.13	1	2.8	1	1.82	1	2.68±0.53
3.00	1	2.20	1	—		—		—		2.23±0.51
2.29±2.24	2	4.12	1	1.18	1	0.83	1	1.29	1	1.98±1.20
—		—		1.85	1	—		—		1.87±0.62
- —		- —		- —		1.51	1	2.19±0.35	2	1.85±0.48
—		2.05	1	—		—		—		1.60±0.33
0.73±0.32	2	1.05±0.66	3	0.79±0.3	2	0.57	1	0.88	1	0.86±0.21
0.05±0.03	5	0.06±0.03	4	0.05±0.01	5	0.05±0.01	5	0.09±0.12	5	0.05±0.02
3.42		4.82		4.44		3.32		3.35		3.65
7.83	1	4.50	1	4.09±0.13	2	3.38±0.60	2	9.00	1	4.54±2.20
3.72±1.67	3	4.04±2.50	3	5.38±3.10	3	4.90±3.74	2	3.53±2.22	3	4.93±1.72
3.83	1	2.88±1.73	2	4.32	1	5.36	1	3.16±2.56	2	3.28±0.98
2.82	1	2.78	1	1.62±1.24	3	1.02	1	0.32	1	2.43±1.61
4.55		3.55		3.85		3.67		4.0		3.8

Table 11. Income (in pesos) per trip per gear and fishing techniques of fishermen in Bais Bay from January to October 1992.

A.	Fishing Gear	Jan.	Feb.	Mar.	Apr.	May	June
1.	hulbot (modified Danish seine)	197.76	180.22	175.14	174.92	259.16	232.4
2.	handok (muro-ami)	-	229.88	144.74	237.56	-	-
3.	sahid (beach seine)	132.87	235.76	143	144.4	198.82	172.08
4.	sabinet (fish net)	35	49.91	41.02	91.67	35	24
5.	tapsay (mullet net)	195.91	90.3	79.32	109.03	105.18	91.75
6.	target/sabay (fish net)	98.18	132.14	88.81	220.55	95.94	128.2
7.	bunsod (fish corral)	103.26	73.29	86.31	116.91	115.97	109.96
8.	pukot (gill net)	122.56	96.33	122.48	122.4	102.06	106.73
9.	pana (spear)	100.44	122.2	70.2	85.88	75.29	72.29
10.	katay (multiple hook and line)	173.5	98.17	103.89	94.66	75.37	77.9
11.	sibot (dip net)	33.75	24.39	18.73	28	33.75	40
12.	pasol (hook & line)	-	-	-	84.11	-	112.5
13.	pangkulabutan (squid trap)	89.83	-	46.04	-	-	-
14.	bubo (fish trap)	-	-	-	-	-	-
15.	sikpaw (dip net)	16	28.5	32.08	31.88	-	-
16.	pangnokos (squid jigger)	66.76	39.64	20.63	34	25	23.9
17.	panggal (crab pot)	1.62	2.12	4.16	1.24	1.12	1.93
	Mean income per trip per gear for all geartypes	97.67	100.2	78.44	105.15	93.56	91.82
B.	Fishing technique						
1.	gango (miracle hole)	138.44	106.94	162.67	66	77.22	227.67
2.	panginhas (gleaning)	32.99	22.85	24.71	34.55	21.4	35.09
3.	sikop (use of barehands)	76.26	25.82	44.62	60.57	44.04	45.2
4.	sulo (torch)	40.83	79.77	38.56	24.94	69.46	52.75
	Mean income per trip per gear for all fishing techniques	72.13	58.85	67.64	46.52	53.03	90.18

Table 11. Continued

A.	Fishing Gear	July	Aug	Sept.	Oct.	Average	Range
1.	hulbot (modified Danish seine)	164.82	184.12	229.39	235	203.29±32.77	164.82-259.16
2.	handok (muro-ami)	270	-	264.2	169.81	219.37±51.07	144.74-270
3.	sahid (beach seine)	234.69	148.89	126.88	143.49	168.09±40.93	126.88-235.76
4.	sabinet (fish net)	47.25	192.5	12.5	60	58.89±51.61	12.5 -192.5
5.	tapsay (mullet net)	63.68	55.54	45.34	50.7	88.68±43.88	45.34-195.91
6.	target/sabay (fish net)	149.42	127.73	66.82	49.35	115.71±48.21	49.35-220.55
7.	bunsod (fish corral)	101.24	98.23	88.29	107.7	100.11±13.96	73.29-116.91
8.	pukot (gill net)	116.86	185.76	226.36	101.17	130.27±42.19	96.33-226.36
9.	pana (spear)	113.31	67.05	74	83.62	86.43±19.22	67.05-122.2
10.	katay (multiple hook and line)	87.56	54.58	95.5	64.6	92.57±32.46	54.58-173.5
11.	sibot (dip net)	14.37	-	-	-	27.57± 9.0	14.37-40
12.	pasol (hook & line)	137.44	50.44	25.5	32.25	73.71±45.3	25.5 -137.44
13.	pangkulabutan (squid trap)	-	55.5	-	-	63.79±23.04	46.04-89.83
14.	bubo (fish trap)	-	-	30.01	41.8	35.91±8.34	30.01-41.80
15.	sikpaw (dip net)	10.25	-	-	-	23.64±9.95	10.25-32.08
16.	pangnokos (squid jigger)	36.58	32.73	28.67	44.06	35.20±13.29	20.63-66.76
17.	panggal (crab pot)	1.44	1.29	0.75	0.91	1.66±0.98	0.75-4.16
Mean income per trip per gear for all geartypes		103.26	96.49	93.87	94.51	89.7	78.44-105.15
B. Fishing technique							
1.	gango (miracle hole)	90	102.17	77.66	168	121.66±51.6	66-227.67
2.	panginhas (gleaning)	30.17	36.61	17.32	13.79	26.95±8.05	13.79-36.61
3.	sikop (use of barehands)	22.47	17.14	19.4	17.91	37.34±20.21	17.14-76.26
4.	sulo (torch)	62.51	38.27	39.36	12.47	45.89±20.45	12.47-79.77
Mean income per trip per gear for all fishing techniques		51.29	48.55	38.44	57.97	57.97	38.44-90.18

Table 12. Catch Per Unit Effort (CPUE) for each gear type used in Bais Bay, compared with other places.
Data on Bayawan, Bindoy, Bohol, Ronda and Siquijor taken from Luchavez, unpub. data. CPUE is in kg/trip.

	CPUE					
Gear Type	Bais Bay	Bindoy	Bayawan	Bohol	Ronda	Siquijor
Hulbot	8.25					
Sahid	5.73					
Tapsay	4.27					
Bunsod	3.62					
Pukot	3.60	11.4	7.0	7.8	27.3	14.4
Pana	3.21	5.0		4.7	4.5	3.1
Katay	2.68	5.7	9.4	5.5	6.1	
Pasol	1.98	8.9	4.2	5.9	11.2	3.5
Pangnokos	0.86					

Table 13. Total length (TL) in cm at sexual maturity of some important species harvested from Bais Bay from January to October 1992.
Values in parentheses are standard length (SL) in cm. The commonly caught sizes in Bais Bay and elsewhere are given and the maximum size recorded. Data on maximum size and common sizes caught elsewhere are taken from Rau and Rau (1980) and Schroeder (1980).

Species	Total length of fish with gonad stages				Reprod. Season
	I-VII		Sexually mature (V-VI)		
	Male	Female	Male	Female	
Siganus canaliculatus (danggit)	10.6-21.6 (8.3-16.4)	11.5-22.2 (8.5-16.5)	10.6-17.5 (8.3-13.0)	14.6-19.8 (11.0-15.0)	Jan-July
Terapon jarbua (buga-ong)	12.5-19.5 (10.0-15.0)	12.5-24.8 (10.0-19.0)	-	15.5-24.8 (11.6-19.0)	Feb-July
Liza sp. (gisaw)	12.0-24.0 (9.5-18.5)	11.5-24.8 (9.0-19.0)	16.8-19.2 (13.0-14.5)	15.7-22.8 (12.0-17.5)	Jan-July
Leiognathus splendens (danglay)	8.5-15.5 (6.5-11.5)	9.8-15.5 (7.5-11.5)	10.2-12.9 (7.5-9.0)	10.0-13.2 (7.2-9.5)	Jan-May,Jul
Gerres abbreviatus (bag-angan)	11.5-17.0 (8.5-12.5)	11.5-19.5 (8.5-15.0)	-	17.0-19.5 (12.5-15.0)	March, July
Gazza minuta (piampe)	8.5-13.0 (6.5-9.5)	8.5-16.5 (6.5-12.5)	11.3-13.0 (8.5-10.0)	11.0-16.5 (8.2-12.5)	Jan, Mar, May, Jun
Gerres filamentosus (samulok/lawihan)	10.5-16.5 (8.0-12.0)	9.5-19.0 (7.0-15.0)	-	14.9-15.4 (10.5-11.0)	Jan-March, June-July
Nemipterus sp. (lagaw)					
Gerres sp.(oyena) (kasbo)	8.0-14.5 (5.7-11.0)	8.0-16.5 (5.7-12.0)	14.5-16.5 (11.0-12.0)	-	Jan, Mar-Jun
Sardinella sp. (malangsi)	-	10.0-14.4 (8.0-11.5)	-	10.0-11.5 (8.0-9.0)	Jan, May June
Stolephorus sp. (bolinao)	6.5-8.6 (6.3-6.4)	7.1-8.6 (7.0-6.4)	7.4-8.0 (6.0-7.0)	7.7-8.3 (6.3-7.0)	January
Upeneus sulphureus (hinok)					

Table 13. (Continued)

Species	Maximum Length	Commonly Caught Size Bais Bay	Commonly Caught Size Elsewhere
Siganus canaliculatus (danggit)	20	8-18	10-15
Terapon jarbua (buga-ong)	30	12-20	15-20
Liza sp. (gisaw)	35	12-20	25
Leiognathus splendens (danglay)	14	7-13.5	6-12
Gerres abbreviatus (bag-angan)	23	12-18	12-16
Gazza minuta (piampe)	15	8-14	8
Gerres filamentosus (samulok/lawihan)	25	9-18	15
Nemipterus sp. (lagaw)	30	11-18.5	15-25
Gerres sp.(oyena) (kasbo)	25	8.0-14.5	15
Sardinella sp. (malangsi)	15	10-14	12
Stolephorus sp. (bolinao)	12	6-11	10
Upeneus sulphureus (hinok)	23	9-16.5	12-15

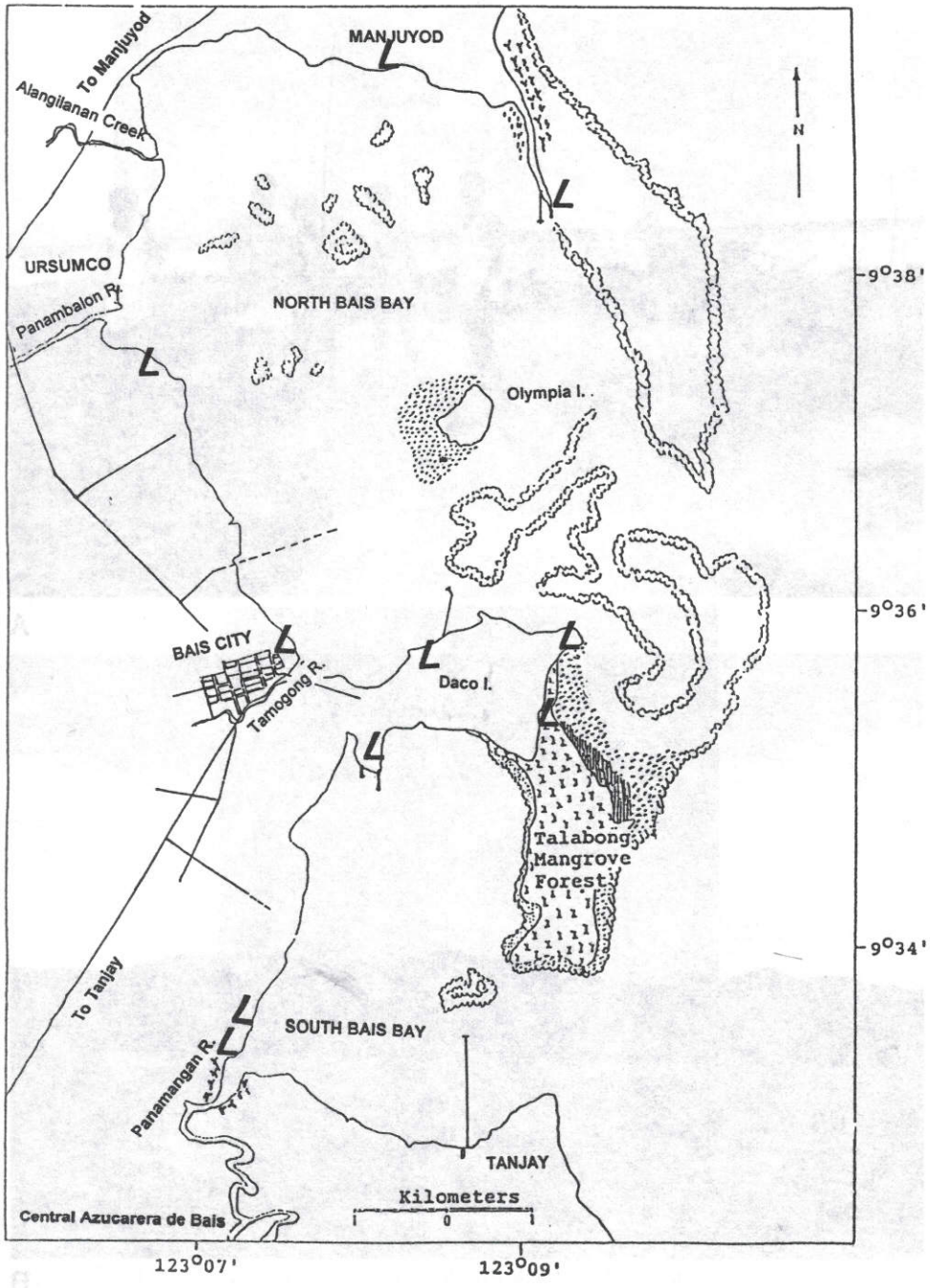
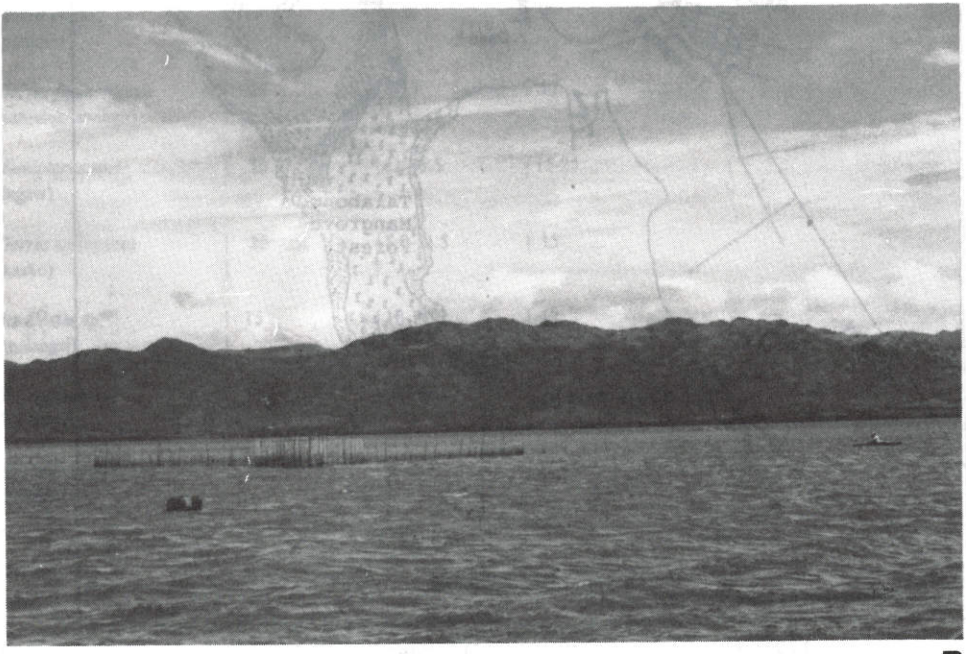


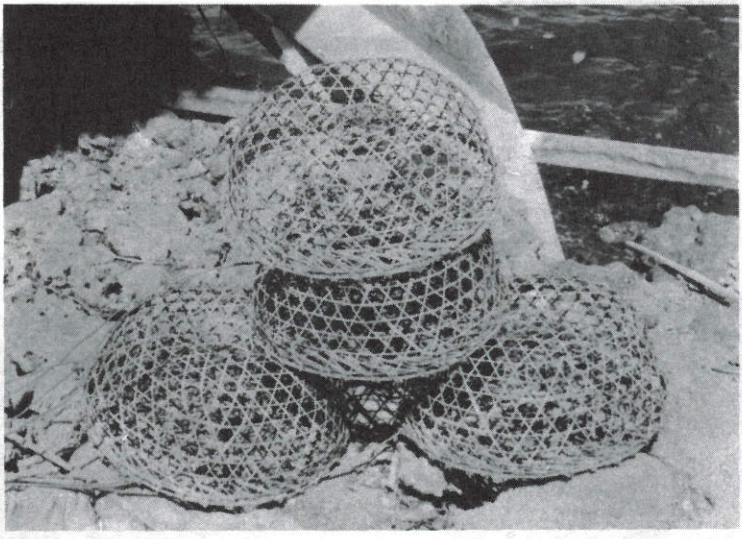
Figure 1. Map of Bais Bay showing fish landing sites.

A



B

Figure 2A-B. **Five major fishing gears used in Bais Bay.**
A. Gill net (Pukot) B. Fish corral (Bunsod)



C

D

Figure 2C-D. **Five major fishing gears used in Bais Bay.**
C. Crab Pot (Panggal)
D. Modified Danish Seine (Hulbot)

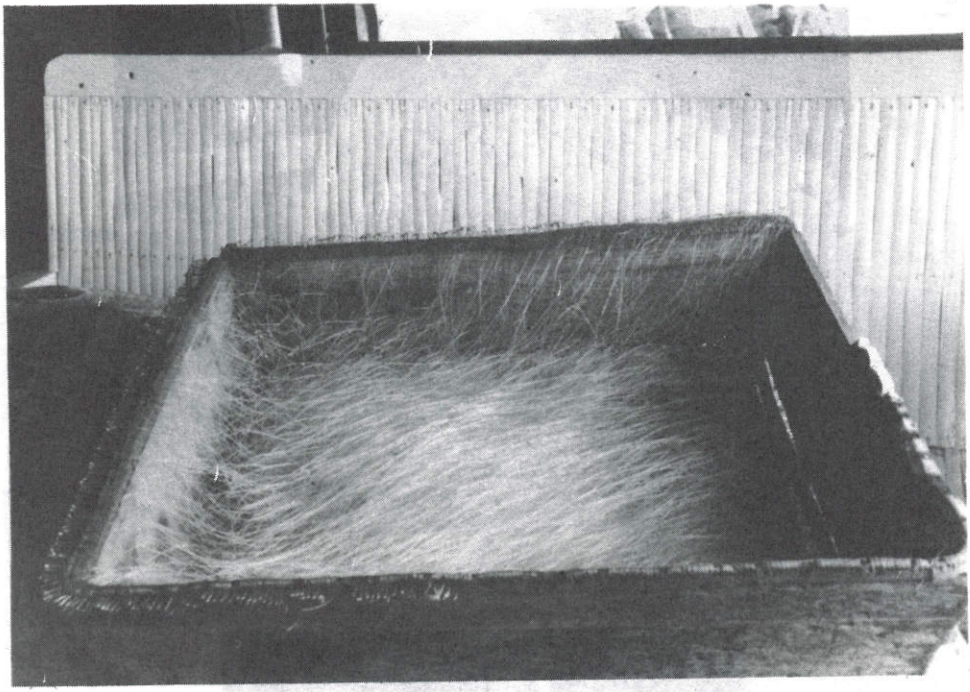


Figure 2E. Five major fishing gears used in Bais Bay.
E. Multiple Hook and Line (Katay)

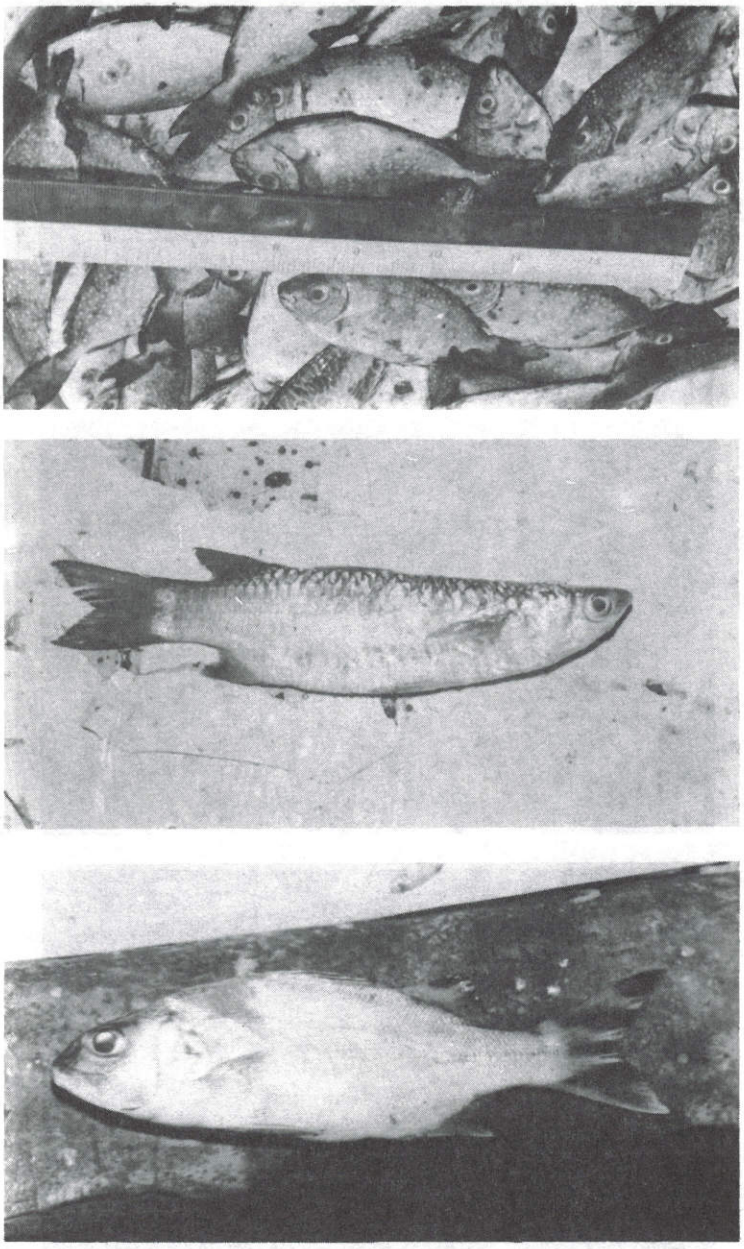
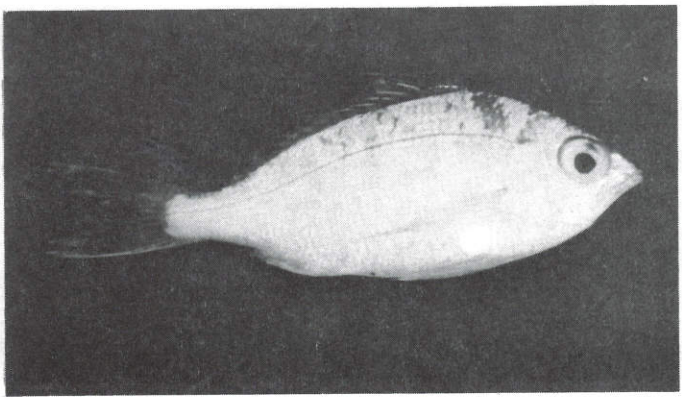


Figure 3A-C. **Six most abundant fish species caught in Bais Bay.**
A. *Siganus canaliculatus* (danggit)
B. *Liza* sp. (gisaw)
C. *Terapon jarbua* (buga-ong)

D

E



F

Figure 3D-F. **Six most abundant fish species caught in Bais Bay.**
D. *Sardinella* sp. (malangsi)
E. *Stolephorus* sp. (bolinao)
F. *Gerres* sp. (kasbo)

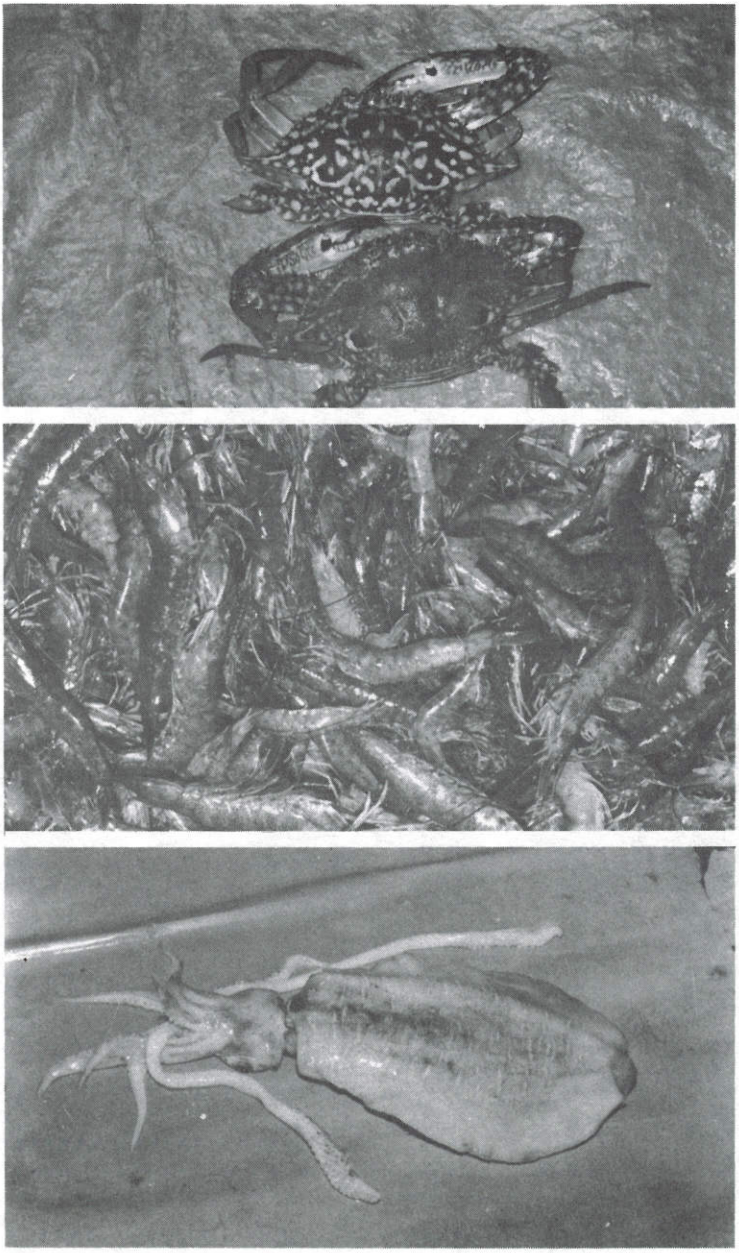


Figure 4A-C. Six most abundantly harvested species of invertebrates in Bais Bay.

