RESULTS OF PERMEABILITY TEST

NOVEMBER 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

I . INTRODUCTION

1.1 General

In the framework of the Development Study on Wastewater Disposal for Denpasar, The Japan International Cooperation Agency (JICA) gives an assignment to CV. VEYGASI DISAIN to conduct the Permeability Test for Soil of Denpasar and its surroundings.

1.2 Background

Bali is one of the main tourism destination in Indonesia, has been developed as an International tourism destination. The number of tourists visiting Bali has been increasing from year to year, and Denpasar as the center of tourism has no sewerage system. To design sewerage system its need much data and permeability test is one of them.

1.3 Objective of the work

The objectives of the work are :

- to analyze the soil for various types of sample
- to know the permeability for various types soil.

1.4. Scope of Work

The study area of this work covers Kabupaten Badung.

The number of samples 10 points

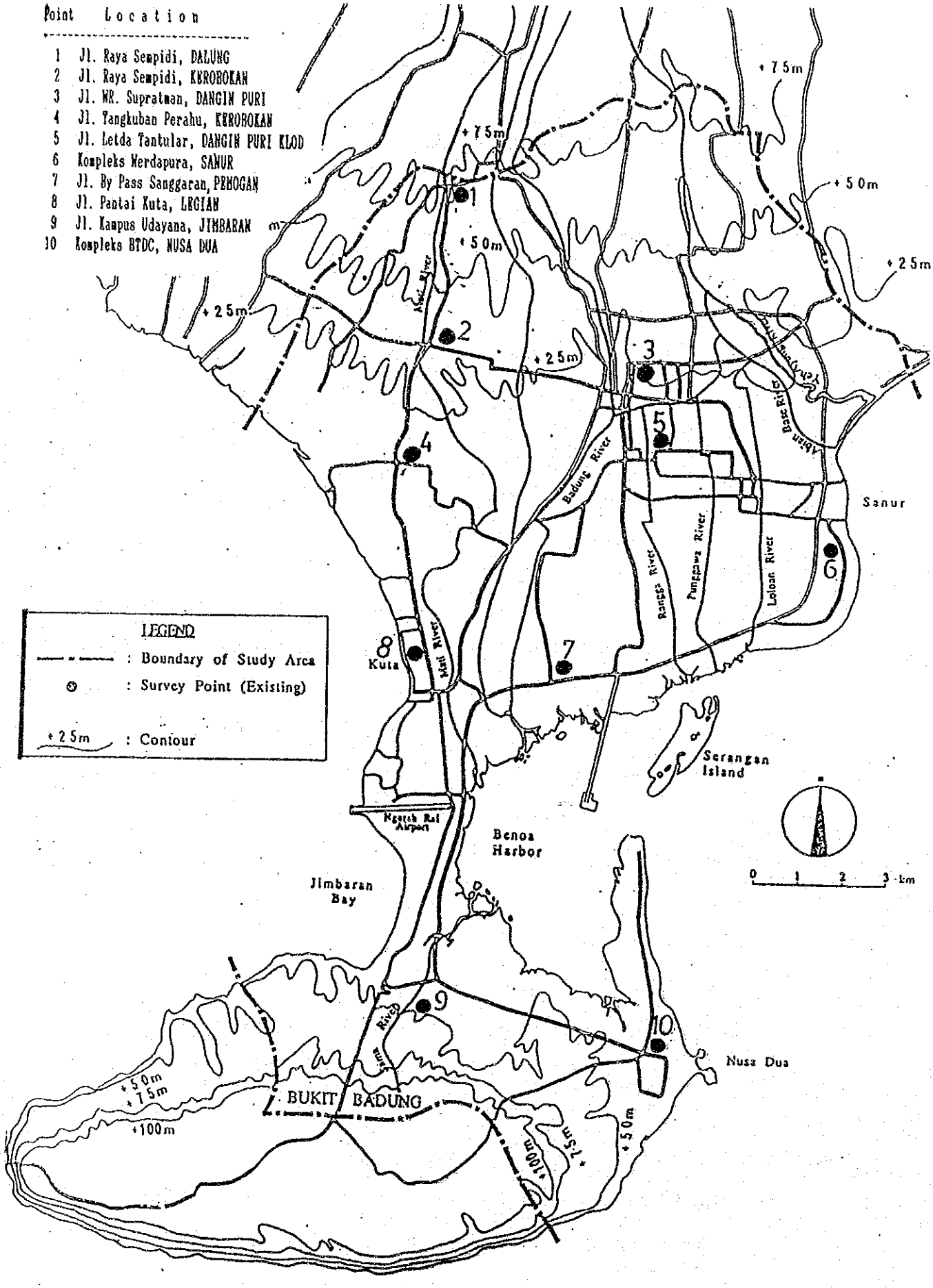


Fig. 1 Location of Permeablity Test Sampling Point

II. SAMPLING

CV. VEYGASI DISAIN

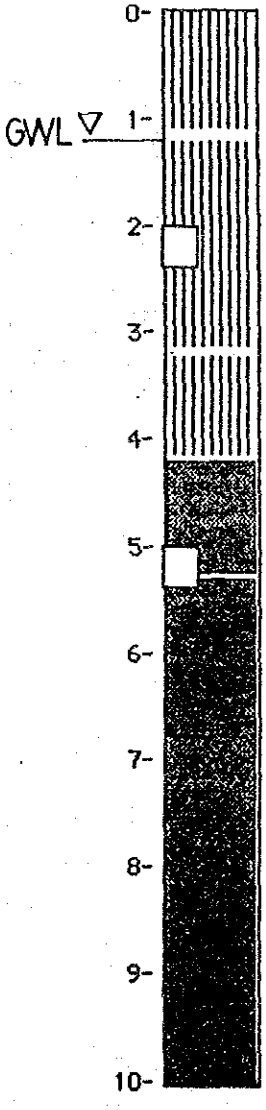
JL. TUKAD UNDA V/2 DENPASAR

BORING REPORT FOR PERMEABILITY TEST SAMPLING AT DENPASAR

BOR NUMBER : 1
LOCATION : SEMPIDI
GROUND WATER LEVEL : -1.1

BOR MASTER : WIRYASUTHA
DATE TO START : 23-12-91

DEPTH BOR-LOG DESCRIPTIONS



Depth : 0.0 - 1.1.
Sandy clay , with a little amount of fine to medium sand. The colour is grey to black. The condition of the clay is soft.