A. *Portunus pelagicus* (lambay)

B. Penaeid shrimps (pasayan)

C. *Sepioteuthis* sp. (nokos)

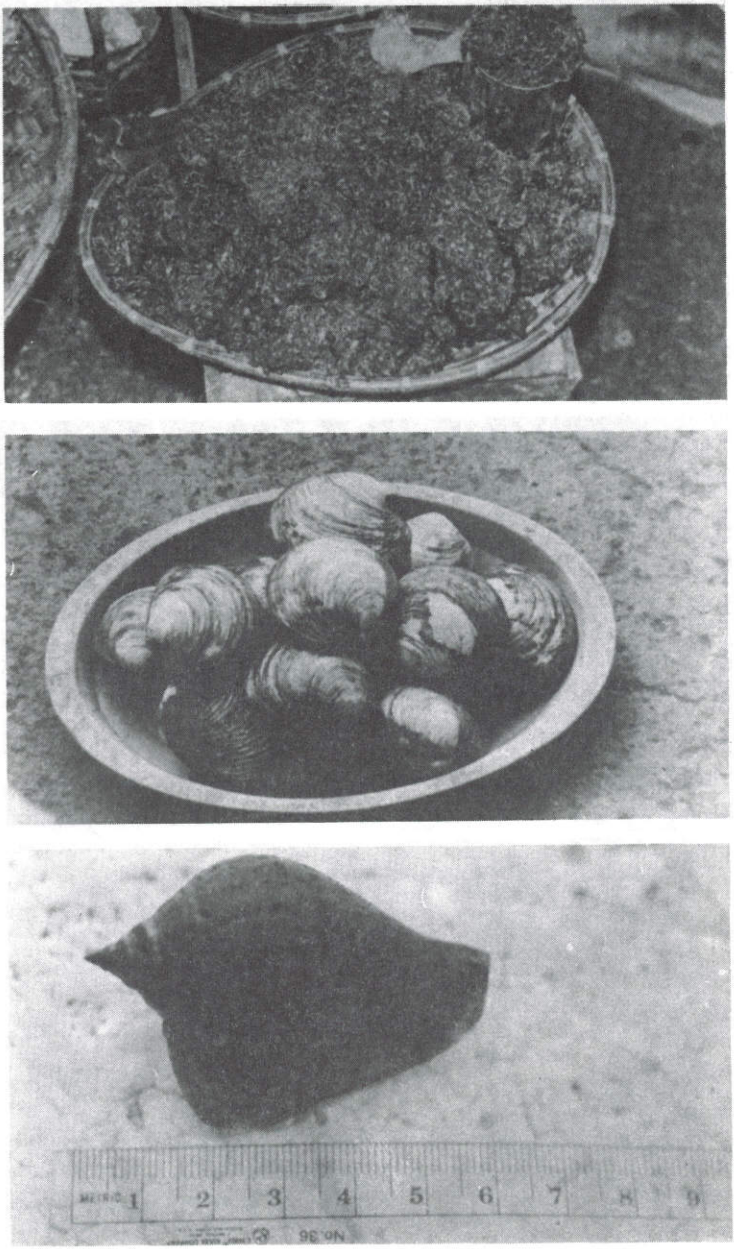
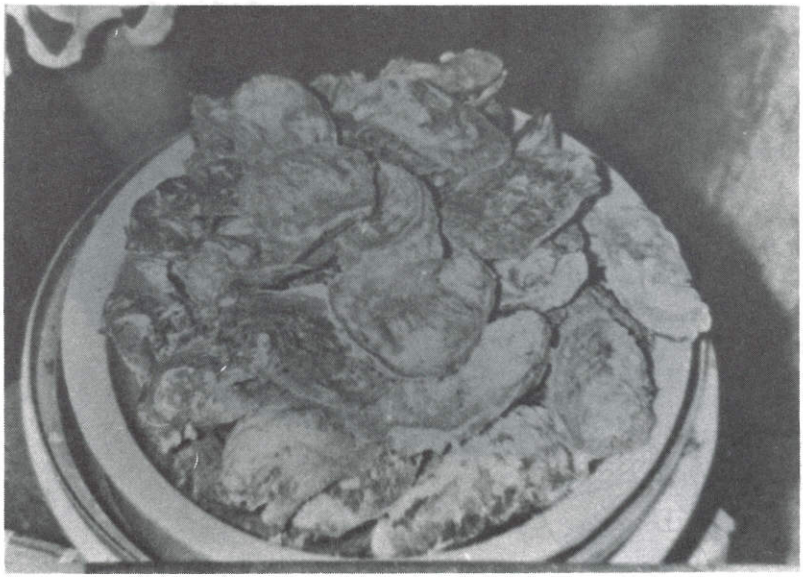


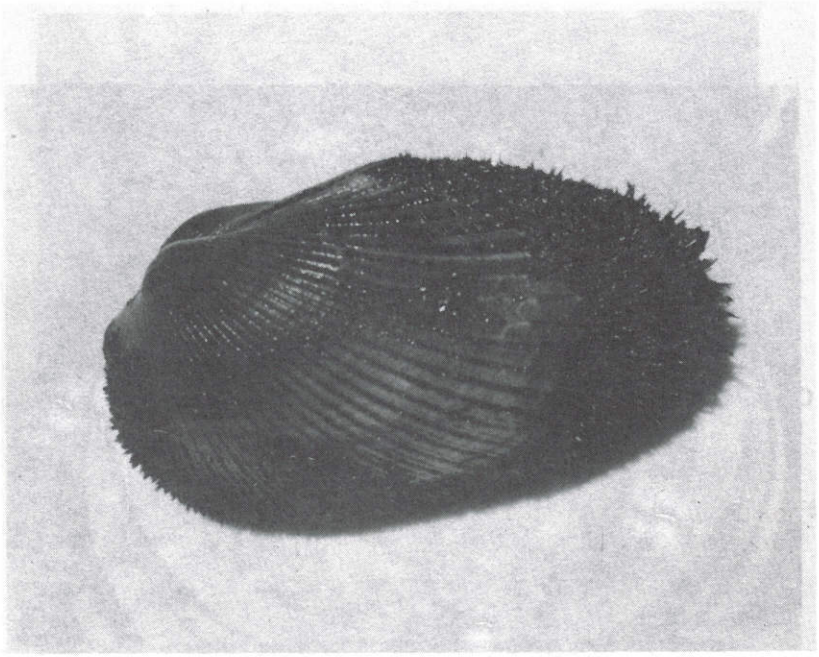
Figure 4D-F. Six most abundantly harvested species of invertebrates in Bais Bay.
D. *Dolabella auricularia* eggs (lukot)
E. *Phacoides philippinarum* (imbao)
F. *Strombus canarium* (bungkawel)



A

B

Figure 5A-B. Species of mollusks cultured in Bais Bay.
A. *Crassostrea* sp. (talaba)
B. *Modiolus metcalfei* (tahong)



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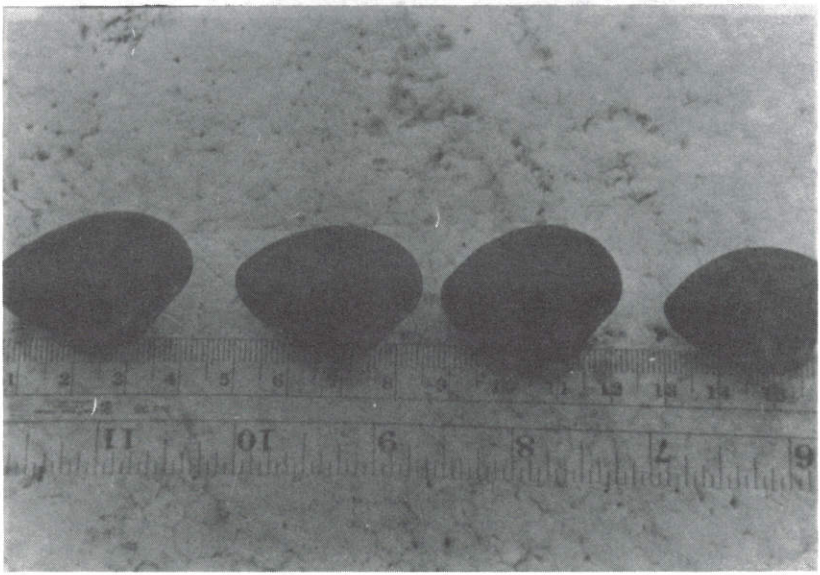


D

Figure 5C-D. Species of mollusks cultured in Bais Bay.
C. *Anadara* sp. (litub)
D. Venereid clam (punao)

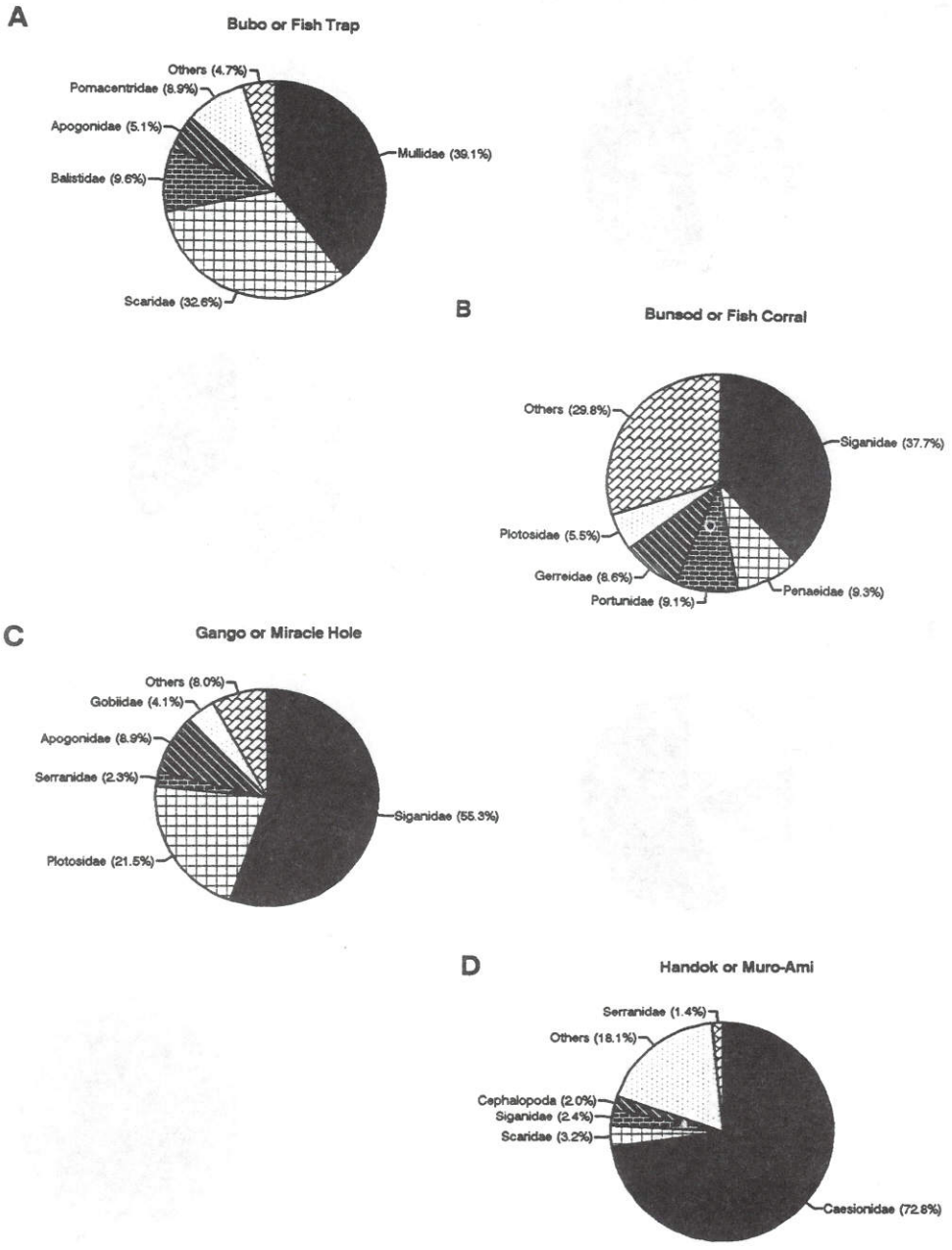


Figure 6A-D. Percentage composition of catches by gear and technique.

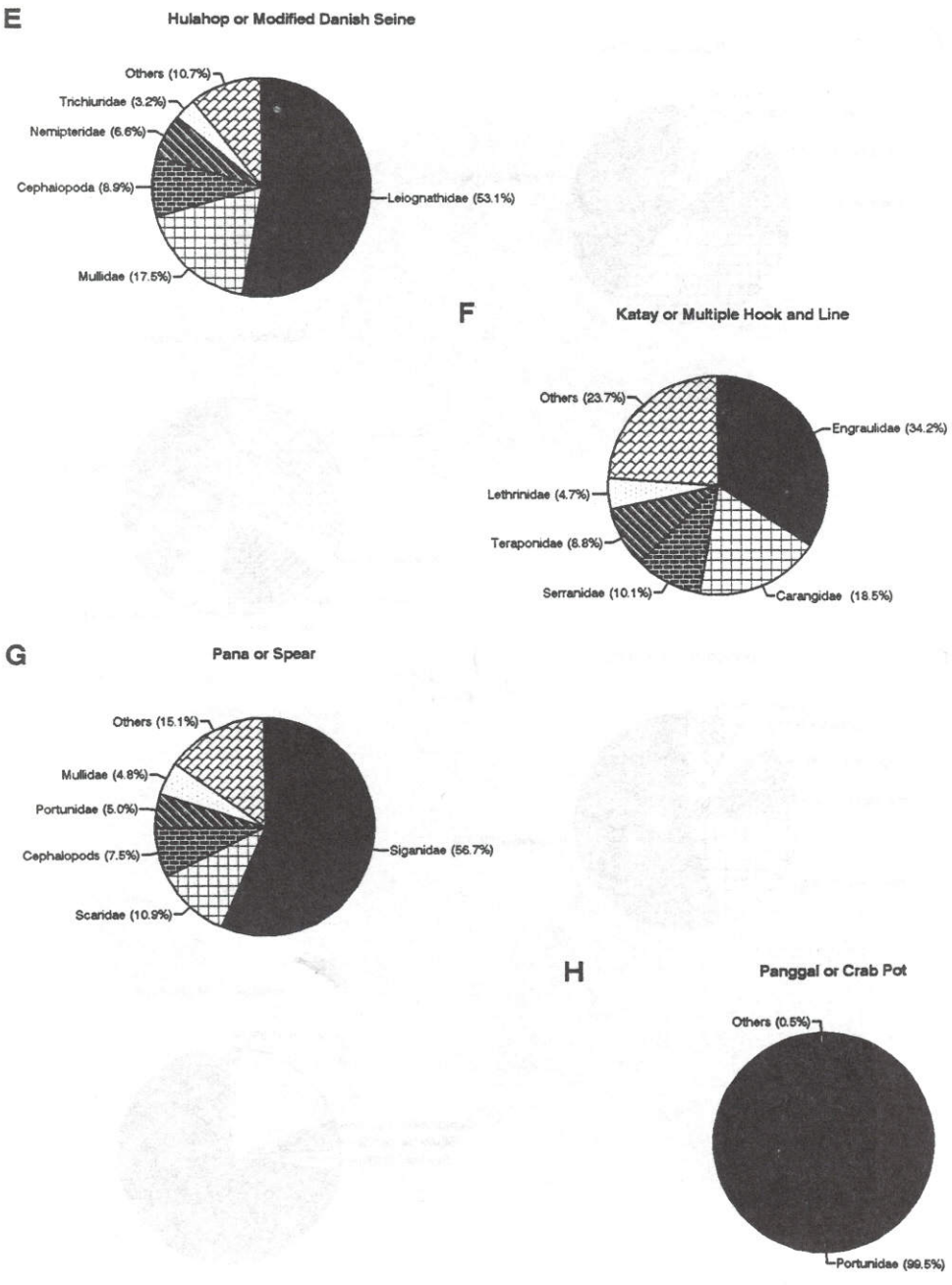


Figure 6E-H. Percentage composition of catches by gear and technique.

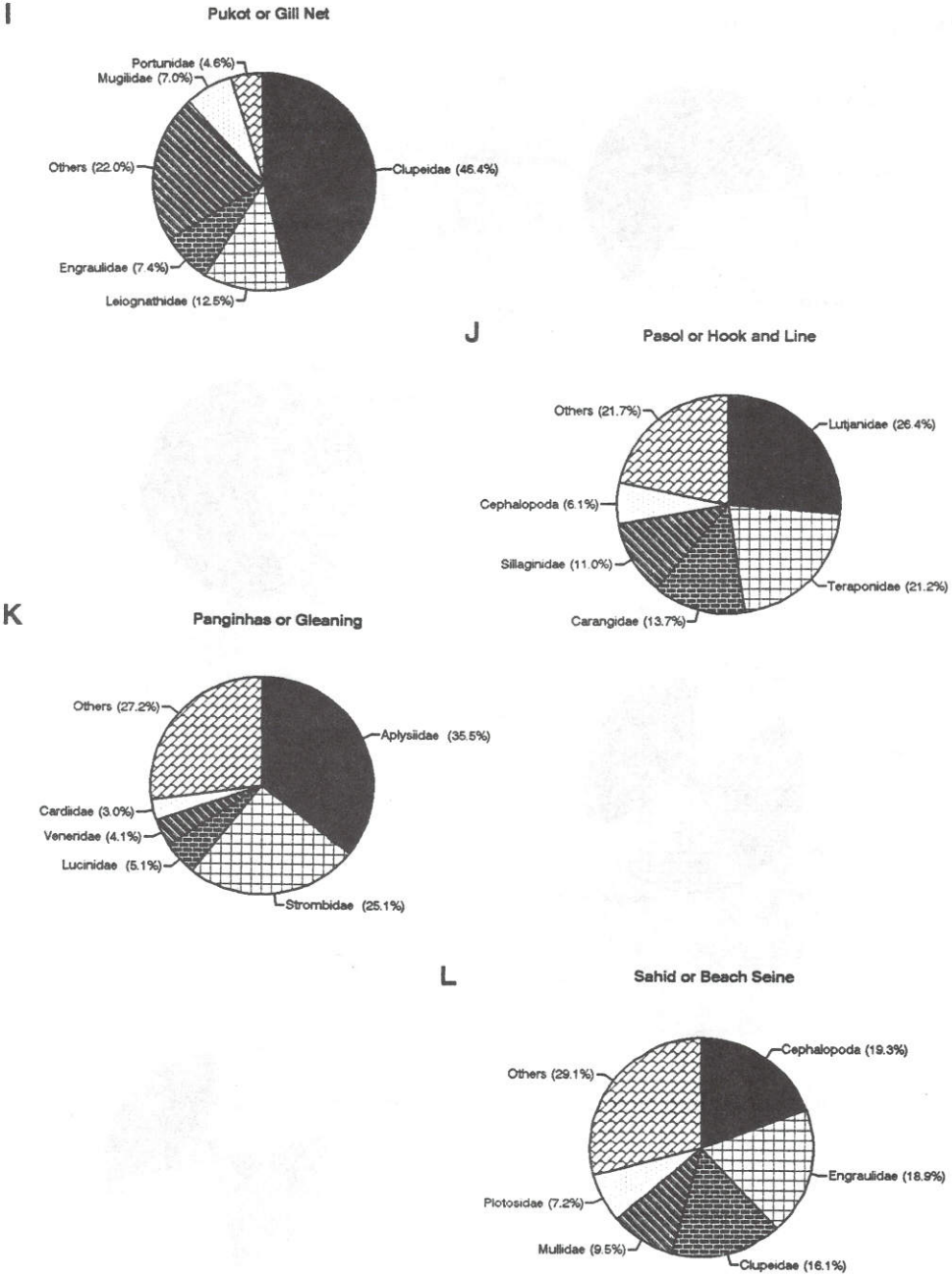
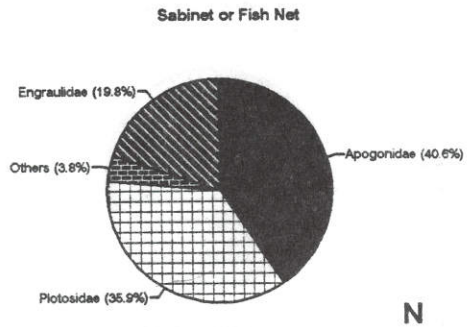


Figure 6I-L. **Percentage composition of catches by gear and technique.**

M



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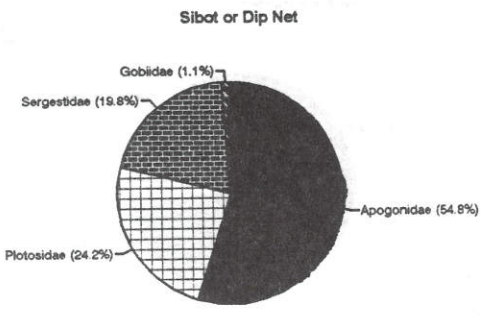

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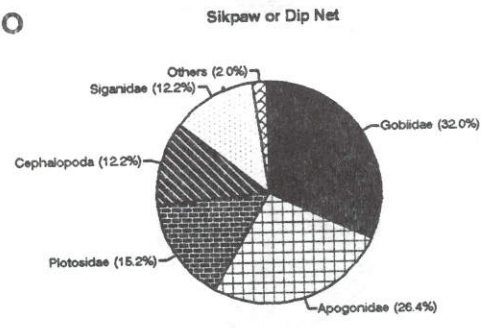


P

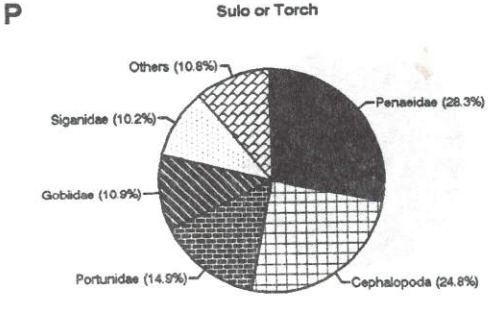


Figure 6M-P. Percentage composition of catches by gear and technique.

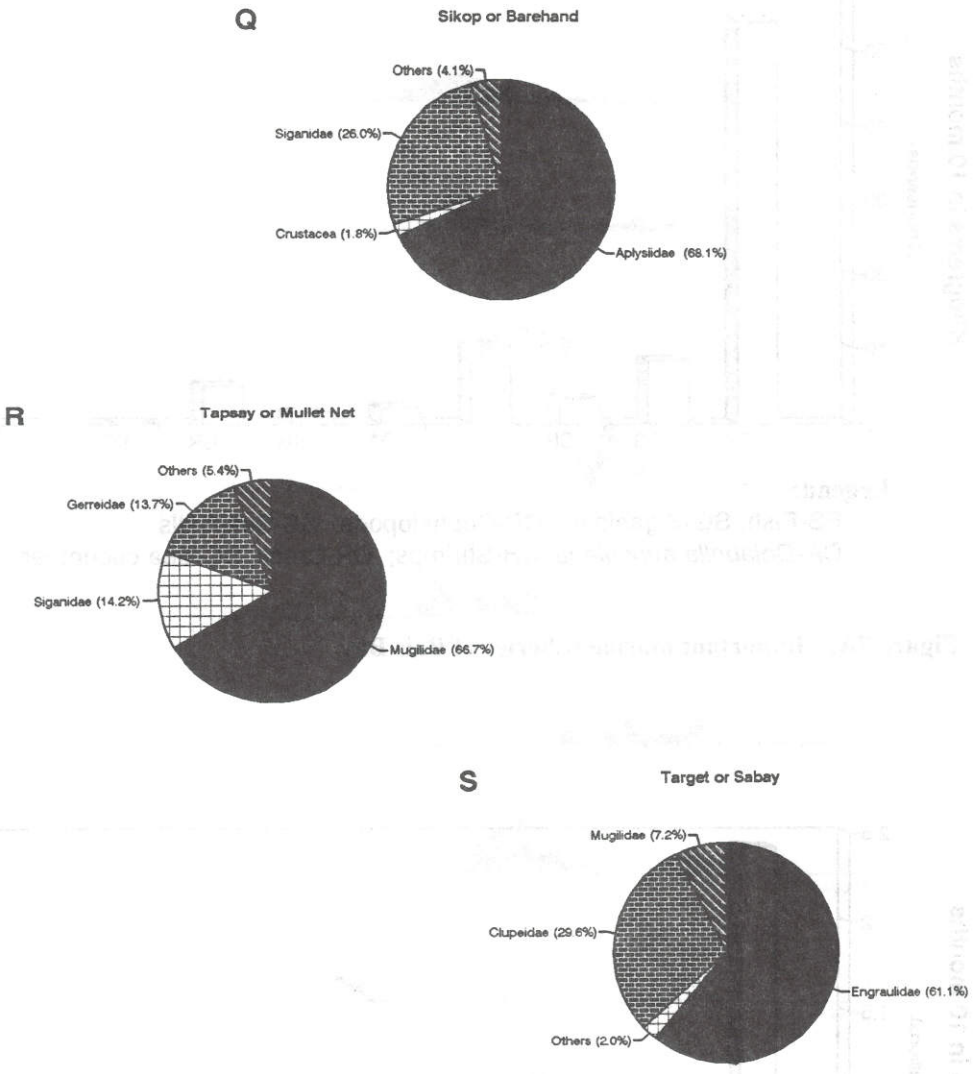
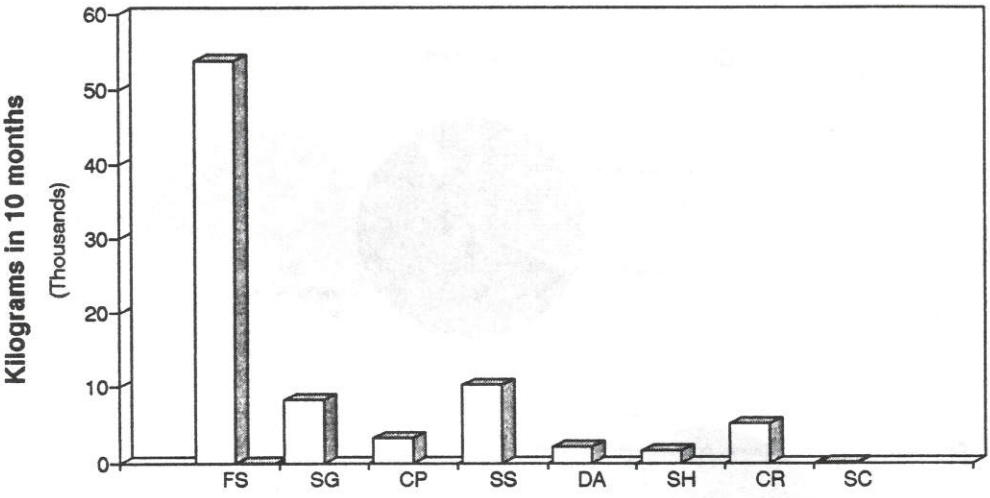


Figure 6Q-S. Percentage composition of catches by gear and technique.



Legend:

FS-Fish; SG-Siganidae; CP-Cephalopods; SS-Seashells
DA-*Dolabella auricularia*; SH-Shrimps; CR-Crabs; SC-Sea cucumber

Figure 7A. Important marine fisheries of Bais Bay.

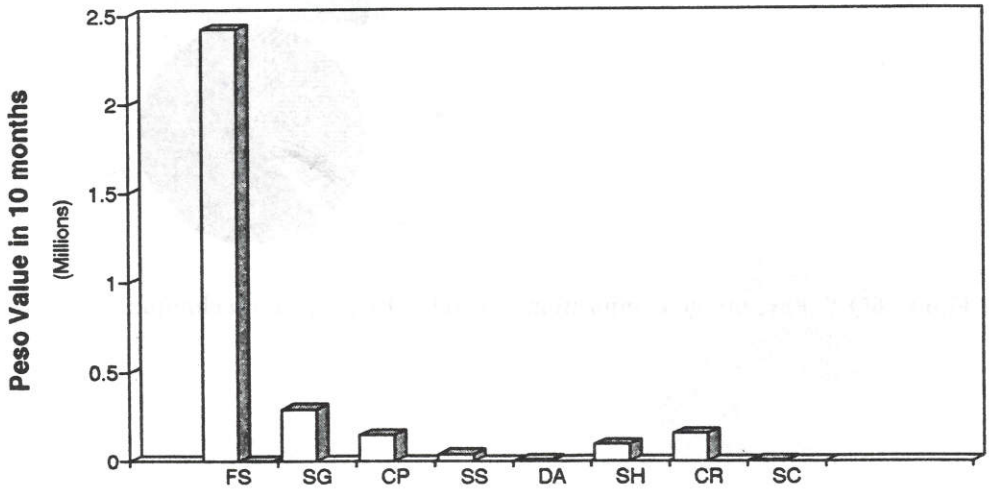


Figure 7B. Peso values of important fisheries in Bais Bay.

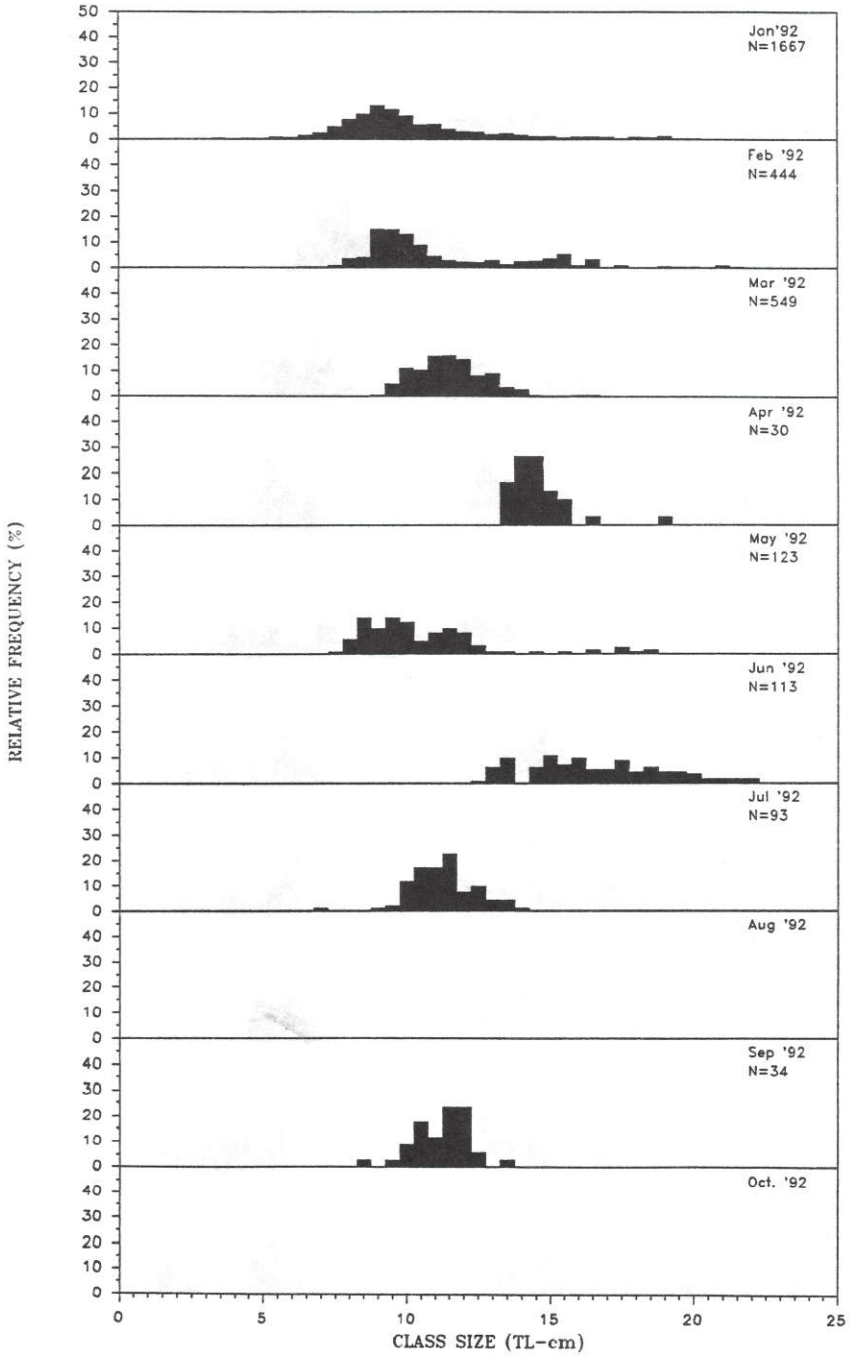


Figure 8A. Length frequency of *Siganus canaliculatus*

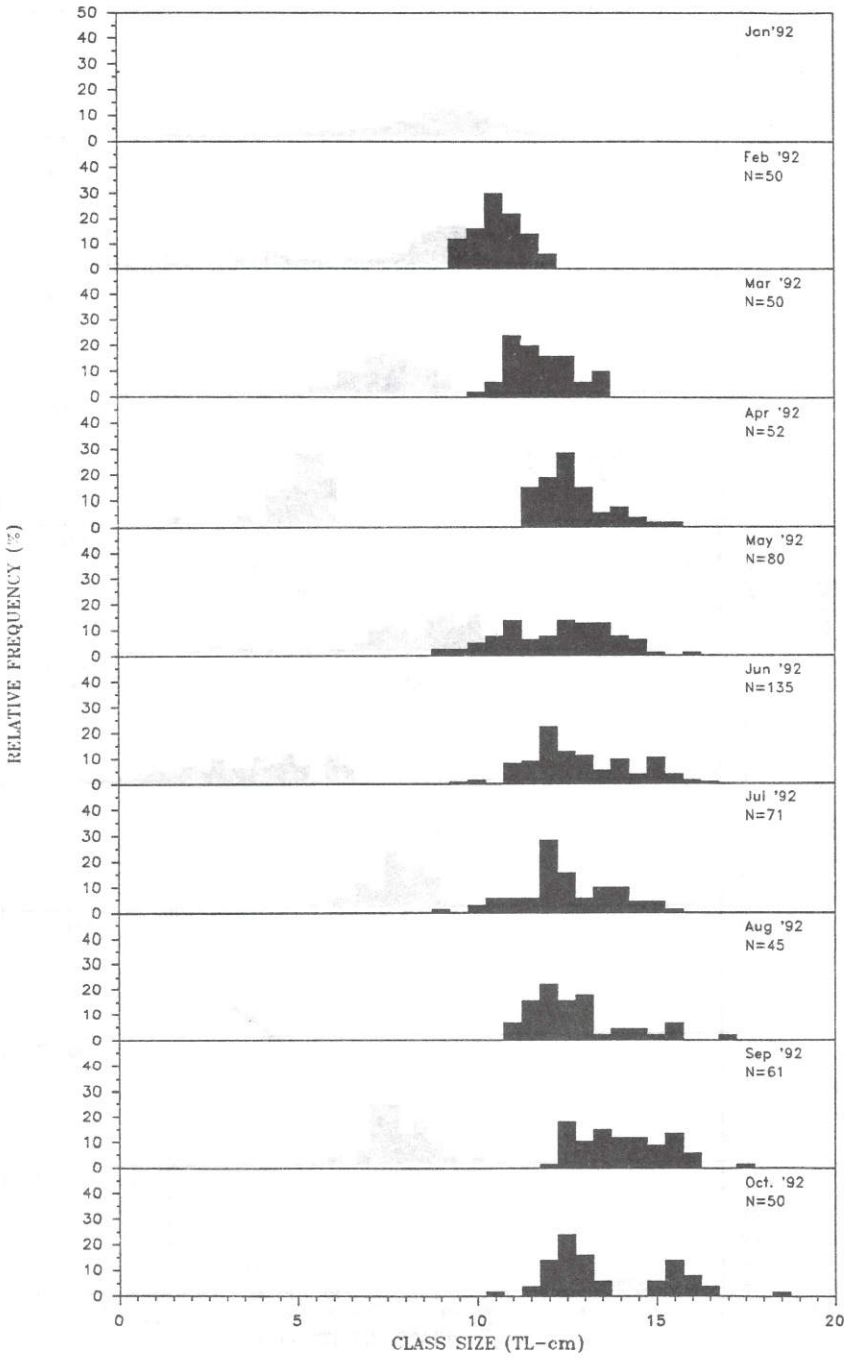


Figure 8B. Length frequency of *Upeneus sulphureus*

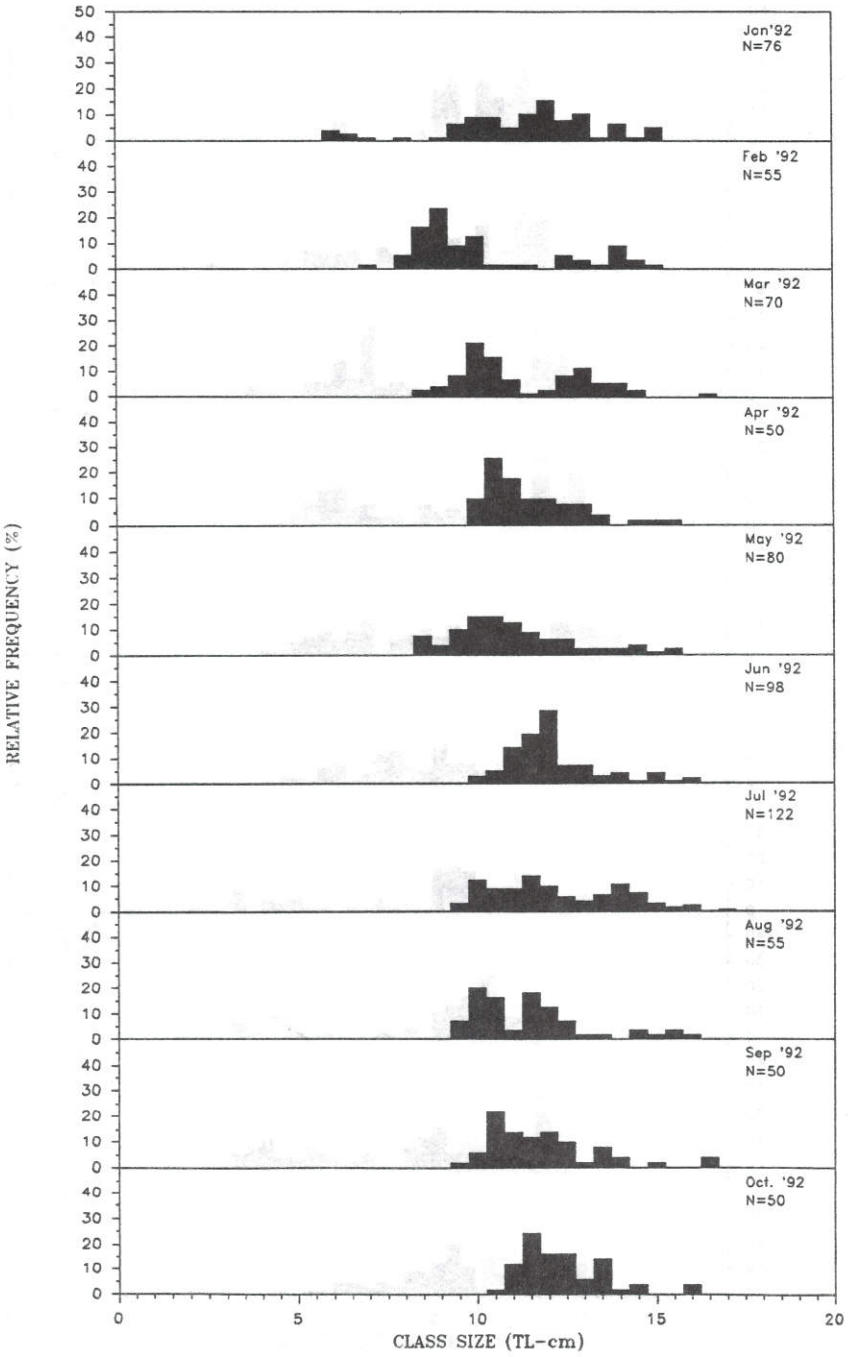


Figure 8C. Length frequency of *Gazza minuta*

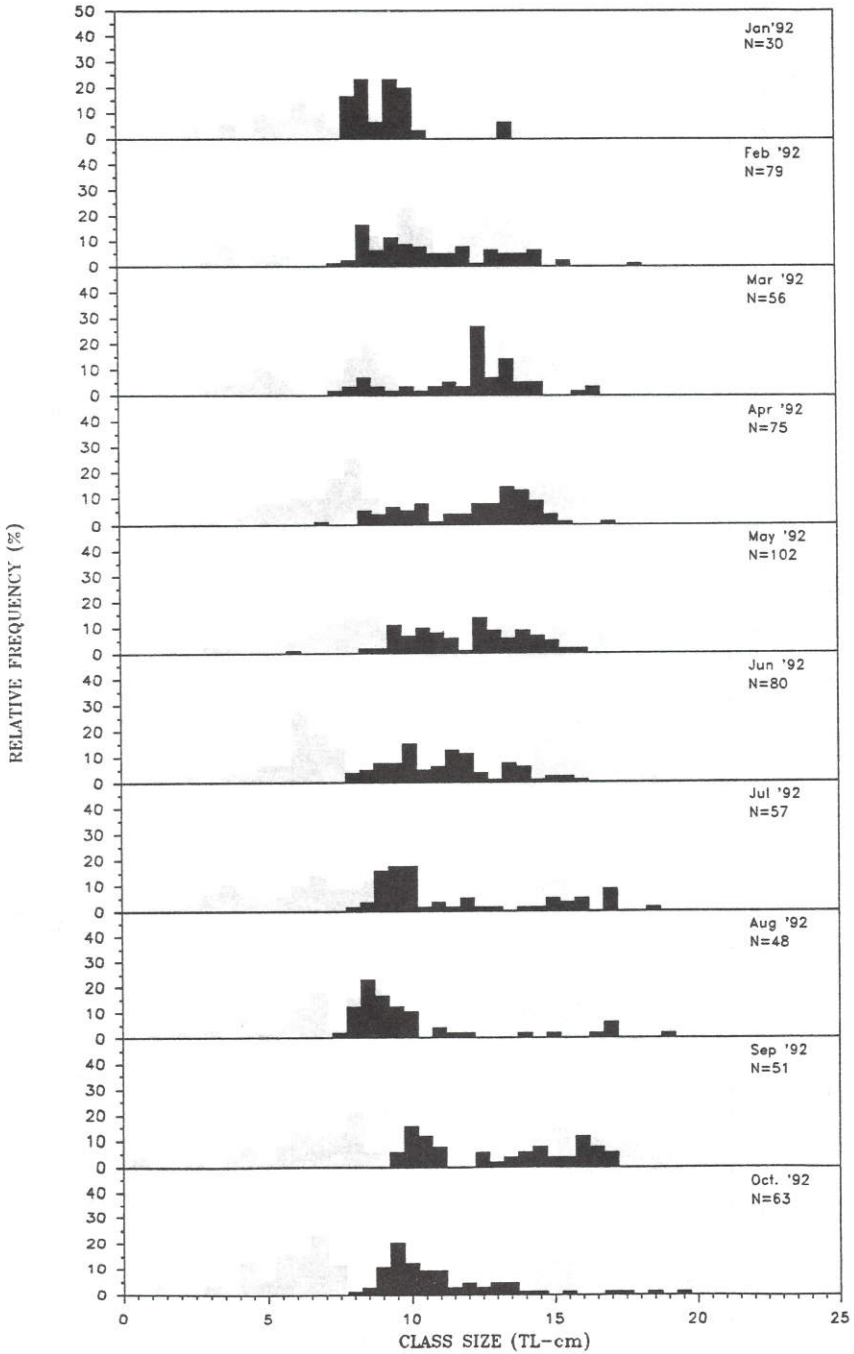


Figure 8D. Length frequency of *Gerres* sp.