Depth : 1.1 - 3.2 .
Sandy clay . The sand is medium sand. Also content alittle amount of gravel. Gravel's diameter 1.0 to 2.0 cm . The colour is grey . The condition of the clay is soft.

Depth : 3.2 - 4.2.
Medium Clay . The colour is grey.

Depth : 4.2 - 5.3.
Rocky ground (cadas). Content alittle amount of silt and gravel. The Rocky ground is hard, and the colour is grey to black.

Depth : 5.3 - 10.0.
Compact Rocky ground (cadas). The Rocky ground is hard, and the colour is grey to black.

□ Undisturb sampling for Laboratoty Permeability Test

▽ Ground water level

CV. VEYGASI DISAIN

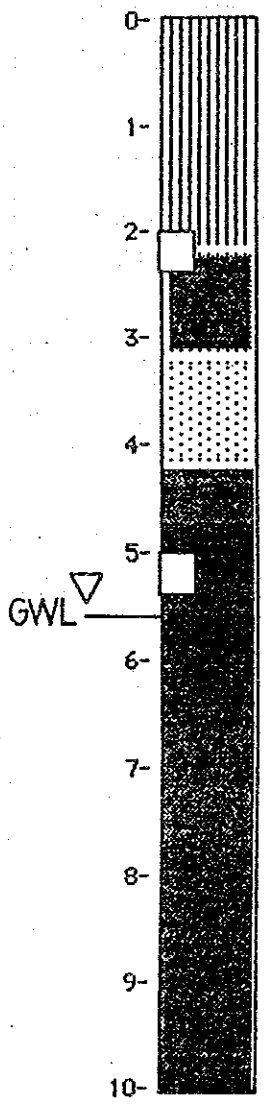
JL. TUKAD UNDA V/2 DENPASAR

BORING REPORT FOR PERMEABILITY TEST SAMPLING AT DENPASAR

BOR NUMBER : 2
LOCATION : KEROBOKAN
GROUND WATER LEVEL : -5.8

BOR MASTER : WIRYASUTHA
DATE TO START : 28-12-91

DEPTH BOR-LOG DESCRIPTIONS



Depth : 0.0 - 2.2.
Silty clay . The colour is dark brown. The condition of the clay is medium.

Depth : 2.2 - 3.2.
Rocky ground (cadas). The Rocky ground is soft to medium , and the colour is browny white .

Depth :3.2 - 4.3.
Medium to coarse sand, content gravel 2.0 to 4.0 diameter. The colour is browny white.

Depth 4.3 - 10.0
Compact Rocky ground (cadas). The Rocky ground is hard, and the colour is brown to black.

□ Undisturb sampling for Laboratoty Permeability Test

▽ Ground water level

CV. VEYGASI DISAIN

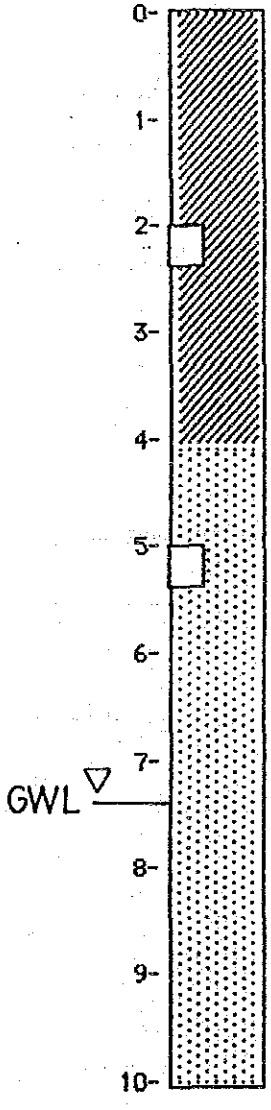
JL. TUKAD UNDA V/2 DENPASAR

BORING REPORT FOR PERMEABILITY TEST SAMPLING AT DENPASAR

BOR NUMBER : 3
LOCATION : Jalan Supratman
GROUND WATER LEVEL : -8.4

BOR MASTER : WIRYASUTHA
DATE TO START : 26-12-91

DEPTH	BOR-LOG	DESCRIPTIONS



Depth 0.0 - 4.0.
Soft Sandy silt. The colour is light brown to grey. The sand is coarse sand and just a little amount. Sometimes meets gravel 0.5 to 1.0 cm diameter.

Depth : 4.0 - 10.0.
Gravelly coarse sand, content a little amount of clay . The gravel's diameter 0.5 to 1.0 . The conditions sand is dense sand . The colour is black.

□ Undisturb sampling for Laboratoty Permeability Test

▽ Ground water level

CV. VEYGASI DISAIN

JL. TUKAD UNDA V/2 DENPASAR

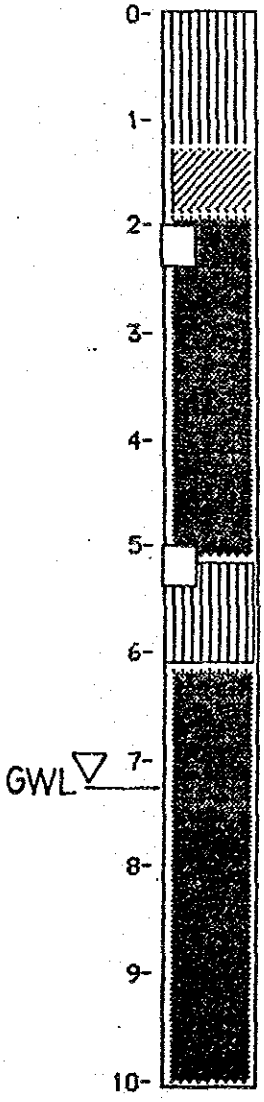
BORING REPORT FOR PERMEABILITY TEST SAMPLING AT DENPASAR

BOR NUMBER : 4 BOR MASTER : WIRYASUTHA

LOCATION : Jl. Tangkuban Perahu DATE TO START : 28-12-91

GROUND WATER LEVEL : -7.2

DEPTH	BOR-LOG	DESCRIPTIONS



Depth : 0.0 - 1.3
Soft to Medium Clay . The colour is grey.

Depth : 1.3 - 1.9
Medium to stiff gravelly Silt. The gravel is from the desintegration of softy Rocky ground (cadas). The colour is brown.

Depth : 1.9 - 5.2
Rocky ground (cadas). The Rocky ground is soft to medium , and the colour is browny white .

Depth : 5.2 - 6.1
Medium to Stiff Clay with a little amount gravel from soft Rocky ground, diameter 0.5 - 2.0 cm. The colour is light grey.

Dept 6.1 - 10.0
Compact Rocky ground (cadas). The Rocky ground is hard, and the colour is brown to black.

□ Undisturb sampling for Laboratoty Permeability Test

▽ Ground water level

CV. VEYGASI DISAIN

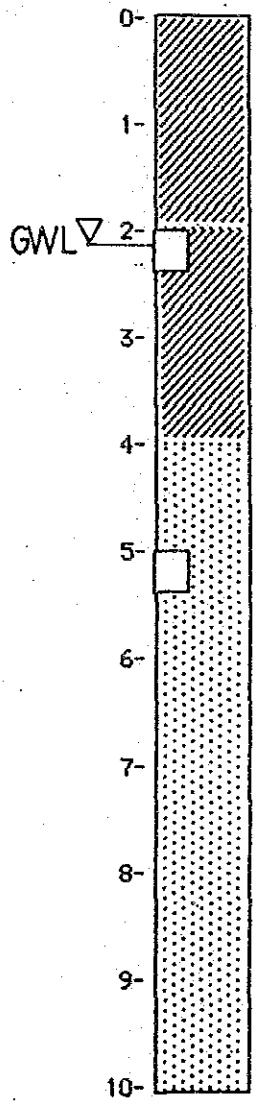
JL. TUKAD UNDA V/2 DENPASAR

BORING REPORT FOR PERMEABILITY TEST SAMPLING AT DENPASAR

BOR NUMBER : 5
LOCATION : Jln. Letda Tantular
GROUND WATER LEVEL : -2.1

BOR MASTER : WIRYASUTHA
DATE TO START : 26-12-91

DEPTH	BOR-LOG	DESCRIPTIONS



Depth : 0.0 - 1.9
Very soft Sandy Silt. The sand just a little amount, and medium sand. The colour is dark brown.

Depth : 1.9 - 4.0
Medium Sandy silt. The sand is just a little amount, and fine to medium sand. The colour Dark brown to dark grey.

Depth 4.0 - 10.0.
Dense silty sand, content gravel 1.0 to 5.0 cm diameter. The colour is brown to black.

Compact Rocky ground (cadas). The Rocky ground is hard, and the colour is brown to black.

□ Undisturb sampling for Laboratoty Permeability Test

▽ Ground water level

CV. VEYGASI DISAIN

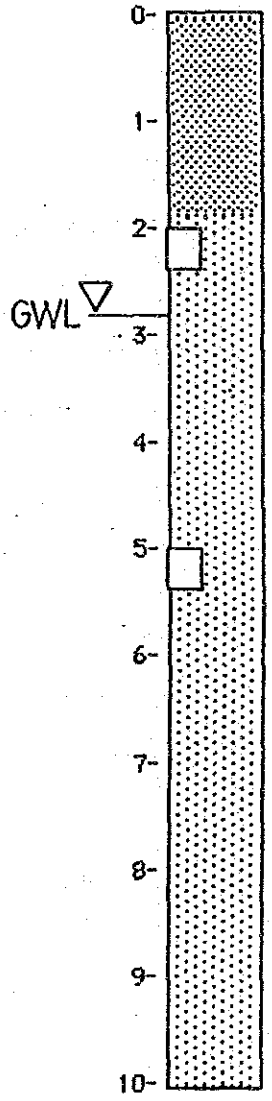
JL. TUKAD UNDA V/2 DENPASAR

BORING REPORT FOR PERMEABILITY TEST SAMPLING AT DENPASAR

BOR NUMBER : 6
LOCATION : SANUR
GROUND WATER LEVEL : -2.9

BOR MASTER : WIRYASUTHA
DATE TO START : 2 - 1 - 92

DEPTH	BOR-LOG	DESCRIPTIONS



Depth : 0.0 - 1.9
Fine to medium Beach sand and loose. The colour is white to light brown. This sand is from desintegration of coral and sea shell.

Depth : 1.9 - 4.0
Medium to coarse Beach Sand and loose. The sand is from desintegration of coral and sea shell . The colour is white to light brown . Sometimes met gravel from the desintegration of coral.

☐ Undisturb sampling for Laboratoty Permeability Test

▽ Ground water level

CV. VEYGASI DISAIN

JL. TUKAD UNDA V/2 DENPASAR

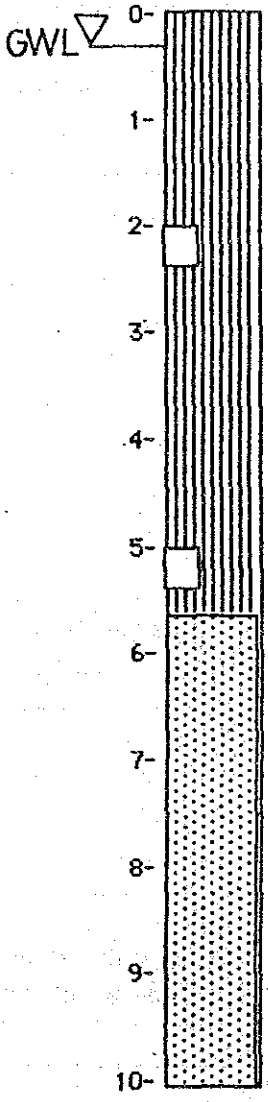
BORING REPORT FOR PERMEABILITY TEST SAMPLING

BOR NUMBER : 7 BOR MASTER : WIRYASUTHA

LOCATION : Jln. By Pas Sanggaran DATE TO START : 2-1-92

GROUND WATER LEVEL : -0.3 m

DEPTH	BOR-LOG	DESCRIPTIONS



Depth : 0.0 - 5.6
Sandy clay , with a little amount of fine to medium sand. The colour is grey to black. The condition of the clay is very soft. The clay is sediment.