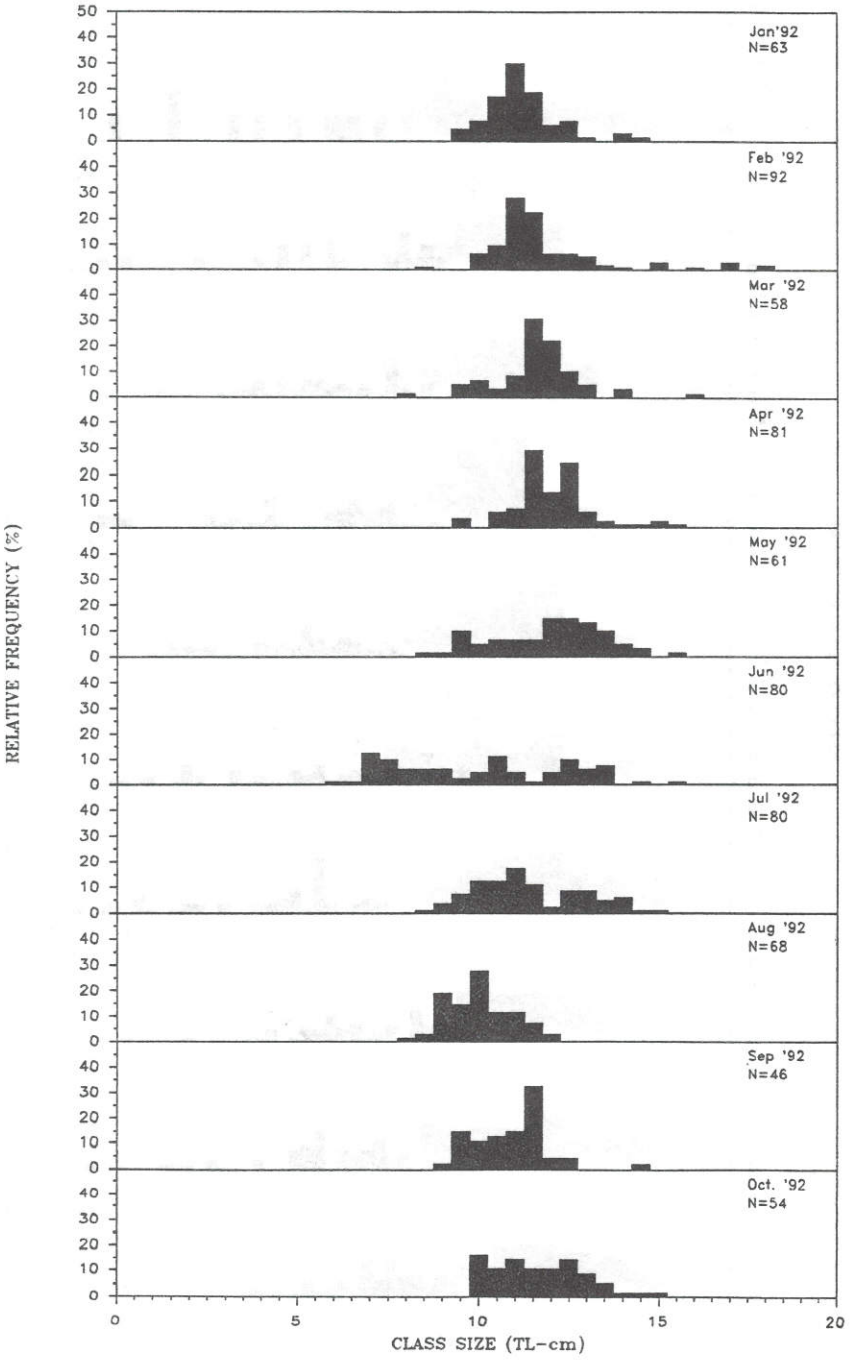


Figure 8E. Length frequency of *Leiognathus splendens*

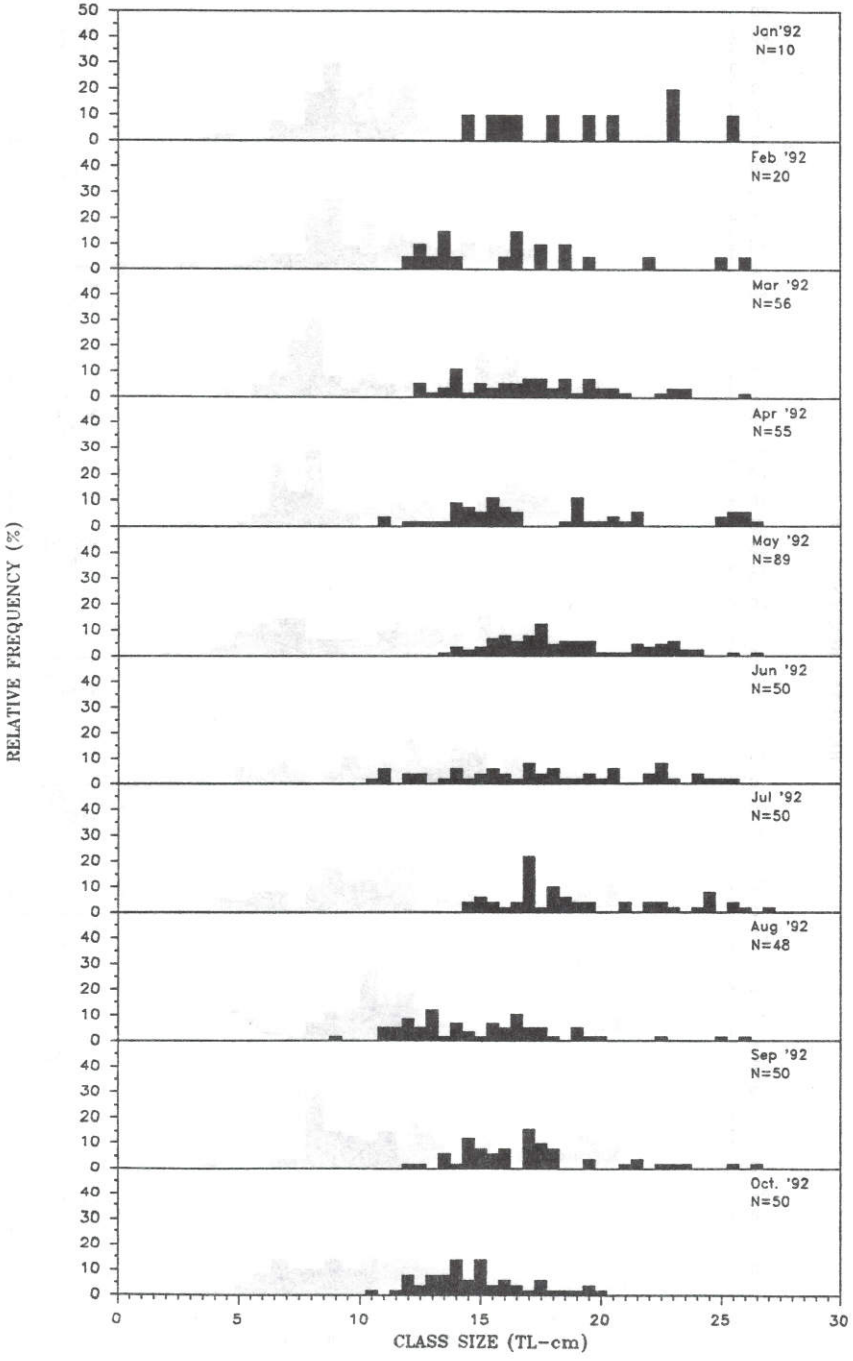


Figure 8F. Length frequency of *Nemipterus* sp.

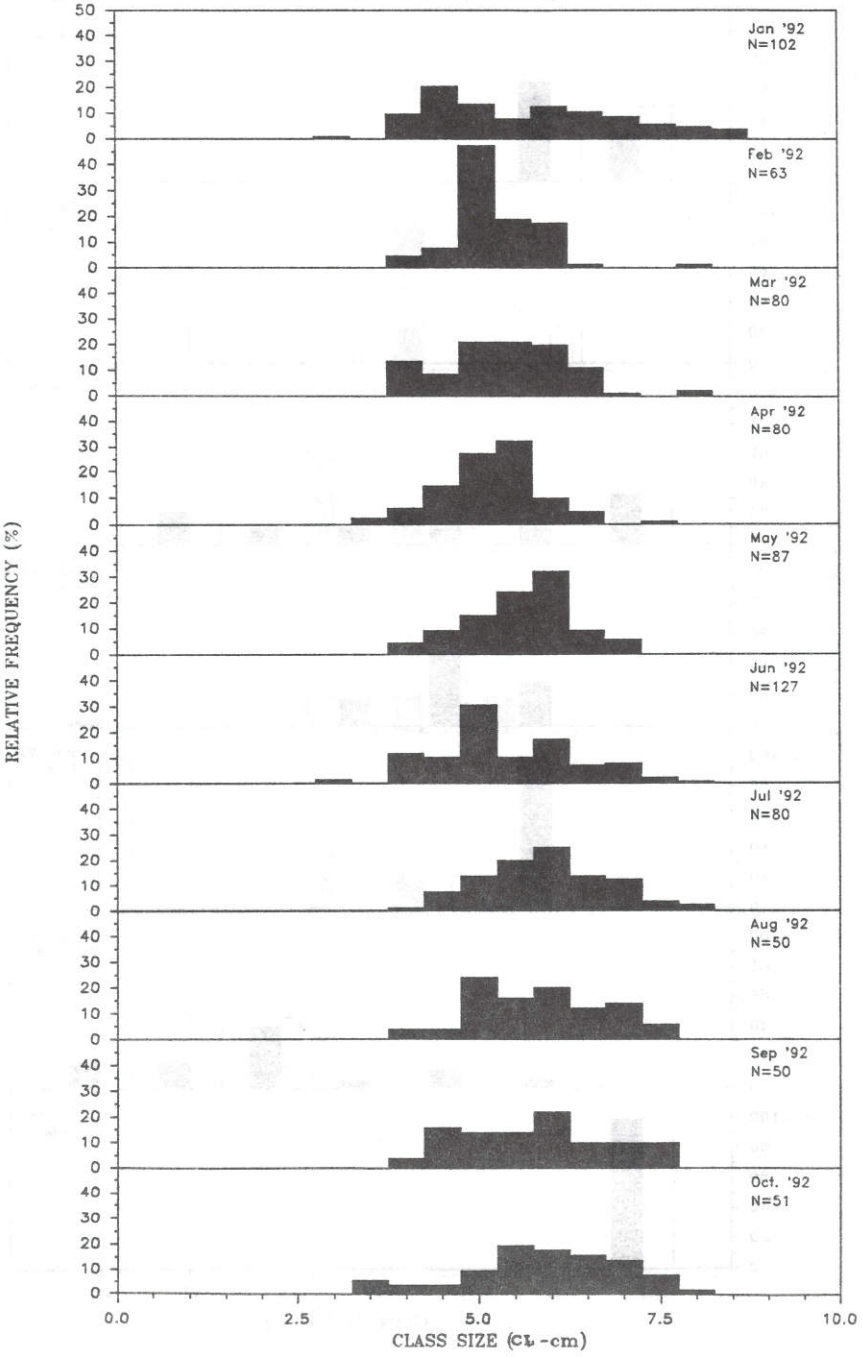


Figure 8G. Length frequency of *Portunus pelagicus*

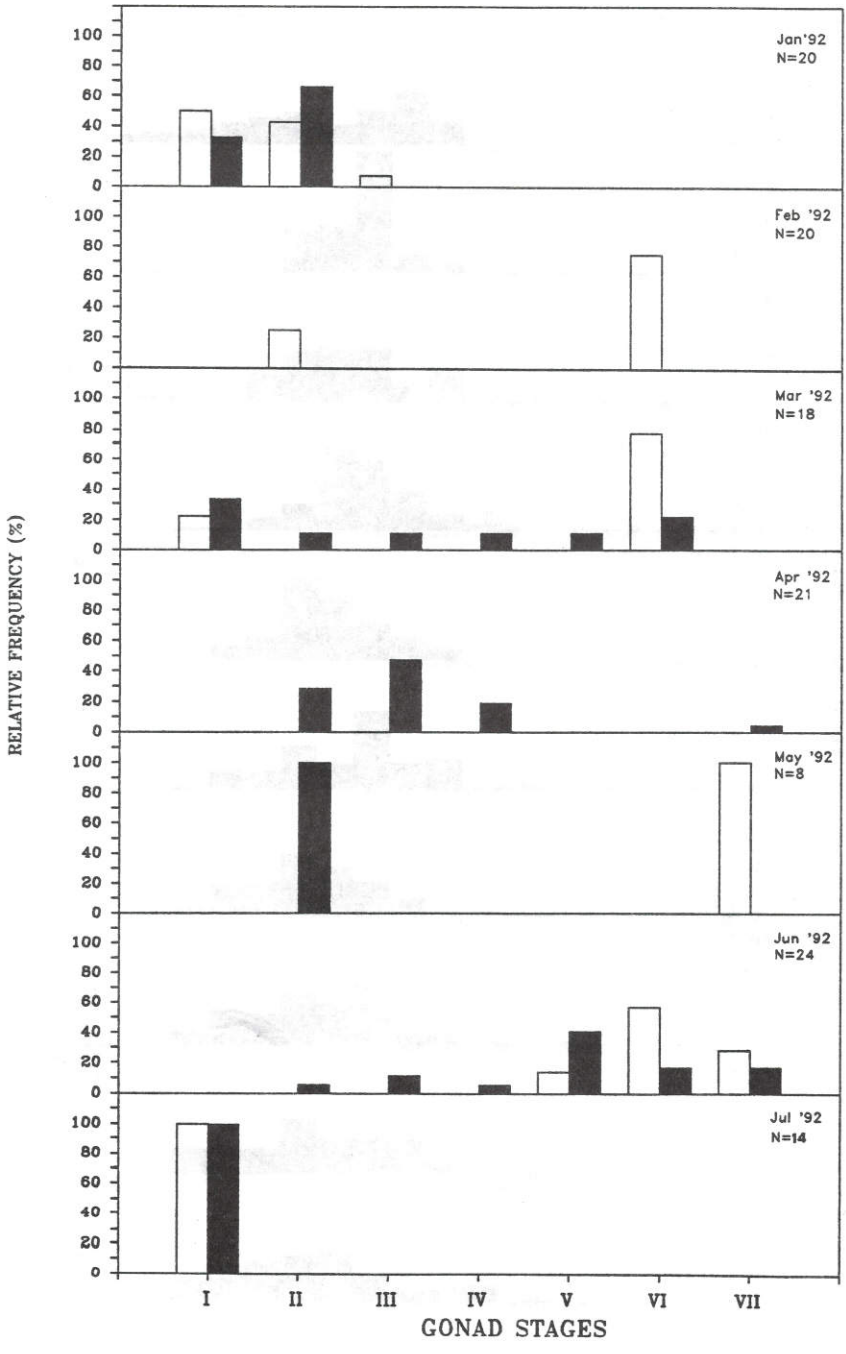


Figure 9A. Gonad stages of *Siganus canaliculatus*.

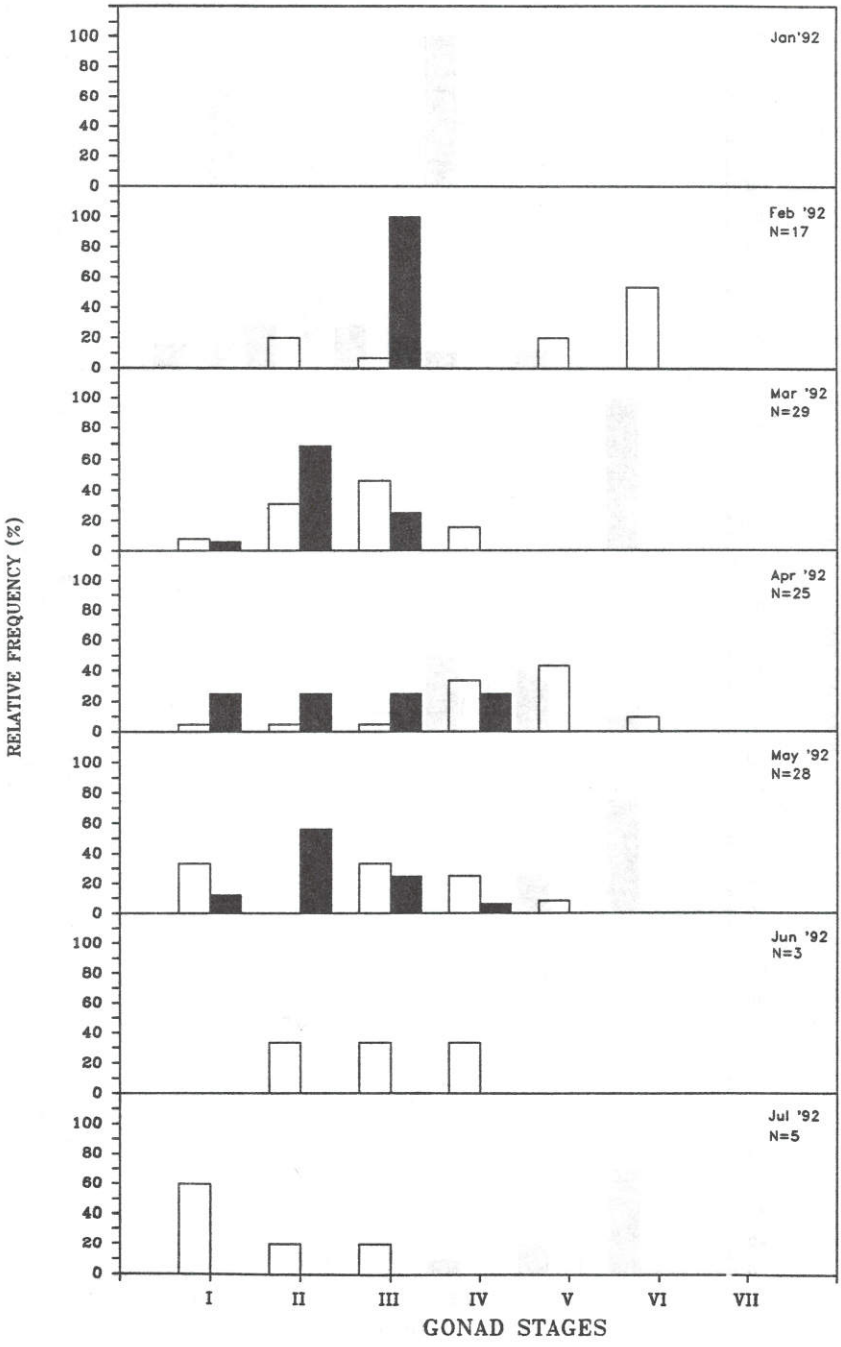


Figure 9B. Gonad stages of *Terapon jarbua*.

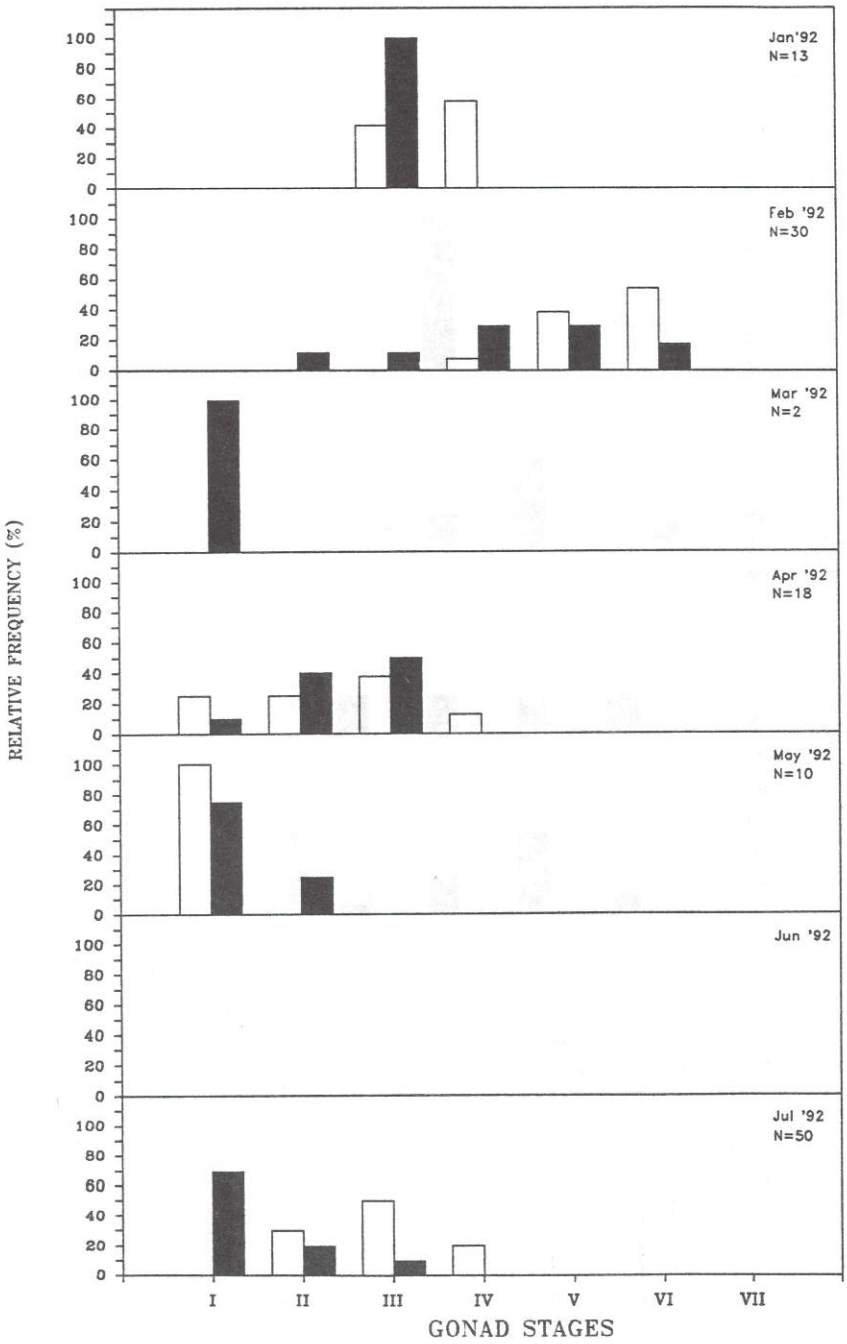


Figure 9C. Gonad stages of *Leiognathus splendens*.

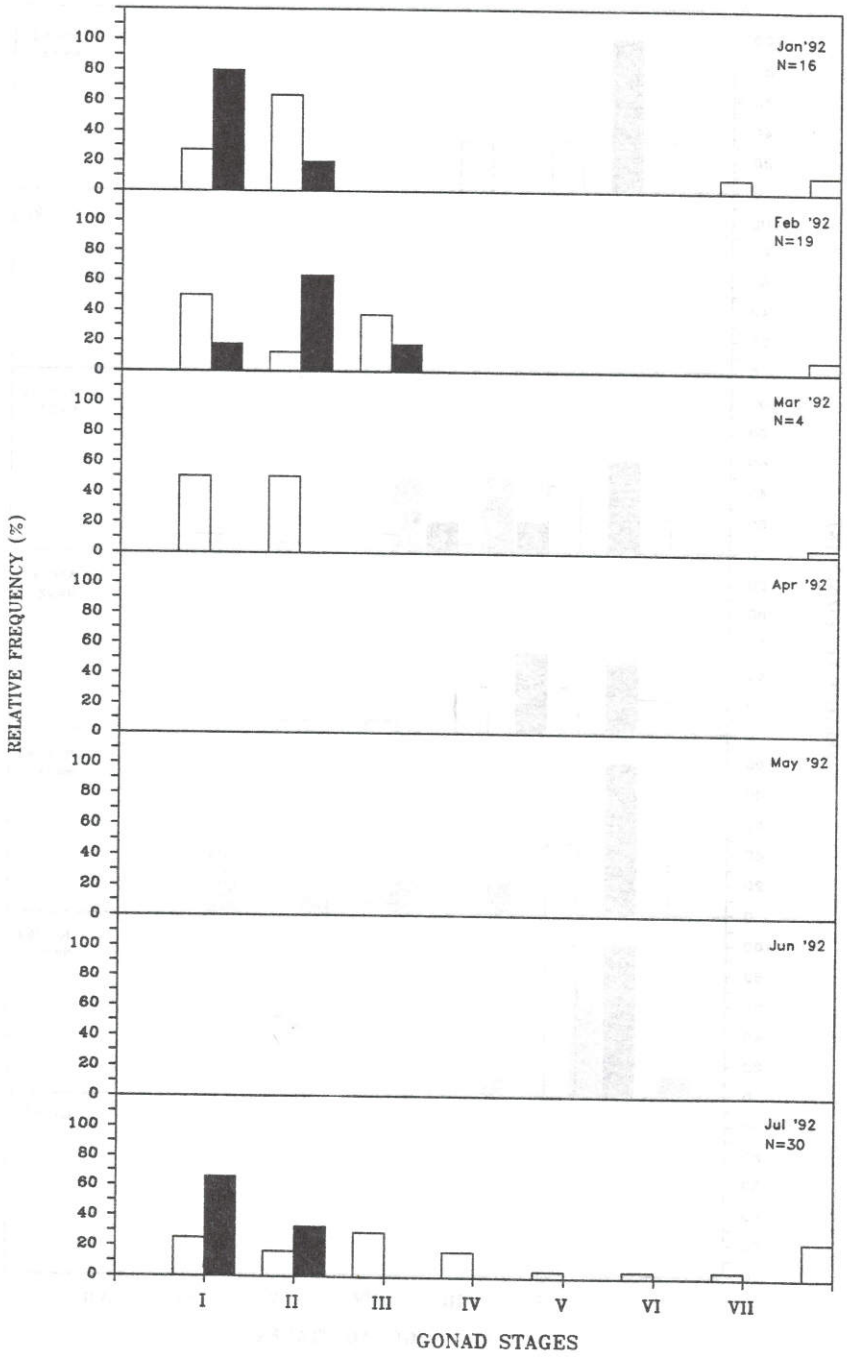


Figure 9D. Gonad stages of *Gerres filamentosus*.

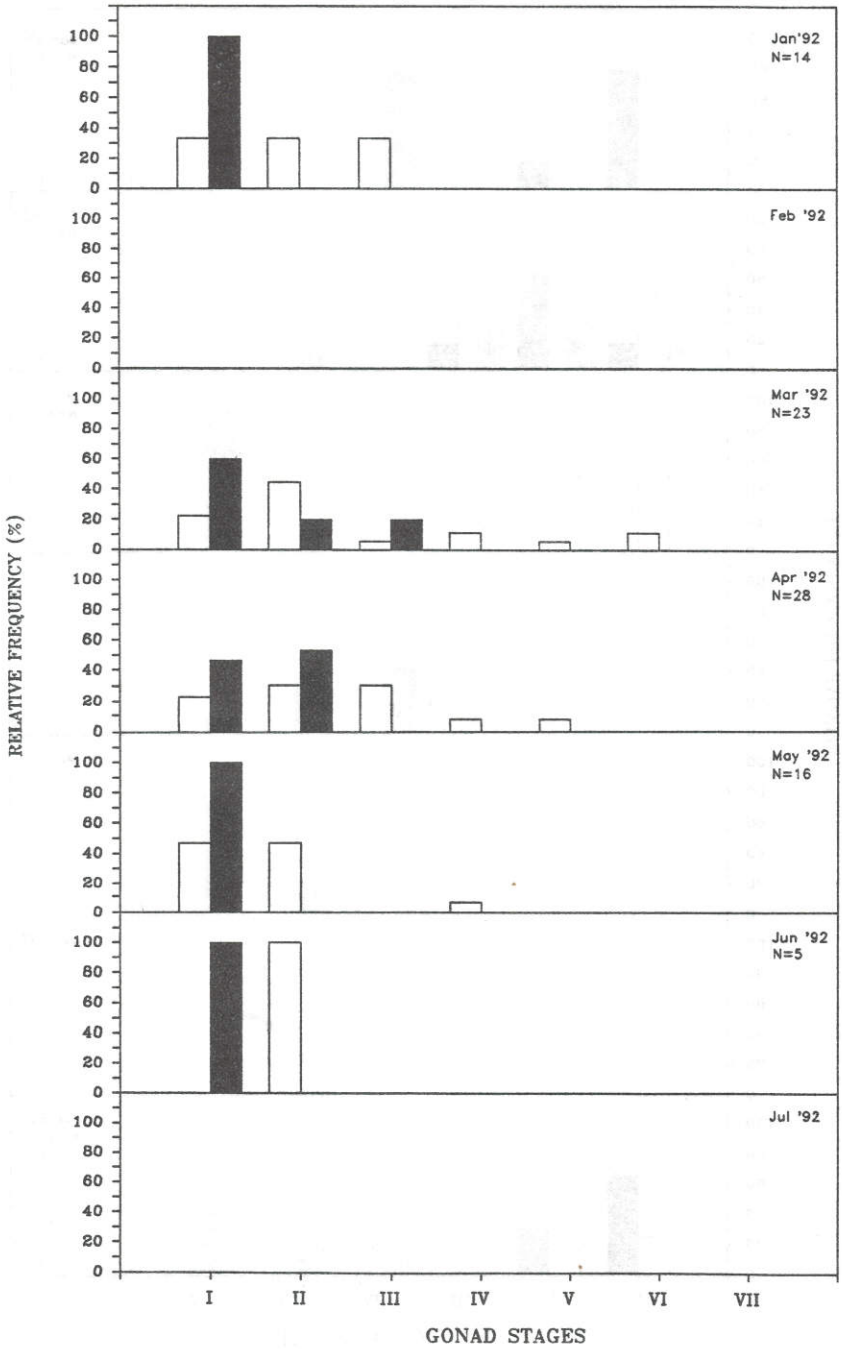


Figure 9E. Gonad stages of *Gerres* sp.