Depth : 5.6 - 10.0
Soft Clayly sand . The clay is Sediment. The sand is fine sand. The colour is black.

□ Undisturb sampling for Laboratoty Permeability Test

▽ Ground water level

CV. VEYGASI DISAIN

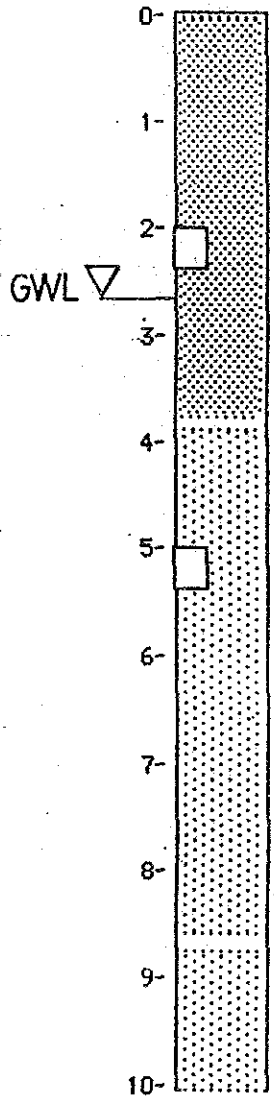
JL. TUKAD UNDA V/2 DENPASAR

BORING REPORT FOR PERMEABILITY TEST SAMPLING AT DENPASAR

BOR NUMBER : 8
LOCATION : Pantai Kuta
GROUND WATER LEVEL : -2.8

BOR MASTER : WIRYASUTHA
DATE TO START : 4-1-92

DEPTH	BOR-LOG	DESCRIPTIONS



Depth : 0.0 - 3.8
Fine to medium Beach sand and loose. The colour is white to light brown. This sand is from desintegration of coral and sea shell.

Depth : 3.8 - 8.6
Fine to medium Beach sand and in medium conditions. The colour is white to light brown. This sand is from desintegration of coral and sea shell.

Depth : 8.6-10.0
Medium to coarse Beach Sand and loose. The sand is from desintegration of coral and sea shell . The colour is white to light brown . Sometimes met gravel from the desintegration of coral.

□ Undisturb sampling for Laboratoty Permeability Test

▽ Ground water level

CV. VEYGASI DISAIN

JL. TUKAD UNDA V/2 DENPASAR

BORING REPORT FOR PERMEABILITY TEST SAMPLING AT DENPASAR

BOR NUMBER : 9

LOCATION : JIMBARAN (TO CAMPUS)

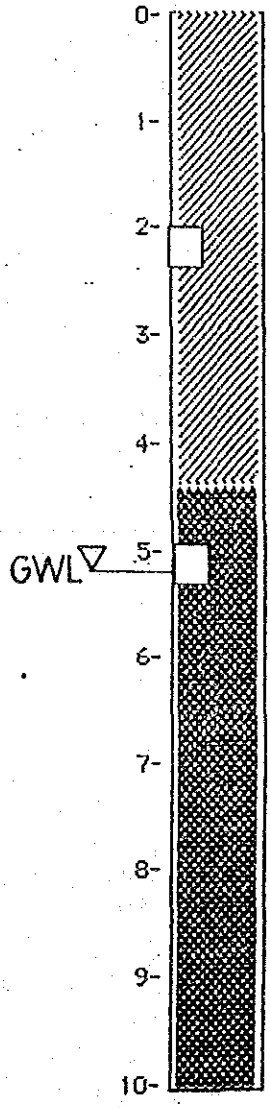
GROUND WATER LEVEL : -5.2

BOR MASTER : VIRYASUTHA

DATE TO START : 9-1-92

SOIL MECH. ENG. : KETUT KINOG

DEPTH	BOR-LOG	DESCRIPTIONS



Depth : 0.0 - 4.4 m
Stiff silt, the colour is brown. Some times met a litle amount trh fractions of lime stone, diameter 2 cm - 5,0 cm.

Depth : 4.4 - 10 m.
Hard Limestone. The condition some times compact and fresh, and part of it decayed . The colour is white, mixed with brown.

□ Undisturb sampling for Laboratoty Permeability Test

▽ Ground water level

CV. VEYGASI DISAIN

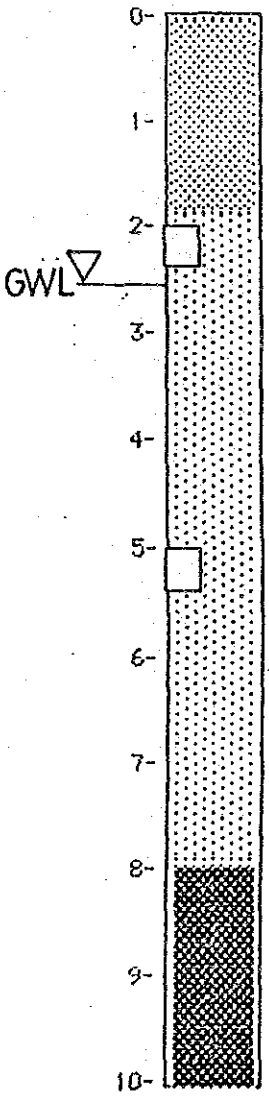
JL. TUKAD UNDA V/2 DENPASAR

BORING REPORT FOR PERMEABILITY TEST SAMPLING AT DENPASAR

BOR NUMBER : 10
LOCATION : NUSA DUA (BTDC)
GROUND WATER LEVEL : -2.6

BOR MASTER : WIRYASUTHA
DATE TO START : 9-1-92
SOIL MECH. ENG. : KETUT KINOO

DEPTH BOR-LOG DESCRIPTIONS



Depth : 0.0 - 4.5
Fine to medium Beach sand and loose. The colour is white to light brown. This sand is from desintegration of coral and sea shell.

Depth : 4.5 - 7.9
Medium to coarse Beach Sand and loose. The sand is from desintegration of coral and sea shell . The colour is white to light brown . Sometimes met gravel from the desintegration of coral.

Depth : 7.9 - 10
Medium to coarse Beach Sand and loose. The sand is from desintegration of coral and sea shell . The colour is white to light brown . Sometimes met gravel from the desintegration of coral.