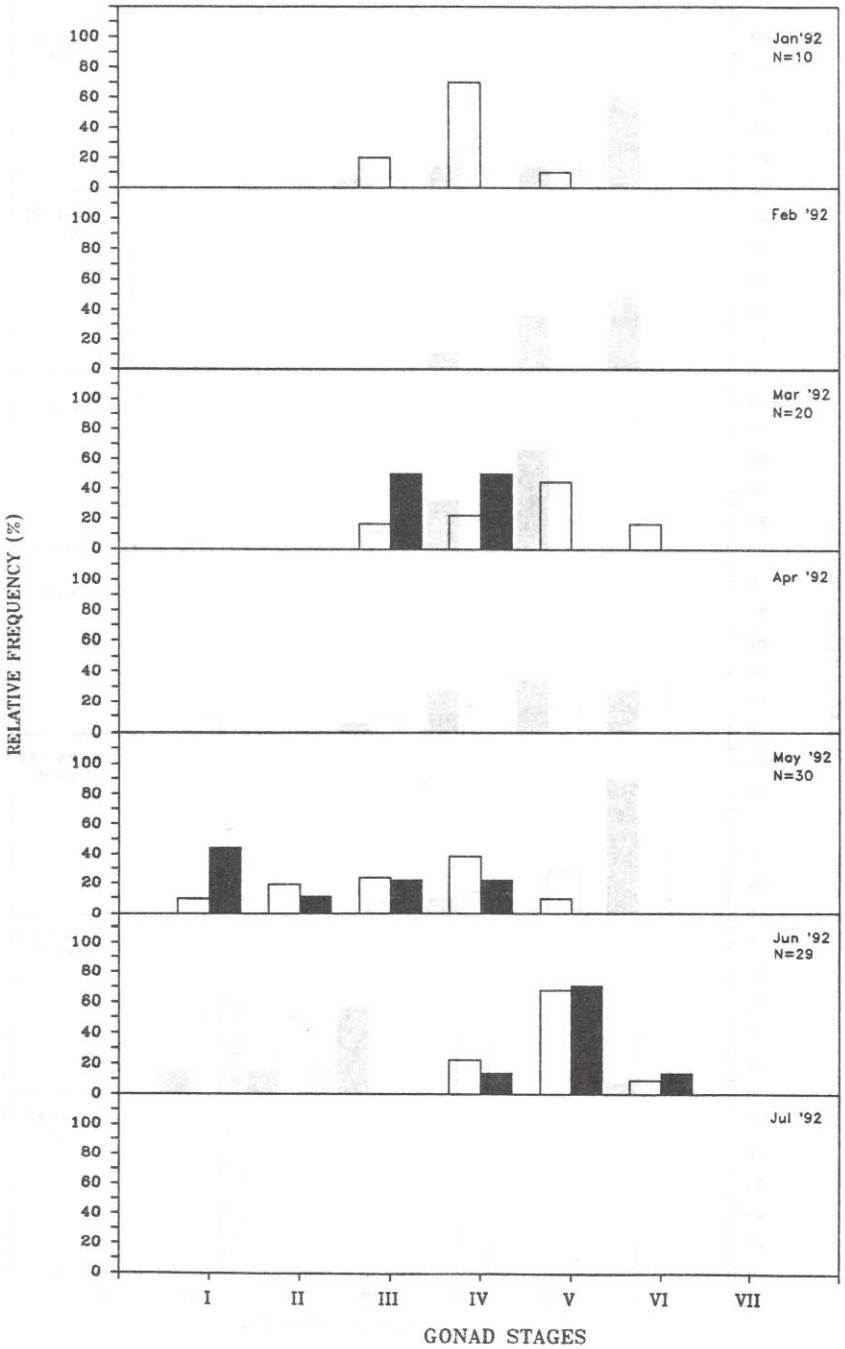


Figure 9F. Gonad stages of *Gazza minuta*

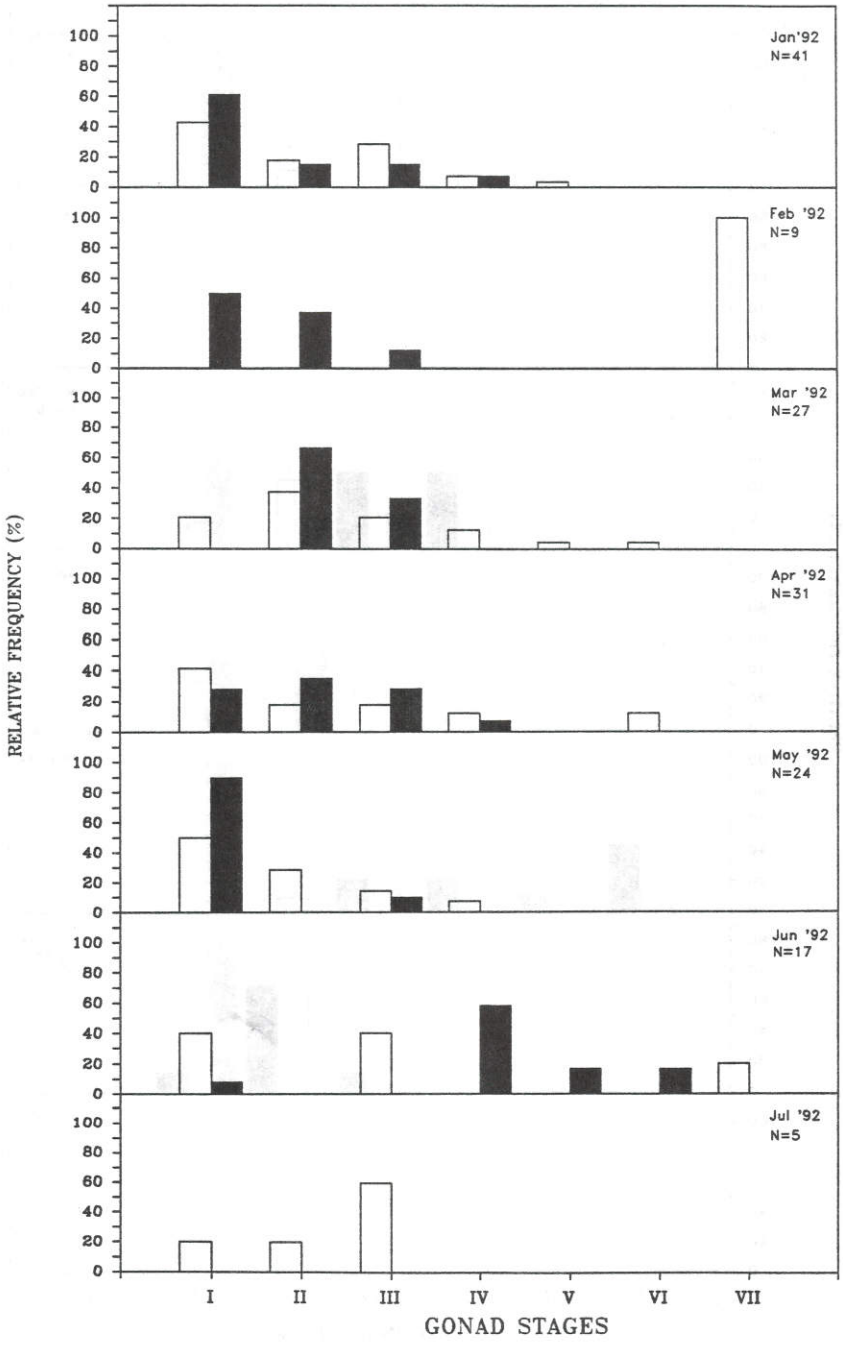


Figure 9G. Gonad stages of *Liza* sp.

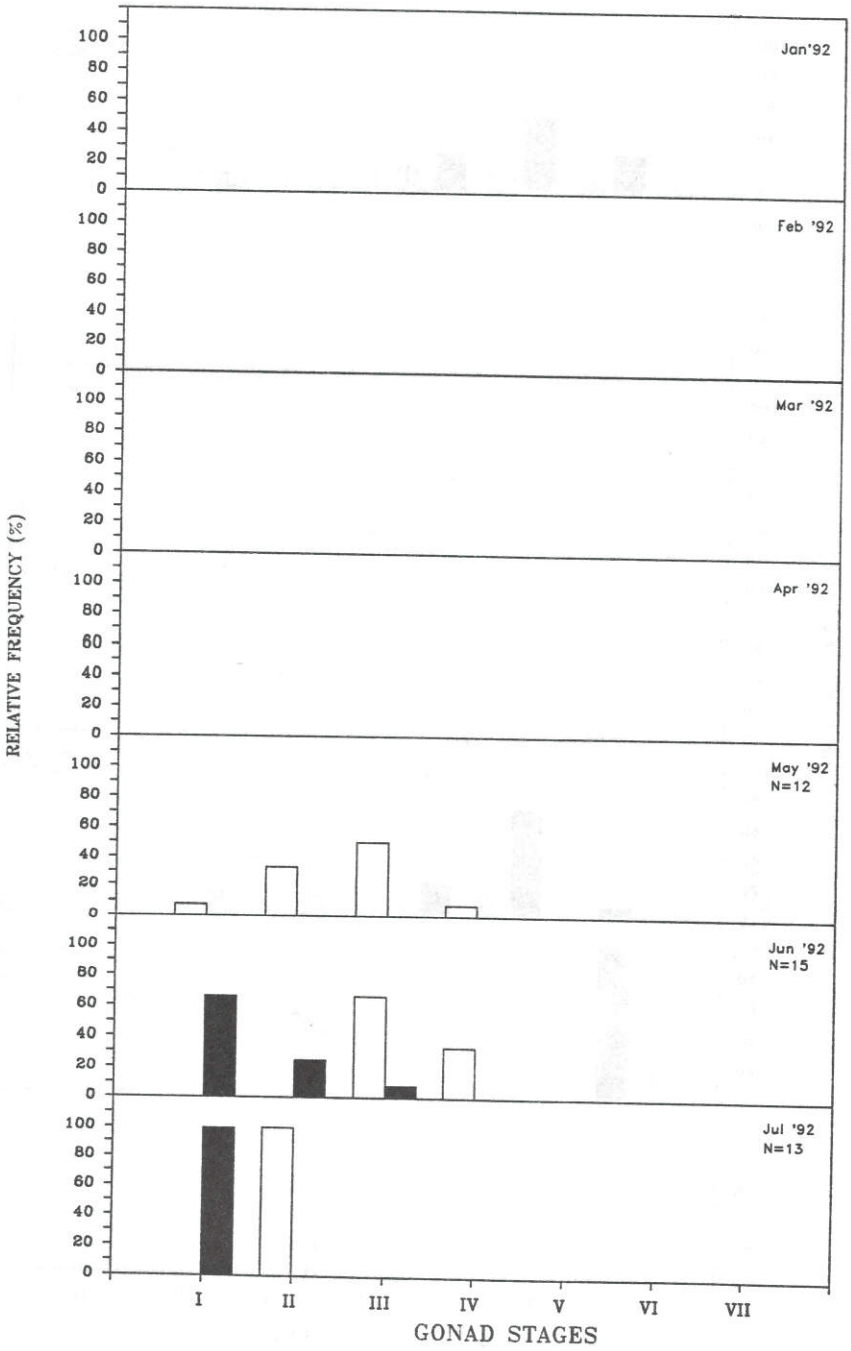


Figure 9H. Gonad stages of *Upeneus sulphureus*

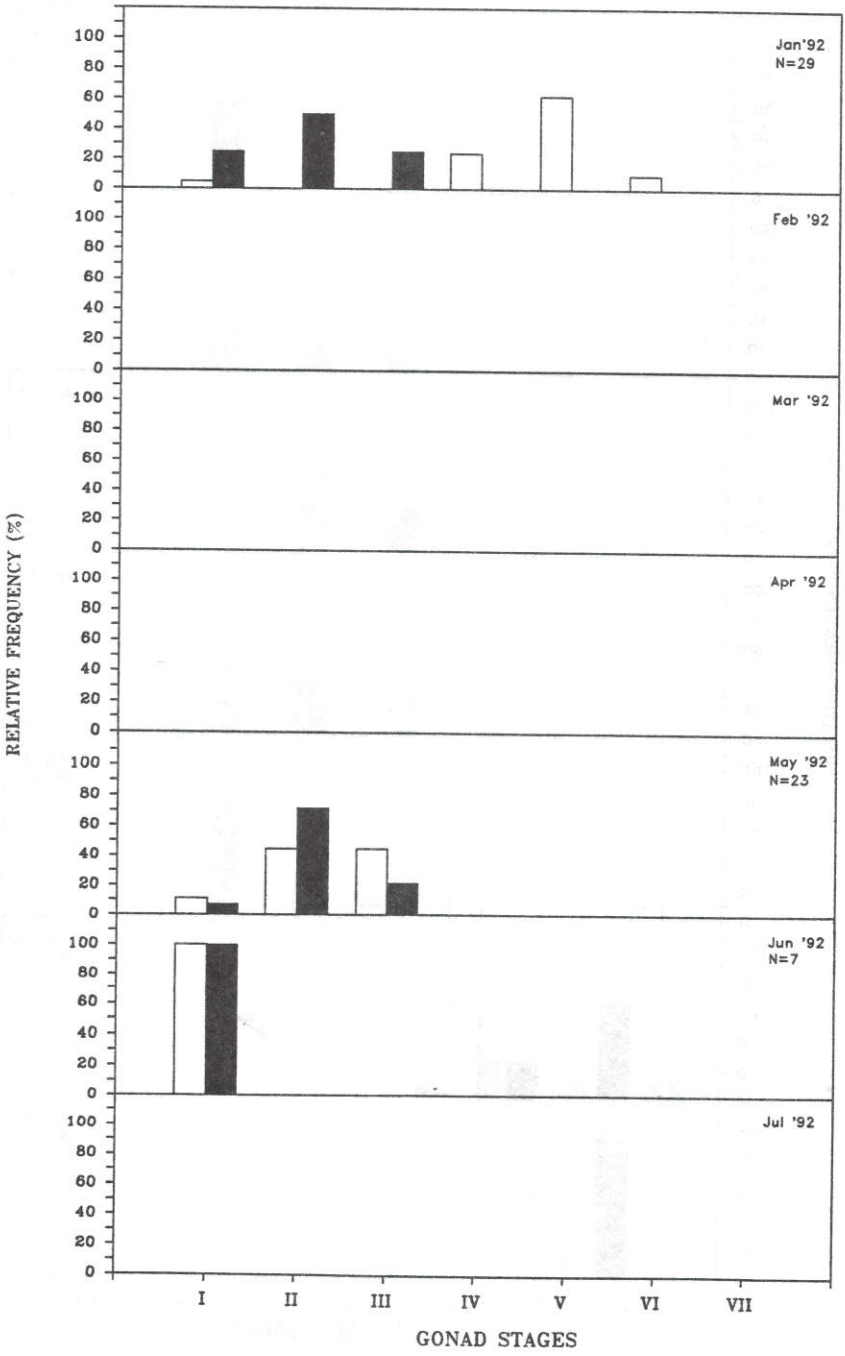


Figure 9I. Gonad stages of *Sardinella* sp..

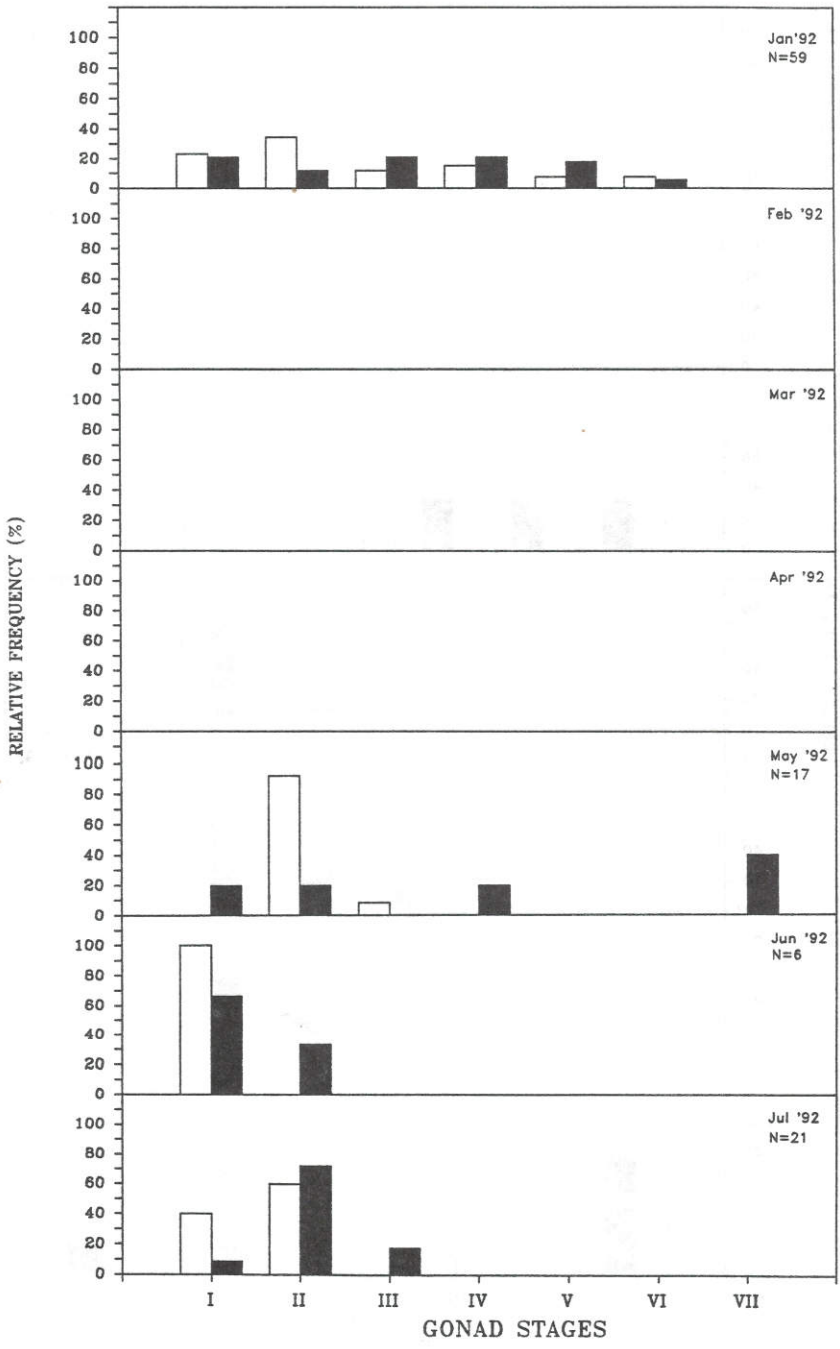


Figure 9J. Gonad stages of *Stolephorus* sp.

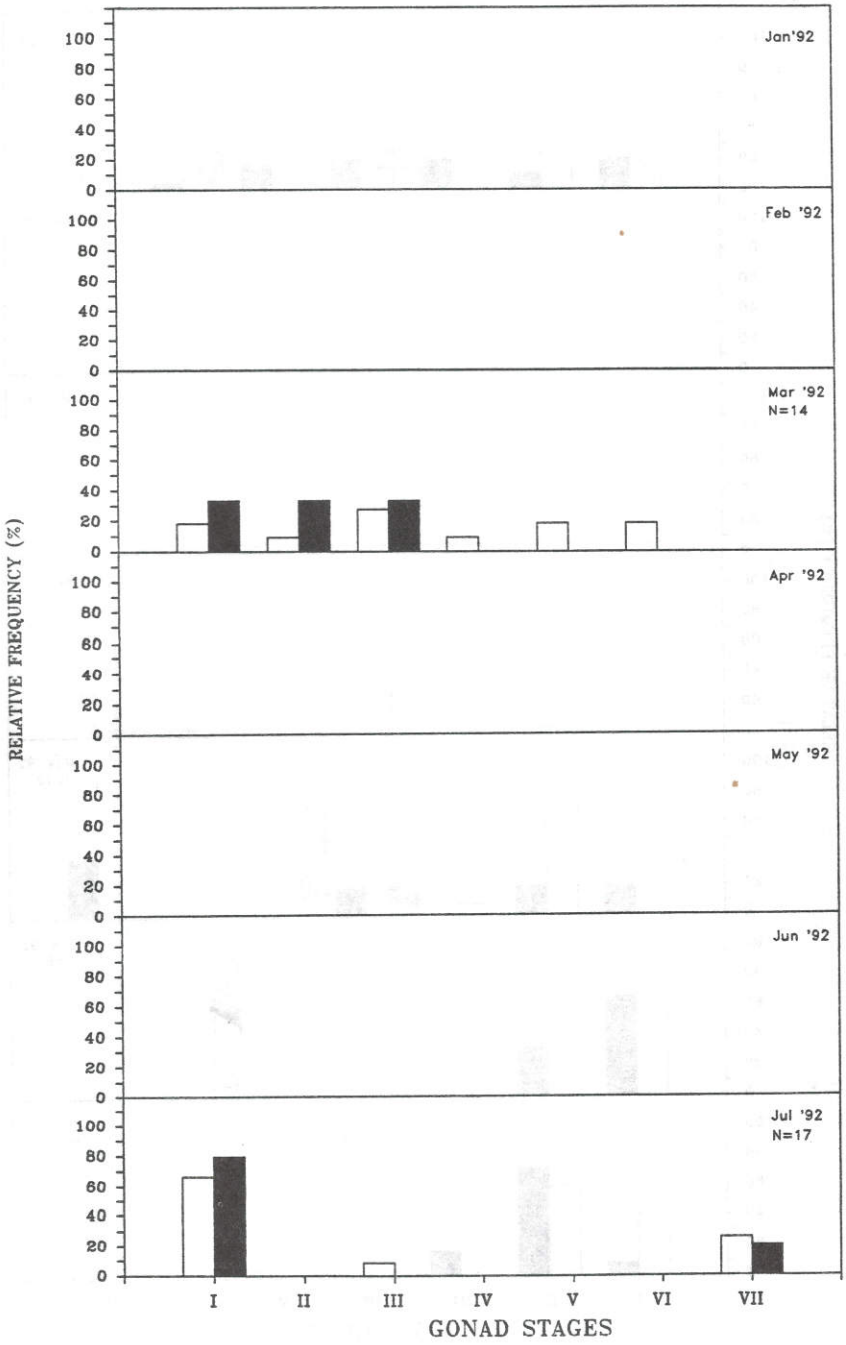


Figure 9K. Gonad stages of *Gerres abbreviatus*

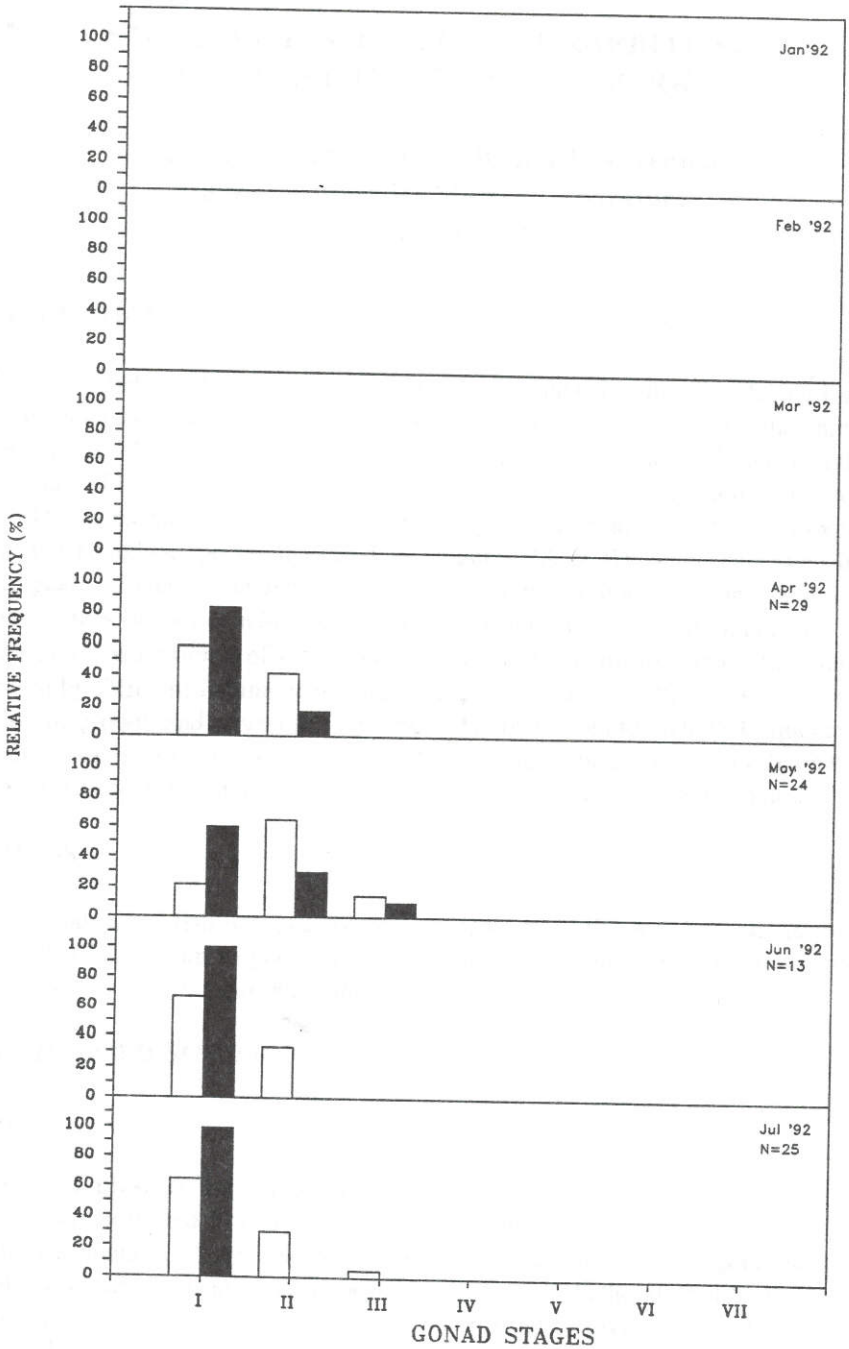


Figure 9L. Gonad stages of *Sillago* sp.