☐ Undisturb sampling for Laboratoty Permeability Test

▽ Ground water level

III. LABORATORY ANALYSIS

SOIL MECHANICS LABORATORY

LABORATORY PERMEABILITY TEST

Location	Bor Num.	Sample Num.	Depth (m)	Test Num.	A (cm2)	L (cm)	h (cm)	t (sec)	Q (cm3)	k (cm/sec)	k avr. (cm/sec)	Soil Identification
Sempidi	1	1.1	2,00	1	34,23	4,50	72,0	2.650	8,0	5,5E-06	5,7E-06	sandy clay
				2	34,23	5,00	72,0	3.100	7,0	4,6E-06		
				3	34,23	5,00	72,0	2.890	10,0	7,0E-06		
		1.2	5,00		could not be tested						0,0E+00	rocky ground
Kerobokan	2	2.1	2,00	1	34,23	2,3	200,0	5666	3,0	1,8E-07	3,4E-07	silty clay
				2	34,23	3,8	200,0	4234	4,0	5,2E-07		
				3	34,23	3,4	200,0	4787	3,0	3,1E-07		
		2.2	5,00		could not be tested						0,0E+00	rocky ground
Jl.Supratman	3	3.1	2,00	1	34,23	4,80	72,0	2.904	13,0	8,7E-06	7,7E-06	sandy silt
				2	34,23	5,00	72,0	2.801	9,0	6,5E-06		
				3	34,23	5,10	72,0	2.877	11,0	7,9E-06		
		3.2	5,00	1	34,23	6,40	56,0	1.941	57,0	9,8E-05	1,6E-04	coarse sand
				2	34,23	6,20	56,0	1.618	60,0	1,2E-04		
				3	34,23	6,80	56,0	894	63,0	2,5E-04		
Jl.T. Perahu	4	4.1	2,00		could not be tested						0,0E+00	rocky ground
		4.2	5,00	1	34,23	2,20	200,0	7.222	1,5	6,6E-08	8,2E-08	medium clay
				2	34,23	2,40	200,0	6.454	2,0	1,1E-07		
				3	34,23	2,20	200,0	7.012	1,5	6,9E-08		
Jl.L. Tantular	5	5.1	2,00	1	34,23	5,00	72,0	3.102	4,0	2,6E-06	8,8E-06	sandy silt
				2	34,23	5,10	72,0	2.910	11,0	7,8E-06		
				3	34,23	5,50	72,0	2.644	19,0	1,6E-05		
		5.2	5,00	1	34,23	6,20	56,0	612	53,0	2,8E-04	2,4E-04	silty sand
				2	34,23	7,00	56,0	555	35,0	2,3E-04		
				3	34,23	5,60	56,0	431	31,0	2,1E-04		

POLITEKNIK UDAYANA UNIVERSITY
SOIL MECHANICS LABORATORY

LABORATORY PERMEABILITY TEST

Location	Bor Num.	Sample Num.	Depth (m)	Test Num.	A (cm2)	L (cm)	h (cm)	t (sec)	Q (cm3)	k (cm/sec)	k avr. (cm/sec)	Soil Identification
Sanur	6	6.1	2,00	1	34,23	11,20	56,0	64	92,0	8,4E-03	8,1E-03	beach sand
				2	34,23	12,40	56,0	73	83,5	7,4E-03		
				3	34,23	13,90	56,0	67	79,5	8,6E-03		
		6.2	5,00	1	34,23	14,1	56,0	115	73,5	4,7E-03	7,4E-03	beach sand
				2	34,23	14,5	56,0	61	71,0	8,8E-03		
				3	34,23	14,5	56,0	63	72,5	8,7E-03		
Sanggaran	7	7.1	2,00	1	34,23	4,50	72,0	2.152	4,0	3,4E-06	5,8E-06	sandy clay
				2	34,23	4,20	72,0	2.502	11,0	7,5E-06		
				3	34,23	4,70	72,0	2.588	9,0	6,6E-06		
		7.2	5,00	1	34,23	4,50	72,0	3.233	5,0	2,8E-06	2,3E-06	sandy clay
				2	34,23	4,80	72,0	2.944	5,0	3,3E-06		
				3	34,23	4,60	72,0	4.323	2,0	8,6E-07		
Pantai Kuta	8	8.1	2,00	1	19,64	14,00	60,0	71	285,0	3,0E-02	2,7E-02	beach sand
				2	19,64	14,60	60,0	107	438,0	3,1E-02		
				3	19,64	12,80	60,0	74	124,0	1,9E-02		
		8.2	5,00	1	34,23	12,80	60,0	61	90,0	9,2E-03	8,8E-03	beach sand
				2	34,23	14,10	60,0	61	97,7	1,1E-02		
				3	34,23	14,50	60,0	70	60,5	6,1E-03		
Jimbaran	9	9.1	2,00	1	34,23	6,00	60,0	2.111	34,0	4,7E-05	8,6E-05	Stiff silt
				2	34,23	5,50	60,0	1.822	64,0	9,4E-05		
				3	34,23	5,30	60,0	1.335	60,0	1,2E-04		
		9.2	5,00		could not be tested						0,0E+00	lime stone
Nusa Dua	10	10.1	2,00	1	34,23	12,20	60,0	62	95,0	9,1E-03	7,3E-03	beach sand
				2	34,23	11,6	60,0	88	88,8	5,7E-03		
				3	34,23	11,8	60,0	79	97,6	7,1E-03		
		10.2	5,00	1	34,23	12,80	60,0	78	80,1	6,4E-03	6,2E-03	beach sand
				2	34,23	11,6	60,0	91	72,5	4,5E-03		
				3	34,23	12,5	60,0	76	96,2	7,7E-03		

POLITEKNIK UDAYANA UNIVERSITY
SOIL MECHANICS LABORATORY

LABORATORY PERMEABILITY TEST
(SUMMARY)