STOCK ASSESSMENT OF THE RABBITFISH, *SIGANUS CANALICULATUS* PARK

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Silliman University Marine Laboratory
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INTRODUCTION

After the fish stock assessment training was conducted in the SU Marine Laboratory from October 11 to 16, 1993, an assessment to estimate growth and mortality parameters of "danggit" (*S. canaliculatus*) was made from the available length-frequency data (Figure 1) of sampled fish caught by fish corral from January to October 1992. The assessment was made only on "danggit," since this was the most exploited among the abundant species in Bais Bay (Figures 2A & B), being harvested by six fishing gears (Figure 3-A) and five fishing techniques (Figure 3-B) and as shown by the small sizes of fish caught and low catch per unit effort. Furthermore, the length frequency measurements of other fish species were monitored from fish samples harvested by different fishing gears and an analysis of this would not generate a good estimate of growth and mortality. Also because of the limited length-frequency data that have been monitored for only 10 months, other parameters like stock biomass and maximum sustainable yield (MSY) for *S. canaliculatus* cannot be estimated.

METHODS

The analysis of fish data was performed using FAO/ICLARM Stock Assessment Tools (FiSAT) program to generate growth parameters and mortalities (both natural and fishing) for *Siganus canaliculatus*.

RESULTS AND DISCUSSION

Growth

Figure 1 presents the length-frequency (L/F; cm, total length) data of *Siganus canaliculatus* collected from Bais Bay. The minimum recorded length (TL) is 5 cm and the maximum is 25 cm. Since the samples did not show modal progression and the linking of sample means was not possible, the Powell Wetherall Plot Method (1986) was used to get estimates of $L\infty$ (asymptotic length) and Z/K which yielded $L\infty$=26.661 cm and Z/K=3.481 (Figure 4). Further testing using ELEFAN 1 program generated a K value (growth constant) of K=0.29 for year 1. The K value of 0.29 for *Siganus*

canaliculatus (Figure 5) is quite low--which may suggest that "danggit" is a slow-growing species. Studies by Carumbana and Luchavez (1979) revealed that the rate of 5-15 cm (SL) for *Siganus canaliculatus* reared in fish pen at Bais Bay was slow, about 0.5 mm (SL) per month for 3 months.

Mortality

Catch curve analysis (Figure 6) reveals the overall mortality of *Siganus canaliculatus*, Z = 1.53; natural mortality, M = 0.85 which maybe caused by natural death, predation and/or immigration and fishing mortality, F = 0.68 (for fish corral only). The overall exploitation rate is E = 0.44. This value of E = 0.44 which is almost 50 % rate for fish corral alone, is quite high, considering that there are six more fishing gears and five fishing techniques also used to exploit *S. canaliculatus* in Bais Bay (Figure 3-A & B). Figure 7 shows the probability of capture of *S. canaliculatus* in Bais Bay using fish corral, revealing that this species is usually caught at relatively small sizes, from 6 cm to 9 cm total length, with highest number caught for the latter. Samples at 17-20 cm (TL) length sizes are seldom caught. Virtual Population Analysis (VPA), the length-based approach, (Figure 8) shows the trend of catch, natural losses, survivors and fishing mortality of *S. canaliculatus*. It is evident in the graph that the highest fishing mortality occurs at 19 cm-- the approximate size for the gear analyzed (fish corral). Such heavy mortality may be explained by the small population size of the species at this particular length size. Some fishermen revealed that during spawning seasons these fish are heavily exploited because of their schooling behavior and their spawning grounds which are known by the fishermen. Earlier results showed that danggit reach spawning size at length sizes of 10 cm and above. Further estimates of catchable lengths show that at 25%, 50 %, 75 % probability of capture, the most vulnerable sizes are at 6.8, 7.5, 8.0 cm total length, respectively.

SUMMARY AND RECOMMENDATIONS

Using the Fish Stock Assessment Tools (FiSAT) program developed from ICLARM, an assessment of the growth and mortality parameters of *S. canaliculatus* was made. Results show that *S. canaliculatus* in Bais Bay grows to a maximum length of 26.661 cm; ($L\infty$ = 26.661 cm), however it grows very slowly (K = 0.29). Also, the total mortality Z = 1.53, natural mortality M = 0.85, and fishing mortality F = 0.68 with an overall exploitation E = 0.44 are quite high, considering that there are six more fishing gears and five fishing techniques used in harvesting this fish from Bais Bay. Sizes usually caught by fish corral range from 6-9 cm (TL) with heavy exploitation towards 9 cm (TL) size. Highest fishing was estimated to fall at 19 cm length size (TL) which may mean that there are very few fish left of this size, or there are only a small number of samples.

Based on the results, it is recommended that:

1. Growth overfishing (i.e. harvesting before fish reaches sexual maturity) of *S. canaliculatus* (danggit) be minimized by banning the use of less than 3-cm mesh-sized nets (measured between two separate knots of a full mesh when stretched) by sahid (beach seine), pukot (gill net), hulbot (modified Danish seine), tapsay (fish net), and screen of bunsod (fish corral). Presidential Decree 704 Sec. 34 & F.A.O. 155, Series of 1988, bans the use of nets with mesh sizes of less than 3 cm. Through their students, the Bais School of Fisheries could help to persuade the fishing community to stop the use of small mesh-sized nets. Two of this study's enumerators who are students of this school of fisheries can be potential instruments in persuading the fishermen. Otherwise, the city government is responsible for the execution of the ban through the "Bantay Dagat".

2. Recruit overfishing (i.e., harvesting before fish could spawn) of *S. canaliculatus* should be minimized by declaring a close fishing season for *Siganus canaliculatus* during its spawning season. Studies show that *S. canaliculatus* spawn from four to seven days after the new moon, around midnight (Bryan et al, 1975). Alcala and Alcazar (1979) reported that the spawning season of *S. canaliculatus* in Dumaguete as inferred from gonad indices occur during the months of February through September with peaks in March-April and July- August. Results of this study show that *S. canaliculatus* are reproductive during the months of January to July (Figure 9). The enumerators may be given the responsibility to discourage fishermen from harvesting gravid fish.

3. Since seagrasses are an important habitat not only of *Siganus canaliculatus* but also of other important species, this ecosystem should be protected. Alcala (1979) reported that both young and adult *S. canaliculatus* are found in seagrasses. (Figure 10) shows the seagrass areas of Bais Bay: around Diutay Island and Talabong Mangrove Forest, which are the fishing grounds for *S. canaliculatus*. Making the fishing community understand the importance of seagrass in Bais Bay is a joint responsibility of the CO worker of the Coastal Living Resources Project and the Central Visayas Polytechnic College (CVPC) School of Fisheries.

4. A continuous monitoring of the catch harvest of *Siganus canaliculatus* for at least three years to determine effectivity of these restrictions and most of all to determine the maximum sustainability yield of this species in the Bay, should be carried out by the ERMP enumerators under the supervision of the SUML.

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Bais Bay Environment and Resource Management Project Marine Component: Terminal Report (Year I): 1992. Silliman University, Dumaguete City.

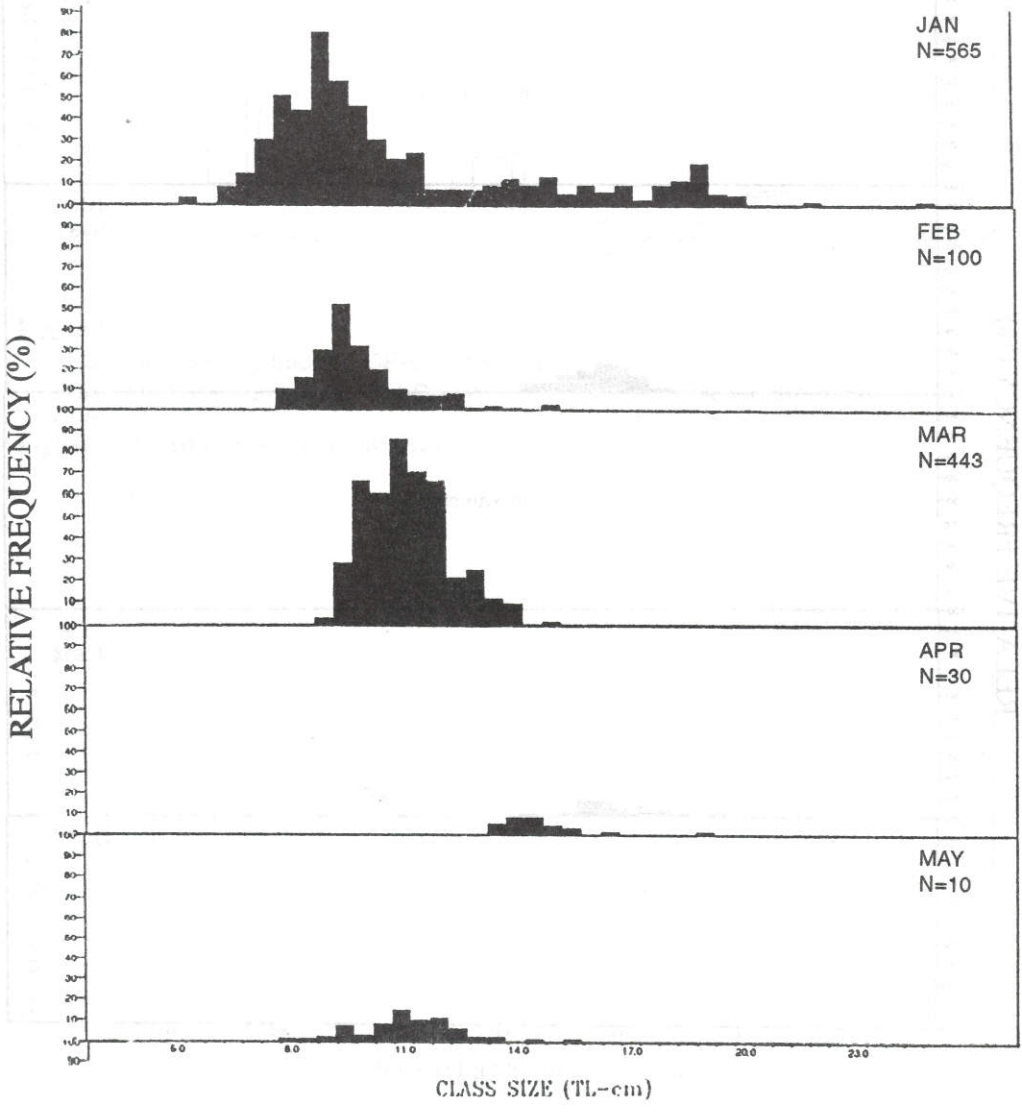


Figure 1. **Length frequency of *Siganus canaliculatus* (danggit) collected using fish corral in Bais Bay from January to October 1992.**

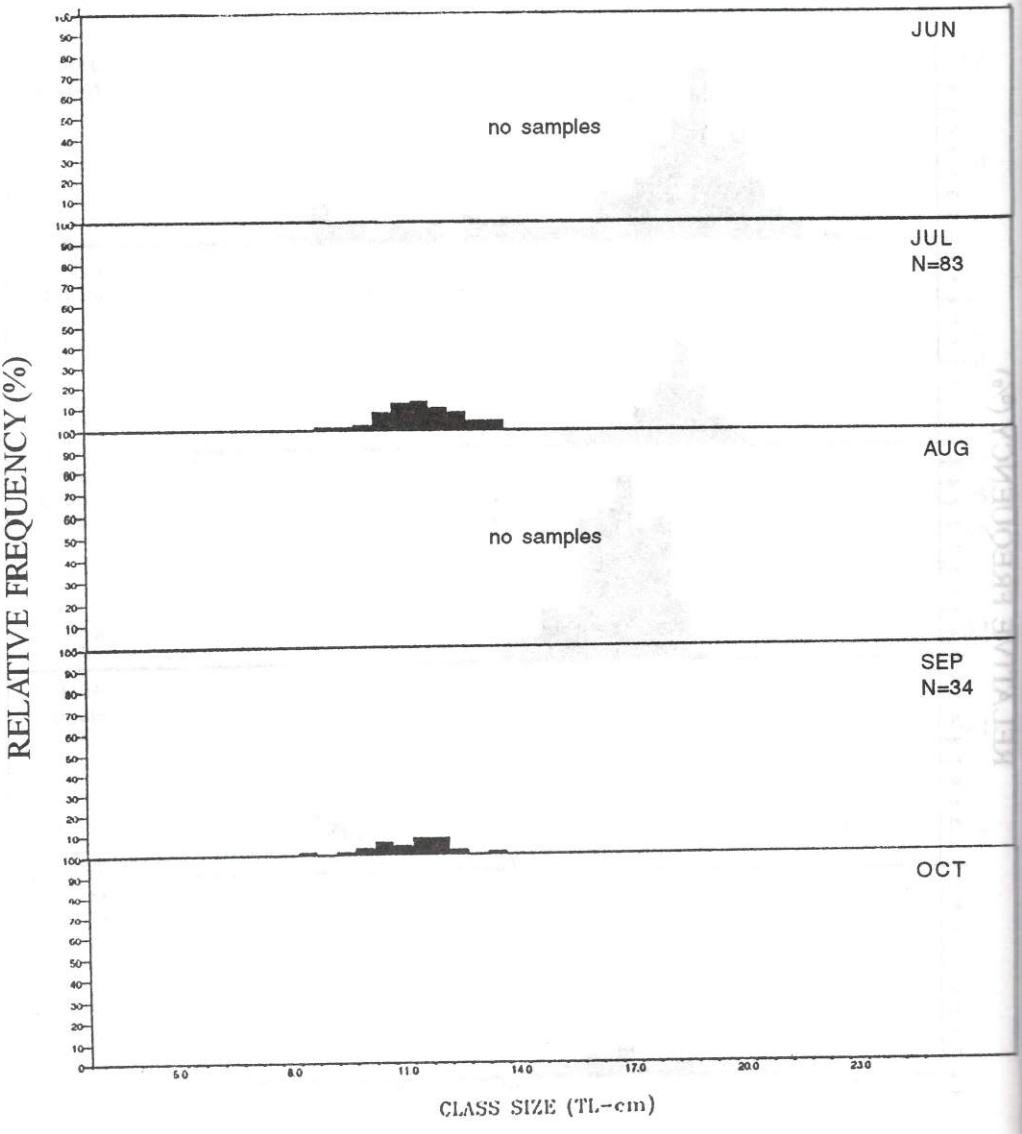
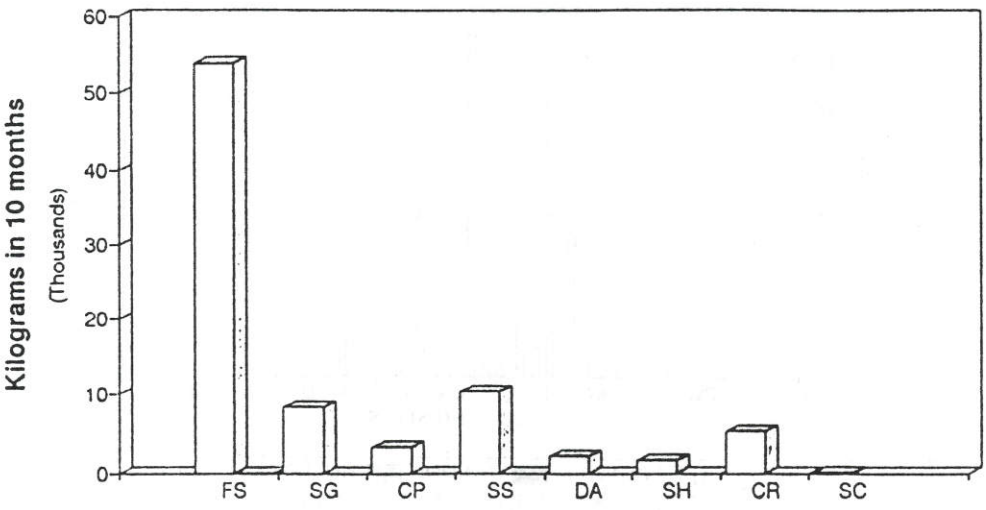


Figure 1. (Continued)



Legend:

FS-Fish; SG-Siganidae; CP-Cephalopods; SS-Seashells
DA-*Dolabella auricularia*; SH-Shrimps; CR-Crabs; SC-Sea cucumber

Figure 2-A. Important marine fisheries of Bais Bay.

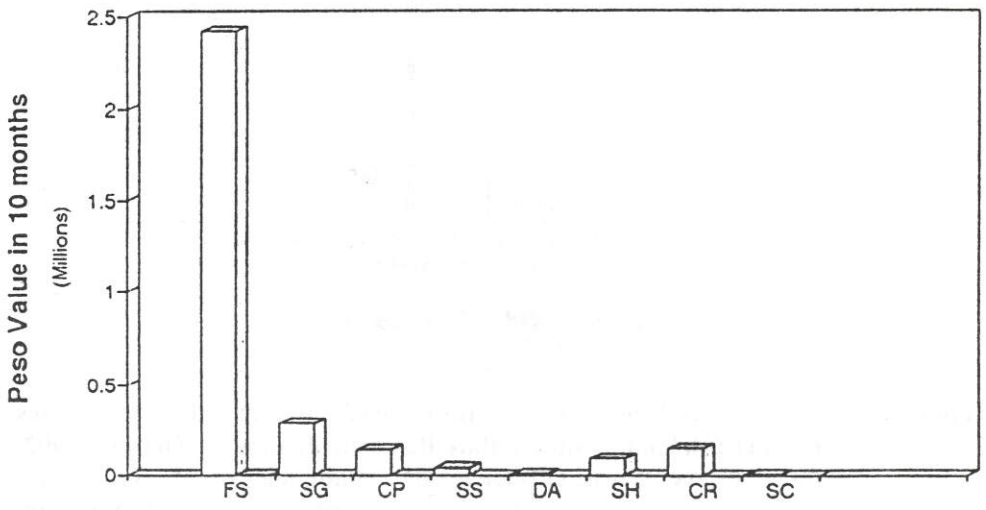


Figure 2-B. Peso values of important fisheries in Bais Bay.

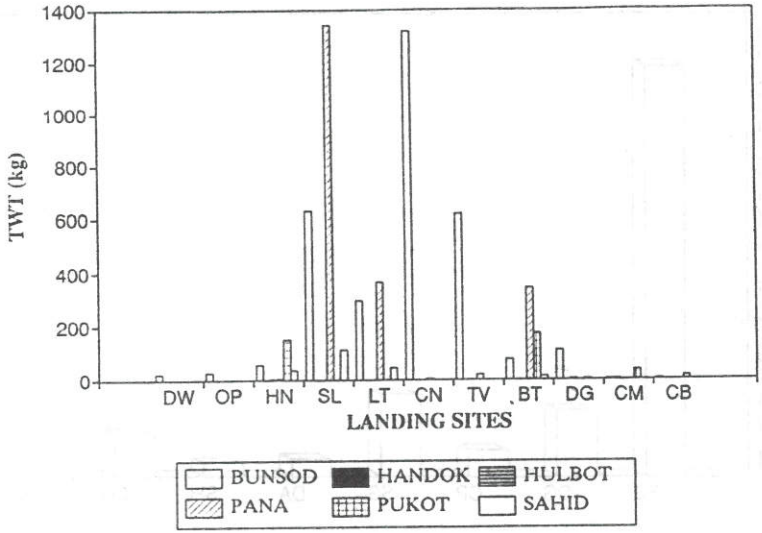


Figure 3-A. ***Siganus canaliculatus*** **harvest (kg) using 6 different types of fishing gears from 11 fish landing sites in Bais Bay from January to October 1992.**

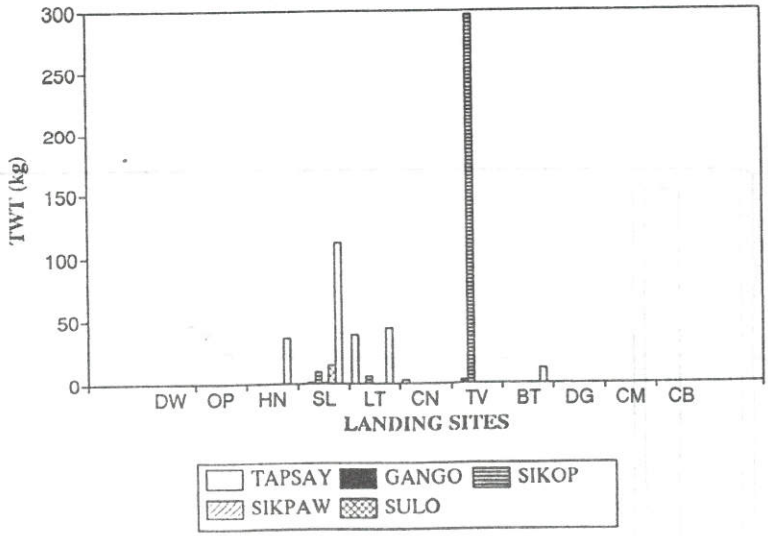
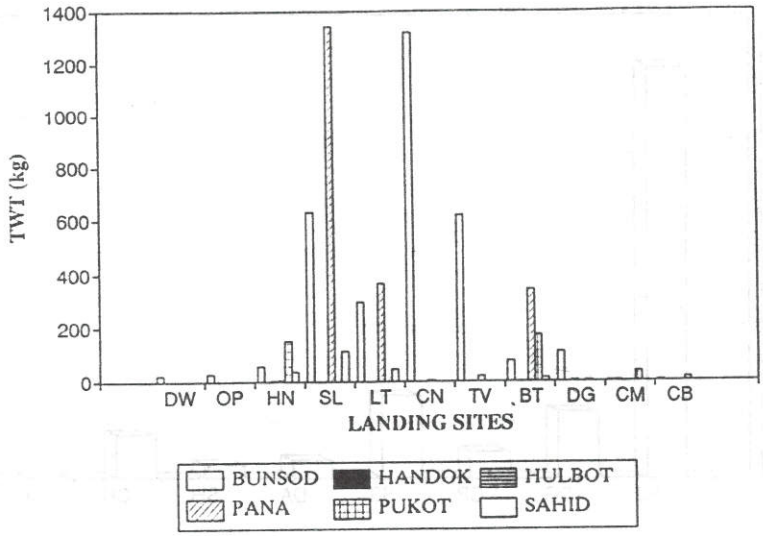