Location	Bor Num.	Sample Num.	Depth (m)	k avr. (cm/sec)	Soil Identification
Sempidi	1	1.1	2,00	5,7E-06	sandy clay
		1.2	5,00	NONE	rocky ground
Kerobokan	2	2.1	2,00	3,4E-07	silty clay
		2.2	5,00	NONE	rocky ground
Jl.Supratman	3	3.1	2,00	7,7E-06	sandy silt
		3.2	5,00	1,6E-04	coarse sand
Jl.T. Perahu	4	4.1	2,00	NONE	rocky ground
		4.2	5,00	8,2E-08	medium clay
Jl.L. Tantular	5	5.1	2,00	8,8E-06	sandy silt
		5.2	5,00	2,4E-04	silty sand
Sanur	6	6.1	2,00	8,1E-03	beach sand
		6.2	5,00	7,4E-03	beach sand
Sanggaran	7	7.1	2,00	5,8E-06	sandy clay
		7.2	5,00	2,3E-06	sandy clay
Pantai Kuta	8	8.1	2,00	2,7E-02	beach sand
		8.2	5,00	8,8E-03	beach sand
Jimbaran	9	9.1	2,00	8,6E-05	Stiff silt
		9.2	5,00	NONE	lime stone
Nusa Dua	10	10.1	2,00	7,3E-03	beach sand
		10.2	5,00	6,2E-03	beach sand

Denpasar, 16th January 1992

CV. VEYGASI DISAIN

IR. KETUT KINOG
Chief Engineer

RESULTS OF LAND USE, SOCIAL/CULTURAL ASPECT

AND

COMPREHENSIVE ECOLOGICAL SURVEY

NOVEMBER 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

Preface

The JICA Study Team entrusted the local consultant consisting of the following members,to carry out the survey on "Land Use,Social/ Cultural Aspect and Comprehensive Ecological Survey". The results are explained in the following sections.

Member List

1.	Prof.Dr. N.K.Mardani, MS	(Environmentalist,Coastal Specialist)
2.	Dr.Ir.Nyoman Merit	(Soil Scientist, hydrologist)
3.	Ir.Wayan Arthana, MS	(Environmentalist, Specialist of Mangrove)
4.	Ir.Wayan Rusna, MS	(Land use and Land Classification)
5.	Ir.Gusti Nyoman Sumatra	(Climatologist)
6.	IR.MADE Sudarma, MS	(Socio Economist and Culturalist)
7.	Ir.Wayan Resta	(Fisheriest and Specialist in Mangrove)
8.	Drs.I.Wayan Wirasa Sapanca	(Terrestrial Biologist)
9.	Ir.I Wayan Surata	(Engineer)
10.	I Ketut Budiawan, SH	(Surveyor Assistant)

Table of Contents

Research Report

Waste Water Treatment Plant

I. Introduction

In order to assist in formulating an environmental evaluation of the proposed waste water treatment plant by the "Development Study on Wastewater Disposal for Denpasar", a comprehensive survey need to be done. The survey area encompasses both the coastal inlands and coastal waters of Benoa Bay at south of Sanur bounded by the Ngurah Rai Bay-pass extends up to the Cape of Benoa.

The area is essentially swampy, known as Suwung Swamp, with dominated by mangrove forest. However, since 1984 the area has already converted to shrimp aquaculture ponds with subsequent loss of swamp and mangrove forests, mainly in Suwung area. By the end of 1992, those area will be reconverted to the mangrove forestation regarding to it function as an environmental stabilator.

The objective of this study is to formulating the baseline environmental analysis, regarding to the development of waste water treatment plant. There are two aspects need to be studied, the comprehensive ecological and social/cultural aspects.

II. Methodelogy

The study is carried out by doing a comprehensive survey on the ecological and social/cultural aspects. For social and cultural aspects, an intensive interview to the local community has been done. This include the aspects of the existing land use, annual land production, status of future land acquisition, cultural and historically important assests and social constraints. While the ecological survey is consist of collecting information on mangrove and benthos distribution along the study area. The existing coastal marine flora and fauna is also studied.

For mangrove distribution, twelve transects were established perpendicular to the coast line at Benoa Bay (See Map 2). Each transect was devided into several points (depend on the widht of the forest), and the distance between points was 50 m. The point was as a plot (10 X 10 m) arranged continuously. Within each plot, all mangrove trees which their diameter more than 7 cm is classified as a tree, while the others are as a cluster (seedlings). The diameter of plant, the distance to the point, and the height of the tree were measured. A same procedures were adopted for the seedling (cluster) in sub-plot of 5 X 5 m.

Five stations were established around the coast (see Map 1) in order to investigate the distribution of benthos (plankton, phytoplankton, zooplankton). Samples were collecting from each station and then it was indentified at Biological Laboratory at Udayana University.

The information of common fishes which are available around the study area was recorded by interviewing the local fisherman/local community.

III. Results

A. Comprehensive Land Use and Social/Cultural aspects:

1. The existing land use pattern:

The study area covered the land of about 2221.7 hectare, along the coast of West Sanur to Terora Beach of Tanjung Benoa, and boundarised by the Ngurah Rai Highway. The mangrove plantation has been recognized since 1927, of the total area of about 1.392 hectares. These mangrove plantation consisted of 838.2 hectares as a protected forest, 418.3 hectares as forest production and 135.5 hectares as a park (Forestry Department, 1989). However, those mangrove plantation has been changed in which about 393.8 hectares become shrimp ponds and another 56.976 hectares has been lent to another departments for several allocations, such as for Ceramic Research Centre, Sewage Treatment Plant Nusa Dua, Turtle Nursery, Waste Dumping, and road. Therefore, the real mangrove plantation was only 1235.776 hectares. Futhermore, in 1985, another 40 hectares of mangrove plantations at East Suwung has been planned as an alocation of the Cable Water Sky. Unfortunately, this project has been cancelled. Thereafter, since 1992, those area are being

converted into the mangrove forestation. Accordingly, the total area of the ma grove plantation while the survey is carried out is constant of about 1235.776 hectares.

The existing land use patterns are mainly allocated for :

- Manggrove plantation : 1235.776 hectares,
- Shrimp ponds : 393.8 hectares,
- Dry land : 971.04 hectares,
- Salt industry : 0.5 hectares,
- Rice field : 21.11 hectares, and
- Settlement : 135.97 hectares.

The main allocation of the land around the coast was for shrimp ponds which are under the supervision of the Fishery Departement, of the Province of Bali. On dry land, however, it was found the industrial estate, oil storage, power station,. Restaurant and petrol station (See Map 1).