Figure 3-B. ***Siganus canaliculatus*** **harvest (kg) using 5 different fishing techniques from 11 fish landing sites in Bais Bay from January to October 1992. Legend: DW=Dawis, OP=Opao, HN=Hindungawan, SL=Sanlagan, LT=Lag-it, CN=Canibol, TV=Tavera, BT=Batugan, DG=Dunggu-an, CM=Campuyo, CB=Cabiloy.**



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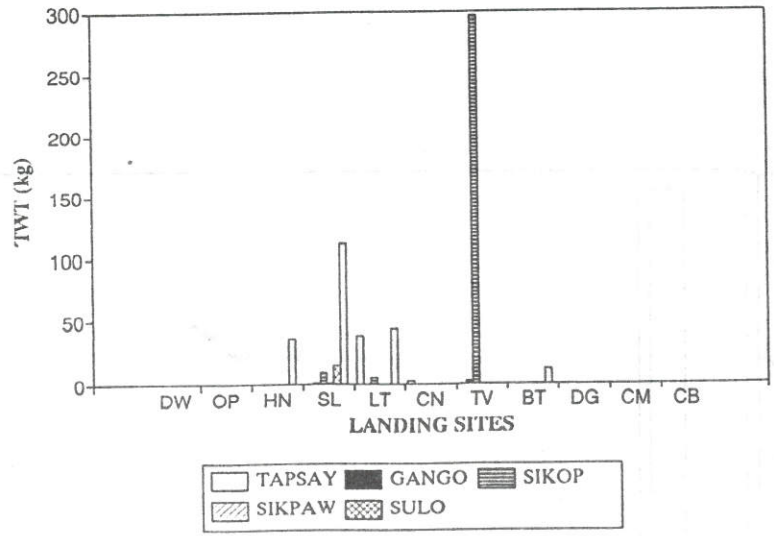

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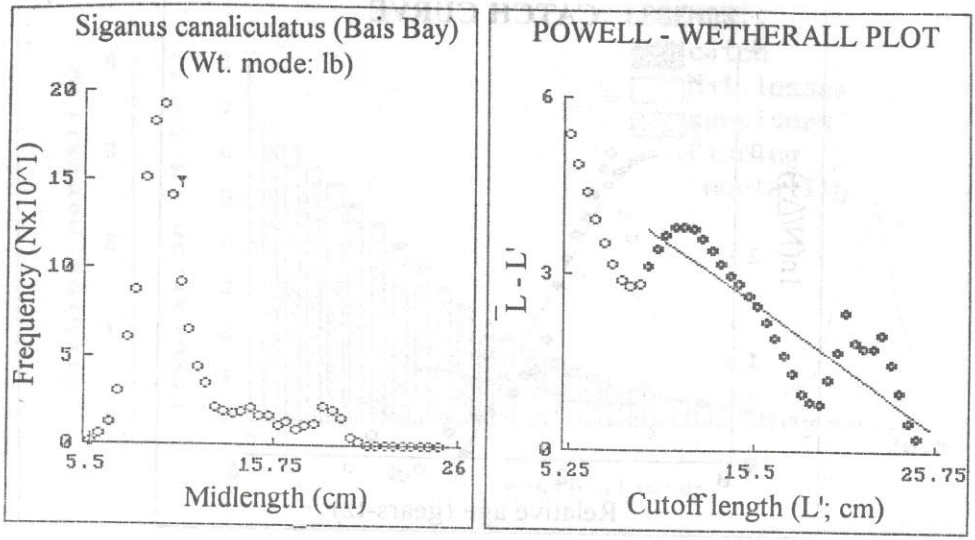

Figure 4. **Wetherall method for estimating L ∞ and Z/K from length frequency data of *Siganus canaliculatus* harvested from Bais Bay, January to October 1992; the regression equation is Y=5.95 -0.223 x, (or = -0.800);i.e, L ∞ = 26.661 cm and Z/K = 3.481.**

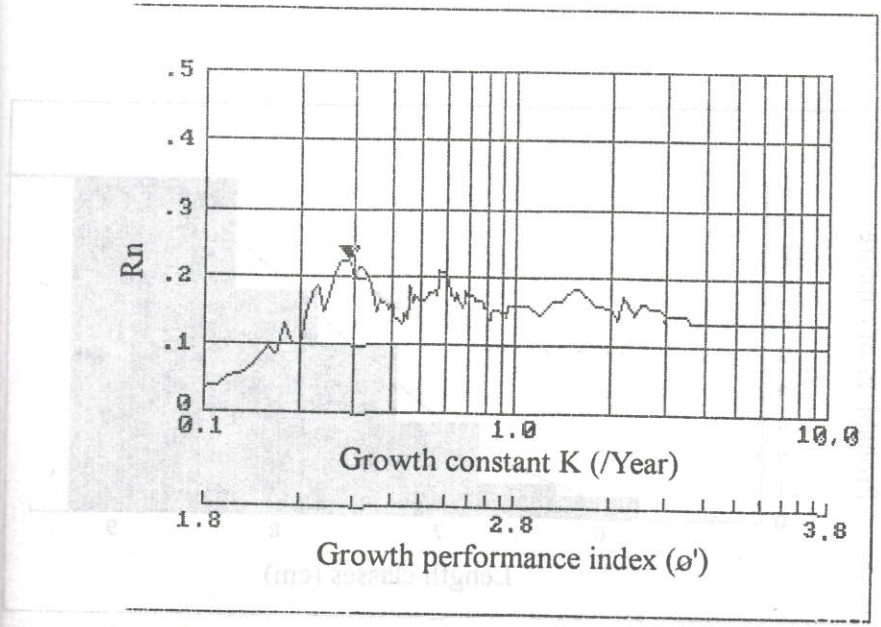

Figure 5. **Growth performance index for *S. canaliculatus* in Bais Bay, January to October 1992 (K = 0.29).**

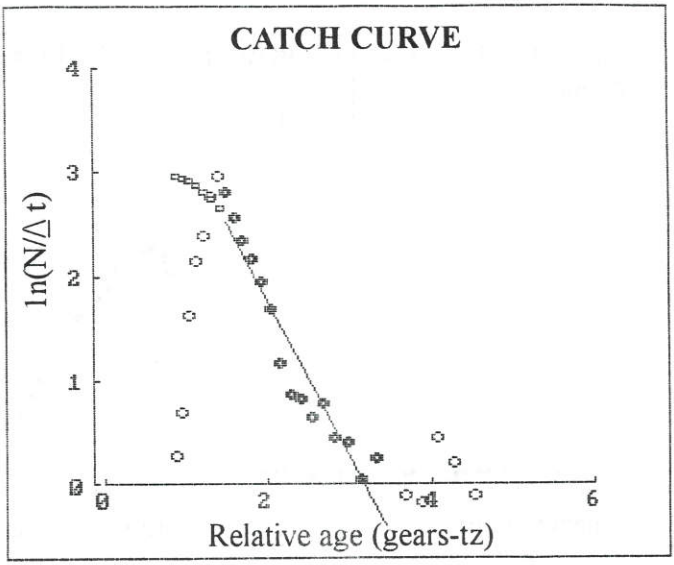

Figure 6. **Length-converted catch curve of *S. canaliculatus* in Bais Bay, January to October 1992 (Z = 1.53 year ^{1}, M = 0.85, F. = 0.68, E = 0.44).**

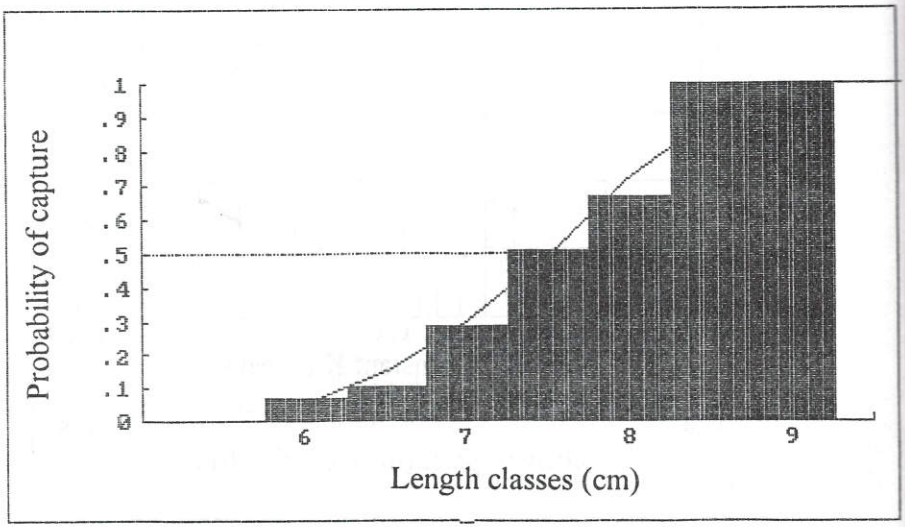

Figure 7. **Probability of capture Analysis of *Siganus canaliculatus***

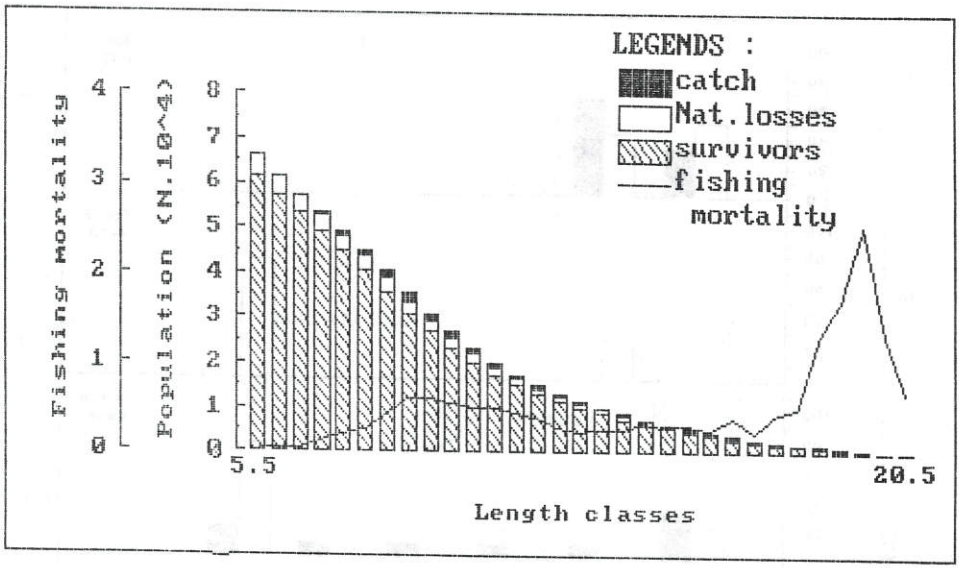

Figure 8. Length-structured Virtual Population Analysis of *S. canaliculatus* in Bais Bay, January - October 1992, showing trend of catch: L50 = 7.533.

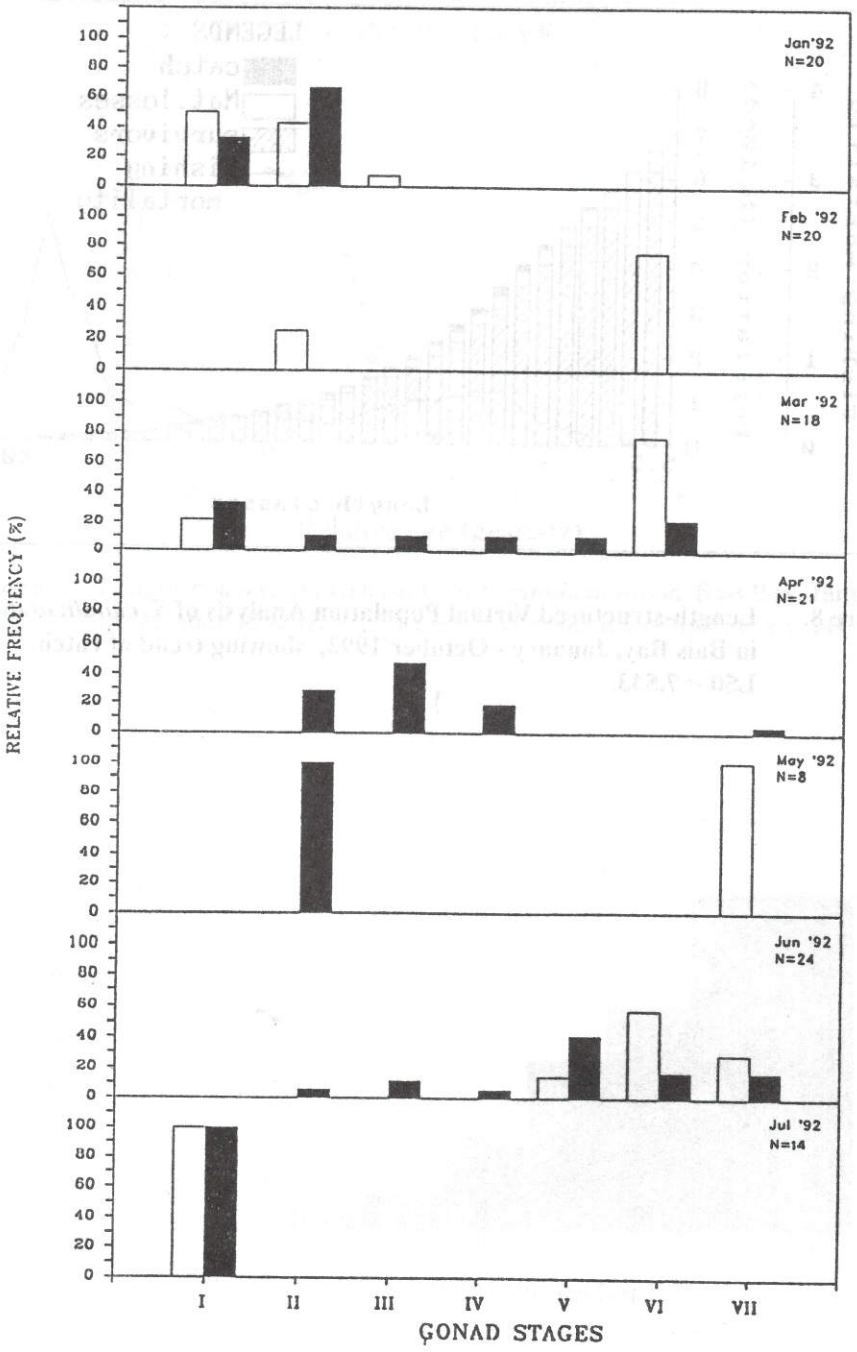

Figure 9. **Gonad stages of *Siganus canaliculatus.***

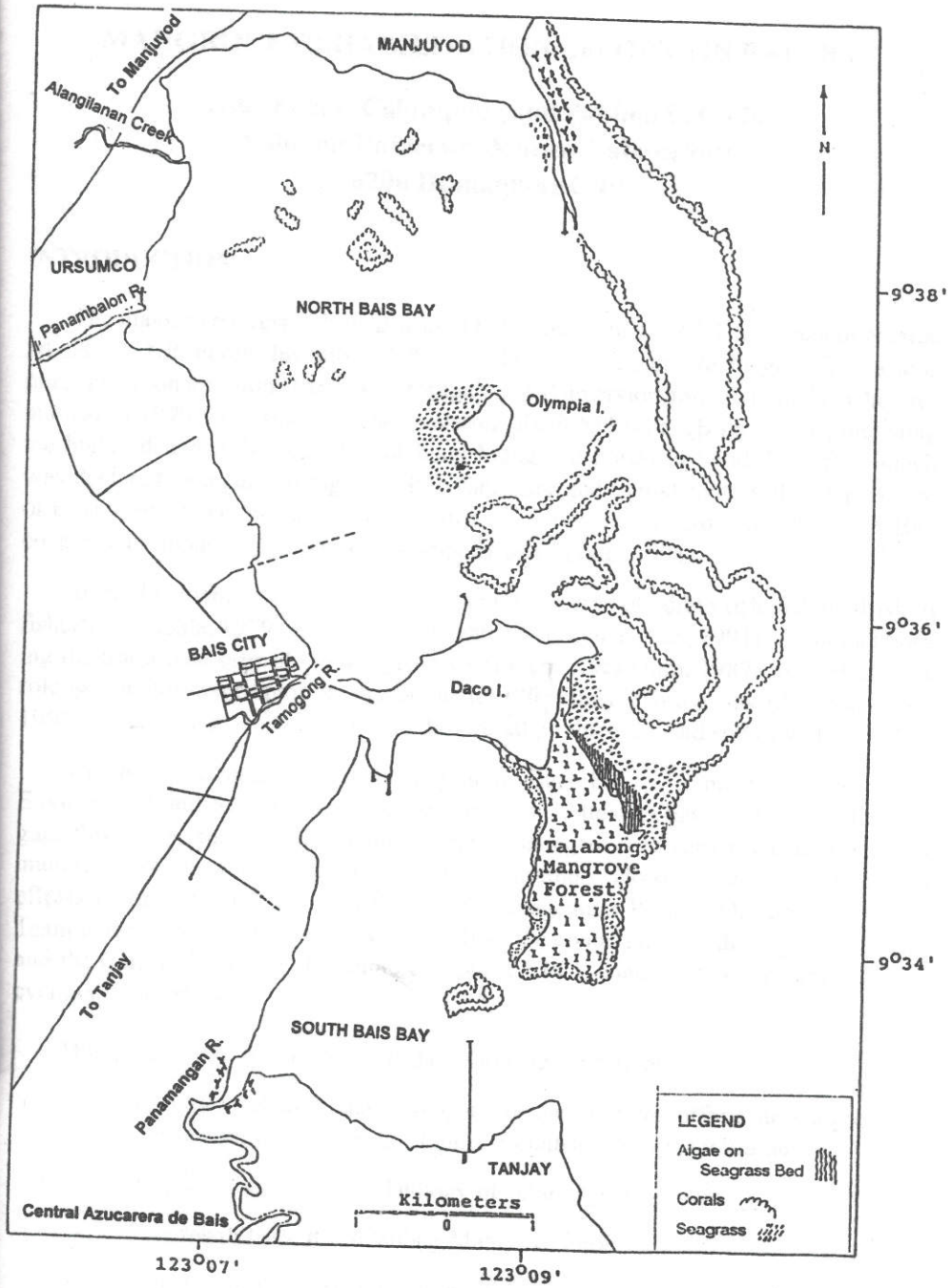

Figure 10. Map of Bais Bay showing the seagrass areas.

MANGROVE REHABILITATION EFFORTS IN BAIS BAY

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Silliman University Marine Laboratory
6200 Dumaguete City

INTRODUCTION

The mangrove forest in Bais Bay used to be contiguous (LANDSAT map of Negros Island, DENR Forest Inventory 1187-01361). However, due to logging for various purposes (construction, firewood, forage) and conversion into fishponds, what remained in 1979 were small patches covering about 811.6 ha. (Biña, 1979), including the highly denuded 200-hectare Talabong Mangrove Forest in South Bais Bay which was declared as a game refuge, wildlife sanctuary and tourist spot by the Department of Environment and Natural Resources in 1985. Now, the mangrove forest in Bais Bay covers only about 250 hectares (Calumpong and Serate, 1994).

Since this mangrove ecosystem has been the source of edible fish and shellfish to fisherfolk (Alcala, 1979; Alcala and Alcazar, 1984; Dolar *et al.*, 1991) — not mentioning the traditional uses of the mangrove trees themselves (Jara, 1987) as well as their role as a major contributor of organic matter ("fertilizer") to the Bay (de Leon *et al.*, 1992) — its management is critical to the overall productivity and stability of Bais Bay.

The issue on mangrove deforestation in Bais Bay is a major concern of the Environment and Resource Management Project. Attempts have been made to mitigate this issue, such as the establishment of mangrove nurseries and multispecies mangrove reforestation, in spite of some constraints. However, with the persistent efforts of the Environment and Resource Management Project-Marine Component Team and the local "ambassadors," as well as the cooperation of the city government and the Central Visayas Polytechnic College (CVPC), some of these constraints were eventually eased out.

This study was conducted with the following objectives:

1. to gain full community support for the on-going efforts in mangrove reforestation and in developing a multispecies mangrove nursery;
2. to disseminate the technology of planting mangroves;
3. to rehabilitate the Talabong Mangrove Park;
4. to conduct experiments on multispecies reforestation; and
5. to establish a multispecies mangrove nursery.

MATERIALS AND METHODS

Establishment of the Nursery Site

An ocular survey of Talabong Mangrove forest and Capiñahan in Bais Bay was conducted to determine possible sites for nursery and reforestation. Initially, a small piece of land at the back of the old Human Settlements Building at Capiñahan was selected because of its strategic location (Figure 1). However, a major problem arose, i.e., the area had been converted into fishponds and the "leasee" wanted to be reimbursed for his expenses amounting to about 30,000 pesos. Because of this constraint, other sites were surveyed. One was the area leased to Central Visayas Polytechnic College (CVPC) adjacent to Barangay Okiot's recreation center. Negotiations with the President of CVPC resulted favorably. Not only was an area set aside for mangrove nursery but also other fields of cooperation with the project was agreed upon in a memorandum of agreement between CVPC and the Project.

The nursery site, adjacent to a newly constructed fishpond of CVPC and behind a cluster of houses, measured 100m x 100m. The substrate is generally mud-silt with a water depth ranging from 0-4m. Natural vegetation consists of *Avicennia marina* in the intertidal and *Sonneratia alba* in the seaward side. A few *Rhizophora* were planted previously.

The area was planted with as many species of mangroves as possible. The site was arbitrarily divided into rows, each row starting 1.8m from the fishpond dike and 1m apart (Figure 2). Propagules or seedlings were planted at 0.5m interval: the first two rows from the land were planted with *Ceriops*, followed by two rows of *Bruguiera*, and the middle to five rows each with three *Rhizophora* species. Sources of these propagules were the Talabong Mangrove Forest, Bindoy and Palawan.

Reforestation Sites

In choosing the sites to be reforested, the Talabong Mangrove Forest was the obvious choice; first, because it urgently needed rehabilitation, and second, because there were no tenurial problems associated with it. However, to mobilize a large number of people to undertake such a task was both costly and nightmarish. The long-term problem was the maintenance and monitoring of the plantings.

The strategy of organizing the community and starting reforestation efforts with associations was discarded because of the long history of community organizing that the fisherfolk of Bais had encountered. One problem with this strategy as has been experienced by the Central Visayas Regional Project is the problem of tenure.

To avoid this, the strategy of starting reforestation efforts with Certificate of Stewardship Contract (CSC) holders was explored. A list of CSC holders and the location and the hectarage of their holdings was secured from Community Environment and Natural Resources Office II (Ayungon Office). It was found that a substantial part of Bais Basin, especially in the Barangays of Looc (8.2699 ha), Okiot (5.7467 ha), and Capiñahan (3.9072 ha) have been designated under a CSC agreement (Figure 1). A total of 183 CSC holders were identified in these three barangays.

A cursory check of these areas under the CSC showed an almost zero reforestation effort being undertaken. Under the law, 20% of an area acquired through CSC should be reforested on pain of cancellation. The Provincial Environment and Natural Resources Office was consulted regarding this and a workshop to remind the CSC holders of their responsibilities and to enlighten them on the real meaning of CSC was recommended. This was also considered a good venue to introduce the ERMP-Development Action Program and mangrove management as a whole. To ensure good attendance, individual letters of invitation signed by the PENRO head himself was distributed to the CSC holders. Barangay and city officials as well as heads of line agencies (e.g., DA) were invited.

Venues for the workshop were explored. CVPC-Bais campus was chosen because of its strategic location and its involvement with the project. Meetings with the CVPC-Bais campus dean and administrators were held. When CVPC gave its okay, preparations were done.

The workshop was conducted in CVPC on 11 July 1992 with the specific objective of initiating community involvement in mangrove reforestation using CSC holders as the point of entry. It was successfully attended by about 80% of the CSC holders, DENR representatives, the mayor of Bais City and his staff, DA representatives, barangay officials and even non-CSC holders. More than 200 people were present.

A follow up house-to-house monitoring was conducted by the DENR representative assigned in Bais. Of the 30 CSC holders monitored, only six had planted part of their area with *Rhizophora* and only three requested for seedlings. Two factors were cited as reasons for not wanting to plant more *Rhizophora*: unsuitability of substrate and disease.

Germination Trials and Growth Monitoring of Refo Species

Different species of mangrove propagules were allowed to germinate at Silliman University Marine Laboratory and at the back of the Human Settlements Building at Capiñahan. The propagules were collected from Bindoy, Talabong (Figure 3) and Ulugan, Palawan. These were allowed to germinate in plastic bags filled with soil for about two months or more, depending on the species germinated (Figure 4).