The salt industry is basically belongs to the local farmers. The number of farmers which are being involved in salt processing is dramatically decreased since the shrimp ponds is introduced to the farmers. For the time being, there are only 10 farmers still active in producing salt. This is because of the some limitations faced by the farmers, such as the difficulties in getting up the fresh sea water as the ponds grew up, and the supply of fire wood for salt industry was strongly restricted by the local goverment.

2. The land ownership :

The land was mainly belongs to the Central goverment (Forestry Department), especially for the shrimp ponds and manggrove plantation. The local proverty is only for the rice field, salt processing and dry land for coconut plantation, and it was in small percentage compared to the total area of the study (Refer to the Existing Land Use).

3. The existing value of the land :

The information regarding to the value of the product of the land around the study area are rare, according to the interview of local farmers. The only information of shrimp ponds and salt production were available from the local goverment and local community of those area. The total value of the shrimp ponds production is about Rp. 30 million/hectare/harvest period (four months). There were three harvest periods per year, so that the total value of shrimp ponds is about Rp. 90 millions/hectare/year (equivalent to 12 ton shrimp/hectare/year). While the salt production is about Rp. 75,000 - 125,000/month/unit processor.

4. Status of future land acquisition :

Based on the goverment policy, the entire land of the coast is allocated for the development of mangrove forestry (The Agreement of the Governor of Bali, Number

522.4/23866/BKLH, 1988 and the Governor Instruction, Number : 12/1992). This is due to the extent of mangrove trees as an environmental stabilator. Therefore, the existing land use pattern, especially the shrimp ponds will be returned to the mangrove forestation. There will be a limit allocation of the land for the bussiness sector due to the environmental policy.

5. Cultural and historically important assets :

The study area is consisted of five small villages which is called "Dusun", such as Dusun Sanur Kawuh, Sidakarya, Pemogan, Jimbaran and Benoa. In each dusun, it was found some cultural and historical assets such as temple and grave. For instance, at West Sanur, there were five temples spreaded over the location, namely Pura Blanjong, Mertesari, Pengembak, Tirta Empul and Sukanata. However, at Dusun Sidakarya, it was only one temple, Pura Sakenan.

At the Pemogan, in which the waste water treatment plant is proposed, there were three temples, namely : Dalem Penataran, Pakedasan and Petasikan. Dalem Penataran is the biggest temple in those area, and it is being closely (150 m) from the shrimp pond area. The location of that temple is on the north part of the shrimp ponds. If the sewage treatment plant will be built up on the location of shrimp ponds while the location of the temple is on the sacral area (based on the Hindu's phylosophy), it was advisable that appropiate technology on waste treatment need to be adopted,

especially to eleminate the smell of the waste. This might be combined with the existancy of green belt as a protector for those problem and to keep the area estetically for over.

The most temples were located at Tanjung Benoa, spreading over the coast. It were : Segara Tanjung Benoa, Tengkulung, Batan Ketapang, Yeh Kuuk, Segara samah, Taman, Lamun, Geger, Barong, and Gung Payung. Three graves were also found at Tanjung Benoa (See Map 1).

6. Social constraints.

By interviewing some respondents from the local community around the area proposed waste water treatment plant, it was known that actually there is no social constraints regarding to the project. This is because of the land is belong to the goverment (Forestry Department). Generally, the local community need to know how to opercome the problem on smell, which may coming from the treatment plant and penetrating to the local community. Morevover, they also suggest that the project should also cove the local waste (from local community).

In order to minimize the negatif impact of the project, the application of an appropiate technology on watse water management, need to be done. The introduction of green belt around the treatment plant, could be as one solution in this matter.

B. Comprehensive ecological aspects :

1. Mangrove

The results of the study on the mangrove ecosystem showed that the dominant mangrove tree is *Sonneratia alba*, while the vegetation as a clusters is dominated by *Rhizophora mucronata*. The seedling composition was ranked into:

a. *Rhizophora mucronata*

b. *Bruguiera cylindrica*

c. *Aegiceras corniculatum*, and

d. *Sonneratia alba*.

Based on these facts, in the long term at Benoa Bay, the vegetation composition will be changed from *Sonneratia alba* to *Rhizophora mucronata*

The qualitative results show that there are six species of mangrove over the entire area, which are: *Sonneratia alba*, *Avicennia marina*, *Aegiceras corniculatum*, *Rhizophora mucronata*, *Bruguiera cylindrica* and *Ceriops tagal*.

Over the plant density basis, the most dent plant are as follows (Figure 2):

a. Line I (East Suwung I) : 900.18 plants/hectare

b. Line X (Jimbaran II) : 447.73 plants/hectare

c. Line VII (Tuban I) : 269.89 plants/hectare,

while the lowest plant density was found in line VI (West Suwung II) of about 84.20 plants/hectare (Table 15). This might be due to the plants in this area are relatively bigger and taller than the others. Therefore, the canopy

shading of the plant is become wider, so that the plant density is become higher.

The canopy shading of mangrove trees which are in clus ters, could be ranked into (Figure 3):

a. Line X (Jimbaran II) : 92.8 %

b. Line V (West Suwung I) : 64.58 %, and

c. Line IX (Jimbaran I) : 51.66 %.

The lowest canopy shading was found in line VIII (Tuban II) of about 12.65 % (Table 14).

On the other hand, however, the plant density based on the seedling composition could be ranked as follows (Figure 4):

a. Line X (Jmbaran II) : 18400 seedlings/hectare

b. Line V (West Suwung I): 12400 seedlings/hectare, and

c. Line VIII (Tuban II) : 5500 seedlings/hectare.

The lowest plant density was found in the line XI (Nusa Dua I) of about 240 seedlings/hectare (Table 13).

If we look at the average plant height, the pattern of the plant composition are as follows (Figure 5):

a. Line II (East Suwung II) : 10.20 m

b. Line VI (West Suwung II) : 9.67 m, and

c. Line I (East Suwung I) : 8.79 m,

while the lowest plant height was observed at the Line IX (Jimbaran II) of about 4.25 m.

After combining the data of plant density, seedling, the canopy sadhing and plant height of mangrove trees, so that, the best condition was found at Line X (Jimbaran

II). The other transects which are in good conditions are likely line V and VI (West Suwung I and II) (Figure 6). The mangrove condition in line X, however, is prefer as a good one, because of the present of the tidal cyclus on the coast. This cyclus is linkage to the settlement, especially Jimbaran. Moreover, the location is far away from the human activity because of the difficulties to get in to those area.