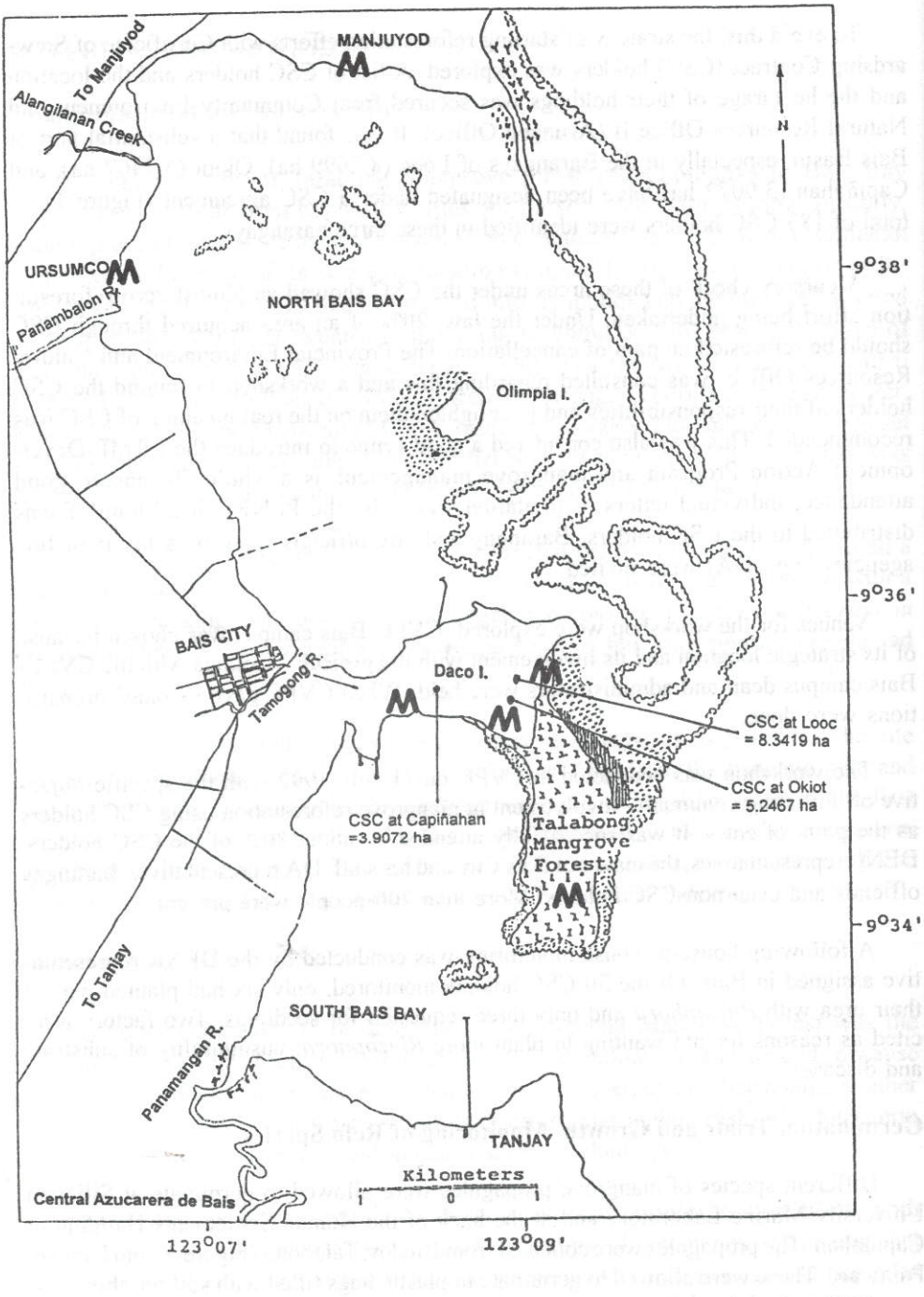

Figure 1. **Map of Bais Bay indicating mangrove reforestation sites (M).**

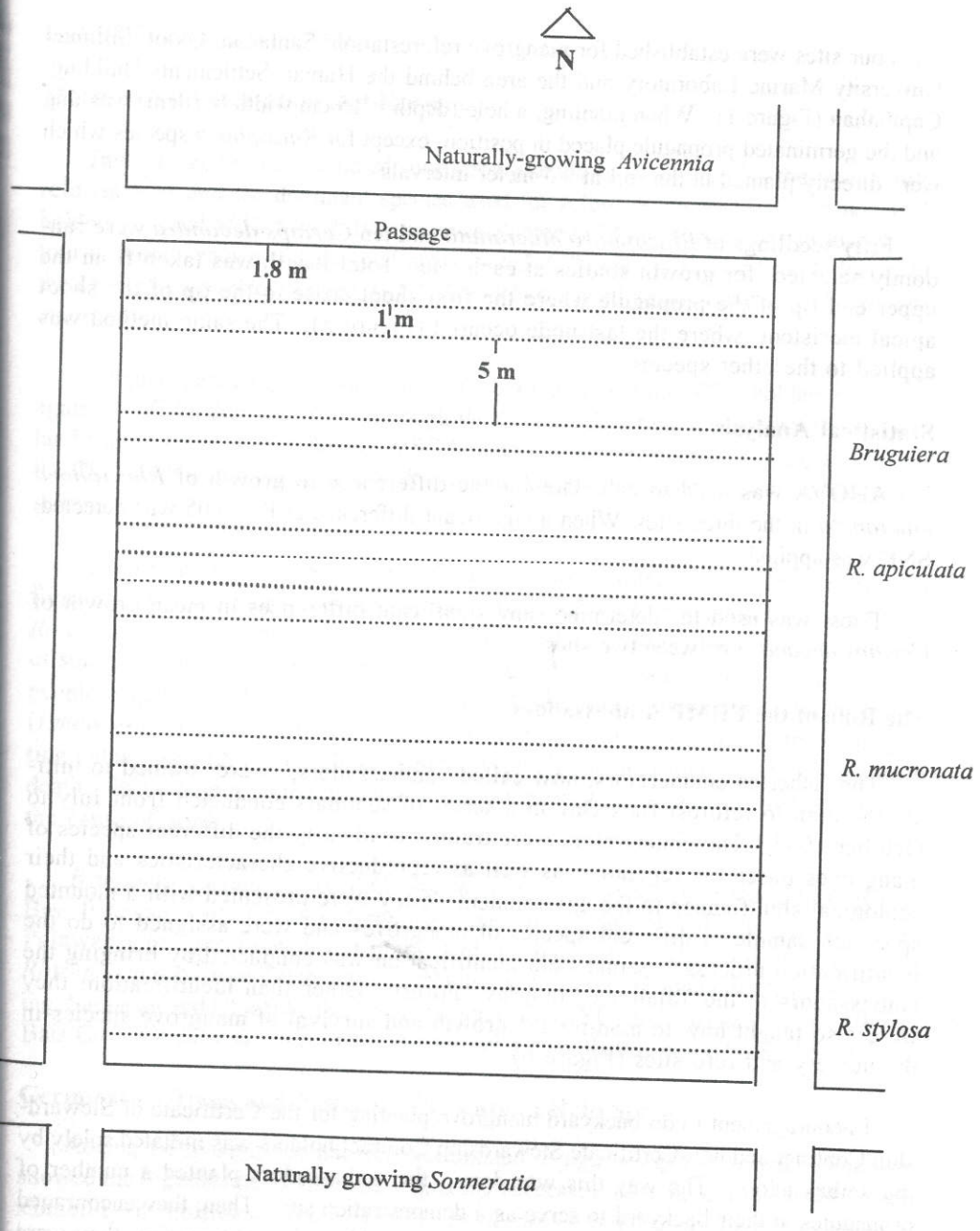

Figure 2. Schematic diagram of the nursery site in CVPC/SU-ERMP (Bais).

Four sites were established for mangrove reforestation: Sanlagan, Okiot, Silliman University Marine Laboratory and the area behind the Human Settlements Building, Capiñahan (Figure 1). When planting, a hole (depth = 15 cm,width = 10cm) was dug and the germinated propagule placed in position, except for *Rhizophora* species which were directly planted in the soil at 0.5 meter intervals.

Fifty seedlings of *Rhizophora mucronata* and ten *Ceriops decandra* were randomly selected for growth studies at each site. Total length was taken from the upper end tip of the propagule where the first shoot arose to the tip of the shoot apical meristem where the last node occured (Figure 5). The same method was applied to the other species.

Statistical Analysis

ANOVA was used to calculate for the differences in growth of *Rhizophora mucronata* in the three sites. When a significant difference at P = 0.05 was detected, SNK was applied.

T-test was used to determine any significant differences in mean growth of *Ceriops decandra* between two sites.

The Role of the ERMP Ambassadors

The fisheries enumerators, now called "ambassadors," were trained to initiate the plan to reforest Bais Bay in a series of seminars conducted from July to October 1993. The enumerators were trained to identify the different species of mangroves based on vegetative as well as reproductive characteristics and their ecological significance to the environment. They were presented with a mounted specimen sample of different species of mangroves and were assigned to do the identification process. Actual field identification was conducted by bringing the ambassadors to the Talabong Mangrove Forest. Other than identification, they were also taught how to monitor the growth and survival of mangrove species in the nursery and refo sites (Figure 6).

Encouragement to do backyard mangrove planting for the Certificate of Stewardship Contract and non-Certificate Stewardship Contract holders was initiated solely by the ambassadors. The way this was done, the ambassadors planted a number of propagules at their backyard to serve as a demonstration site. Then, they encouraged at least five community members to do the same. Using a questionnaire, they were also given the task of surveying the present status of mangrove reforestation done by CSC and non-CSC holders.

RESULTS AND DISCUSSION

Mangrove Reforestation and Nursery

Table 1 shows the estimated total area planted to mangrove by the community, refo survival and the dominant species used for reforestation by CSC and non-CSC holders. A total of 18.5 ha in 10 sitios was planted to 253,074 mangrove propagules of four different species. Of the total area planted, 65% was owned by CSC holders. Of the 253,074 propagules planted, 101,128 or 40% survived. Most of these are *Rhizophora mucronata*.

A higher percentage of survival was recorded among non-CSC holders (68%) as against CSC holders (19.6%); although the CSC holders own a significant amount of land (about twice that of the non-CSC holders). These results do not augur well for the CSC holders, calling for a re-evaluation of this strategy as a mangrove management scheme.

According to a survey conducted by a representative of the Department of Evironment and Natural Resources, only six members had planted their area with *Rhizophora* spp. and only three requested for seedlings. Many cited the unsuitability of substrates and diseases as reasons for not planting. In some areas like Dungguan, people complained that the area was quite exposed and that sometimes algal bloom (*Enteromorpha intestinalis* and *Rhizoclonium* sp.) occurred, resulting in the algae getting entangled with the seedlings, which eventually stunted their growth leading to death. Still others reported predator attacks (*Crassostrea* sp. and *Cardissoma* sp.) as the cause of death.

Bruguiera gymnorrhiza and *Ceriops tagal* were two species collected from Honda Bay, Palawan while *Ceriops decandra* came from Talabong. The two species from Palawan were germinated and planted at the back of SUML while *Ceriops* and *Rhizophora* spp. from Talabong were planted at Bais Bay (Human Settlements Building, Sanlagan and Okiot) by the Rotary Youth Club (RYC) and the students of CVPC in Bais City. *Ceriops decandra* from Bindoy were also planted at the back of SUML.

Germination Trials and Patterns of Growth in Refo Species

Among the five species that were germinated, *Bruguiera gymnnorhiza* of Palawan showed the highest rate of survival, indicating successful adaptation to its location and suitability of substrates (Table 3). *Ceriops decandra* and *Ceriops tagal* showed very low survival rates, which was probably due to heat exposure at the time of planting and the lack of water, as the area they were planted to could not be reached by seawater even at high tide. In addition, the seedlings in the Panambalon area were eaten by

Figure 3. Talabong Mangrove Forest as one of the major sources of propagules.

Figure 4. Germinating of propagules in plastic bags.

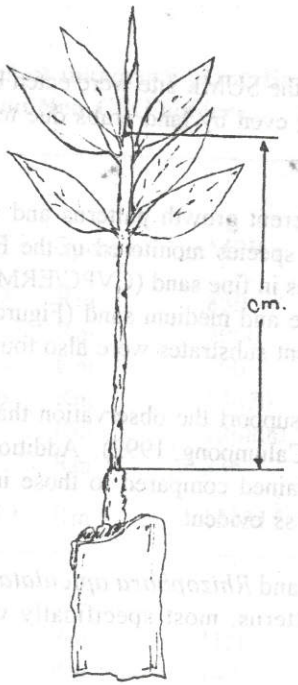

Figure 5. Growth measurement of mangrove.

Figure 6. Monitoring of growth and survival rates by the ambassadors.

goats and sheep while those at the SUML site were eaten by land crabs. *Ceriops* spp. are very susceptible to grazing even by land crabs due to their small and soft young leaves.

Each species showed different growth patterns and survival rates (Table 4 and Figures 7-9). Among the four species monitored in the Bay, *Rhizophora mucronata* showed the highest growth rates in fine sand (CVPC/ERMP site) compared to those in substrates dominated by coarse and medium sand (Figure 7). Differences of growth in *Ceriops decandra* in different substrates were also found (Figure 8).

The results of this study, support the observation that different species have different affinities to substrates (Calumpong, 1992). Additionally, from February to July, slower growth rates were obtained compared to those in August to October, which makes the effect of water stress evident.

Bruguiera gymnnorhiza and *Rhizophora apiculata* (Figure 9) demonstrate different growth habits and patterns, most specifically with regard to substrate affinities (Table 5).

Talabong Mangrove Park

Plans to convert the Talabong Mangrove Forest into a Mangrove Park materialized in the later part of 1992. The Department of Tourism approved and funded a 12- room hotel in Okiot and the City government constructed a ferry terminal in Hindungawan. Board walks were being constructed in Talabong. The next step is to put up labels and do enrichment plantings.

SUMMARY AND RECOMMENDATIONS

A core group of Bais Bay residents (10 ambassadors) were trained in community organizing, information dissemination, mangrove refo technology and techniques in encouraging community participation. Also, teachers and students at the Central Visayas Polytechnic College (CVPC), Bais campus, were included in these trainings. This group represents a big potential that can be tapped to facilitate community-based mangrove management in Bais Bay.

Silliman University workers, together with the ambassadors, have identified the species suitable for reforestation in specific substrates as well as the available sources of propagules. They have looked at the germination performance, the growth rates of some of these species, and some problems associated with reforestation. With these information, reforestation efforts can now proceed at a more systematic pace.

Table 1. Estimated area of mangrove plantation in North and South Bais Bay of CSC and Non-CSC holders.

Location	Area(m^2)	Species	MPP	MTS	% Survival
CSC Holder					
A	3309.102	Rm	850	203	23.9
C	226	Rm	2060	120	5.8
D	3030	Rm	600	20	33.3
E	7920.486	Rm	13670	6465	47.3
H	102750	Rm	126800	21400	16.9
J	1097	Rm	335	91	27.2
Subtotal	118332.59	Rm	144315	28299	
Non-CSC Holder					
A	125	Rm	1150	15	1.3
B	124	Rm	140	7	5.0
C	102	Rm	130	67	51.5
E	41	Rm	520	310	59.6
F	7256	Rm;Bg;Cd	22119	19480	88.1
G	4900	Rm;Ra	24300	20320	83.6
H	39225	Rm	48000	20450	42.6
I	15675	Rm	12200	12050	98.7
J	20	Rm;Ra	200	130	65
Subtotal	67468		108759	72829	
Overall total	185800.59		253074	101128	

LEGEND:
A=Okiot, B=Lag-it, C=Cabiloy, D=Canibol, E=Sanlagan, F=Batugan, G=Opao, H=Dungguan, J=Campuyo, I=Capiñahan

MPP=Mangrove propagules planted
MTS=Mangrove tree surviving
CSC=Certificate of Stewardship Contract

Species:
Rm=*Rhizophora mucronata*, Bg=*Bruguiera gymnorrhiza*
Ra=*Rhizophora apiculata*, Cd=*Ceriops decandra*

Table 2. Percent germination rates in different substrates.

Species	Source	Substrate	Number	Date Germinated	%Survival
B. *gymnorrhiza*	Bais	sandy	515	September 1992	40.30
C. *decandra*	Bais	sandy/muddy	250	September 1992	44.00
C. *decandra*	Bais	sandy/muddy	100	March 1992	0
B. *gymnorrhiza*	Palawan	sandy	125	June 1992	71.30
C. *tagal*	Palawan	sandy	100	June 1992	0
B. *gymnorrhiza*	Palawan	sandy	-	July 1993	83
C. *tagal*	Palawan	sandy	-	July 1993	70
A. *marina*	Bais	muddy/sandy	15	September 1993	* 0
C. *decandra*	Bais	sandy/muddy	475	September 1993	* 0
X. *granatum*	Bais	sandy	10	September 1993	* 0

*eaten by goats

Table 3. Summary of substrate analysis in different refo sites.

	SITES		
	CVPC/ERMP	CAPIÑAHAN	SANLAGAN
Classification	% Composition	%Composition	%Composition
Very coarse sand	12.71	16.94	24.21
Coarse sand	20.40	21.34	23.03
Medium sand	17.48	18.12	16.24
Fine sand	28.78	21.64	19.45
Very Fine sand	12.35	10.30	9.08
Silt	8.27	11.68	8.03

Table 4. Summary of growth and percent survival of the refo species. (N=50)

Site	Species	Initial Growth(I_o)	Final Growth (I_f)	Growth (cm/mo) Rate	Survival
CVPC/ERMP	Rm	28.57	40.91	50.82 ±1.21	76
Capiñahan	Rm	3.72	47.04	29.62 ±5.62	73
	Cd	1.37	8.41	4.85 ±1.21	48
Sanlagan	Rm	3.72	62.3	31.19 ±3.37	52
	Ra	6.82	29.53	25.20 ±1.47	48
	Cd	0.38	14.68	7.08 ±1.09	52.5
SUML	Bg	5.71	23.56	29.58 ±2.38	76.92

Rm=*Rhizophora mucronata*
Cd=*Ceriops decandra*
Ra=*Rhizophora apiculata*
Bg=*Bruguiera gymnorrhiza*

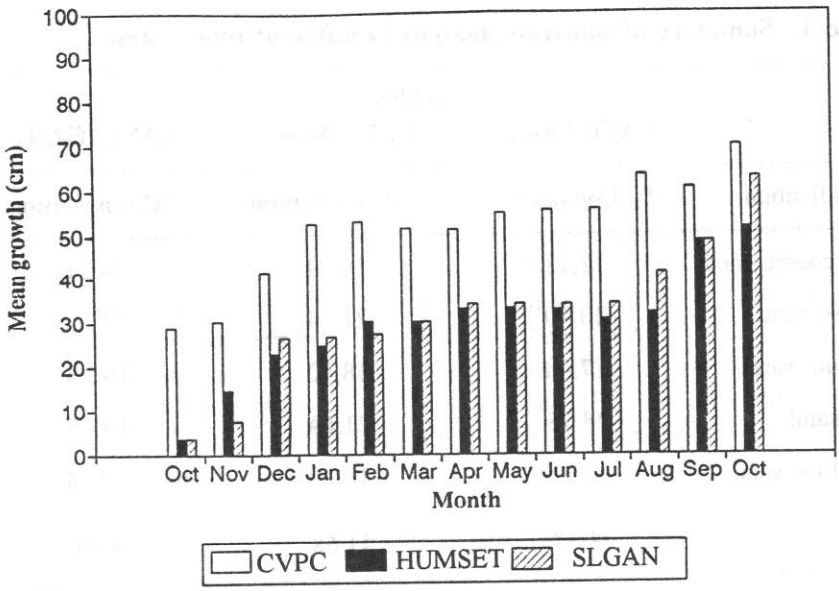

Figure 7. **Monthly growth of *Rhizophora mucronata* in nursery and refo sites. Okiot (CVPC); Capiñahan (HumSet); Sanlagan (SLGAN) (N=50).**

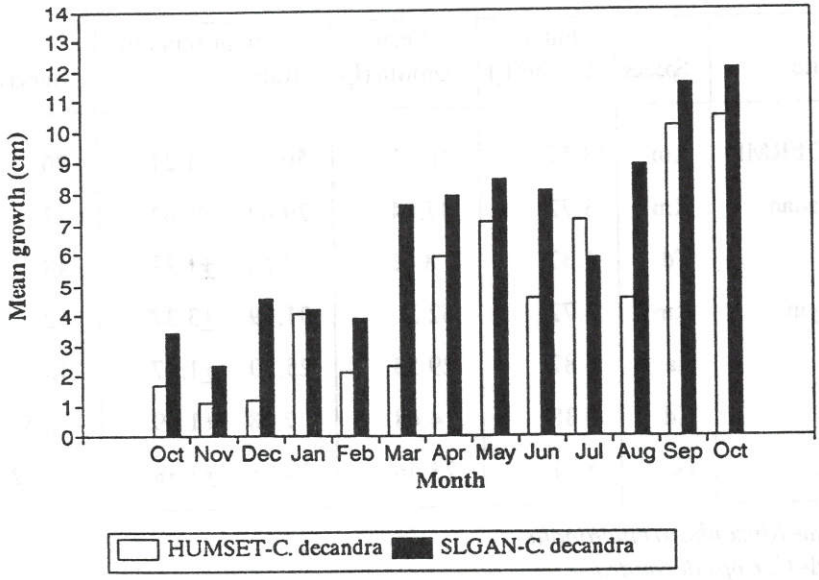

Figure 8. **Monthly growth of *Ceriops decandra* in Capiñahan (HumSet) and Sanlagan (SLGAN). (N=10).**

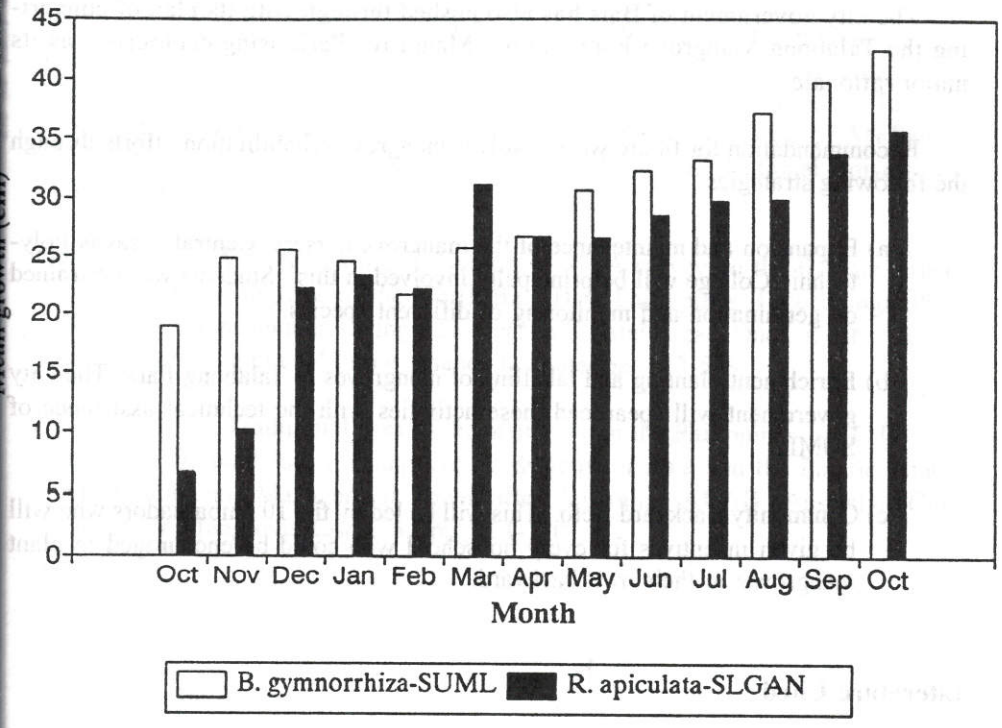

Figure 9. **Monthly growth of *Rhizophora apiculata* and *Bruguiera gymnorrhiza* in Sanlagan (SLGAN) and SU-Marine Laboratory (SUML). (N=10).**

The city government of Bais has also pushed through with its plan of converting the Talabong Mangrove Forest into a Mangrove Park using ecotourism as its major rationale.

Recommendation for future work involves mangrove rehabilitation efforts through the following strategies:

a) Expansion and maintenance of the mangrove nursery. Central Visayas Polytechnic College will be principally involved in this. Students will be trained on germination and monitoring of different species.

b) Enrichment planting and labelling of mangroves in Talabong Park. The City government will spearhead these activities with the technical assistance of SUML.

c) Community Backyard Refo. This will be led by the 10 ambassadors who will be given incentives for every household who could be encouraged to plant mangroves in their own backyard.

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