Most likely, line V and VI are also in good conditions, especially line VI, in which the trees are much bigger and taller. In this area, the dominant species was *Sonneratia alba*. It is recognized that line VI was affected by the Tukad Badung and Tukad Mati, therefore, these area are pavaourable for the growth of mangrove. In contrats, however, line V was affected by the present of mud from the shrimp ponds activities. Therefore, the growth of *Rhizophora mucronata* and it seedling are become vigorous (Figure 4). For the future, with the present of mud wich are coming from Tukad Badung and Tukad Mati, the mangrove composition will be improved in line VI.

During the study, the died mangrove trees was found at East Suwung, especially on young mangrove trees. It was observed that their leaves are dried up and died. Furthermore, some mangrove trees are cut down by the farmer, especially at West Suwung I.

There is no such clear indication in respect to the effect of treated effluent from the Nusa Dua wastewater

treatment plants on the surrounding mangrove trees. The growth of mangrove at Nusa Dua (Line XI and XII), however, is not so vigourus as that one at Suwung or Tuban, and this might be related to the lack of nutrients or other factors are being involved. There is no such indication of the pollutant that are coming from the Nusa Dua wastewater treatment plant. At line XI and XII, the soil surface under the mangrove tree was a litle bit darker than those of Jimbaran or Tuban. This might be due to the penetration of unused oil that drained down to the coast from the service station surrounding the area of Nusa Dua. The other possibilities are regarding to the accumulation of oil which is spilling from the Port Benoa, or an anerob conditions might be occured due to the eutrification processes as a result of decomposition of organic matter.

2. Zoobenthos

Based on the reciprocal index of diversity (RID) value, the RID of Station 1 is about 0.341 and of Station 4 is about 0.345. It has been recognized as a heavily polluted (Figure 9). Both of those stations, were dominated by the *Cerithidea cingulata* and it is known as an indicator for muddy substrates. From the diversity index point of view, the station 5 with diversity index value (H) of 2.0692 is the best one (Table 37). This mean that there are a number of species which are in a balance distribution. Therefore,

the entire ecosystem is becoming more stabil.

3. Plankton

The extent of phytoplankton are generally 541 cells/litres, which is consisted of 34 species (Table 21). The highest of existency of phytoplankton was found at Station 4 (724 cells/litres), while the lowest one was observed at station 2 (415 cells/litres). However, the extent of zooplankton are slightly different, where the highest existency was found at Station 2 (620 individu/litres), while the lowest one was at station 1 (114 individu/litres)(Figure 10). Based on the diversity index (H) in which it value is ranged from 1.92 - 2.16 (for Phytoplankton), the water conditions could be classified as a moderate (Figure 7). For Zooplankton, however, with the diversity index (H) of 1.29 - 1.79, it is termed as an suitable to moderate conditions (Figure 8).

The relationships between phytoplankton and zooplankton existed at the station 4, where the water codition is termed as a good one. In this situation, therefore, the development of plankton and grazing processes is not too high. In contrast, however, the grazing processes at station 2 was slightly high. This might be due to the extent of zooplankton which is higher than phytoplankton (Figure 10).

Therefore, the water condition of Station 4 is classified as the fertile one. This is because of the highest

extent of phytoplankton. From benthos organism point of view, Station 4 is classified as a polluted one because of base substrate condition is mud, which tend the condition become anaerob. However, this bad conditions could not penetrated to the upper level of water, therefore, the plankton become fertile due to the present of the organic matter. If the fertile condition is increased, the eutrofication will be occured, which lead to affect water condition itself. However, for the growth and development of the fishes (feeding ground and nursery ground) of the station 2 is the best one. This is due the highest extent of zooplankton.

4. Phytobenthos (Phytobentic)

Based on the six species of phytobentic observed, viz : *Gracilaria licinoides, Gracilaria sp, Thallacia sp, Caulerpa sp, Padina sp*, and *Enhalus sp*, it was recognized that these conditions was very profitable. Because these species were as a good site for laying the egg (pitophyl), shading places for the small fishes (larva) and as a site for organism which are suitable for fish feeding, as the periphyton/aufwutch (Table 34).

5. Fishes

The mangrove and corall reef ecocystems are known as a good ecocystem for some fishes. This is due to the fact that from those ecosystems, there are lot of nutrients which are available for the organism as a producer in those ecosystem,

such as phytoplankton and phytobenthos (Table 21 and 24). This organisme will produce a good organic matter which are essential for the trophic larvae such as zooplankton (Table 22) and fish larvae (Table 38 and 39).

Based on the characteristic analysis of biological community, it was known that coastal ecosystem of Benoa Bay is the good one for the development of some fishes. The important function of coastal ecosystem of Benoa Bay, are as a spawning ground, nursery ground and immigration centre of some fishes, especially for katadromus species form the Indonesian ocean, such as *Angevilla spengeli* and *Angevilla cualastris*.

Benoa Bay is classified as a good nursery ground because of the extent of mangrove plantation. It is suitable for some species for laying their eggs around the mangrove tree, such as *Sigamas sp, Panaeus monondos*, and *Chamnos chamnos*.

C. Additional Information

The study area is located along the coast of West Sanur to Terora Beach of Tanjung Benoa, and it was bounderised by the Ngurah Rai Haighway (from Sanur to Nusa Dua). The study area is characterised by some specific components, such as: climate, soil type, fauna and flora and social economic and social cultural limitations.

1. Climate :

The climate of the study area can be categorised as tropical wet monsoon with two distinct seasons, namely wet and dry season. The average annual rainfall is about 1683 mm. The wet season is from October to April with total rainfall is about 1328 mm, while the dry season is from March to September with total rainfall of about 356 mm.

The climatic characteristics were as below :

- Consistent high temperature, ranged from 24 - 31 ^{o}C,
- Relative humidity of about 77 - 81 %,
- Winds blow from west to east and south-east during monsoon, and the strongest month is January and February, and wind speed is about 48 - 55 knots,
- The wettest month is January with 400 mm rainfall on average,
- The strongest wind gust recorded since 1980 was 30 knots from the west as the impact of the tropical cycloon,
- The dry season is from March to September, and total rainfall ranged from 12 - 97 mm, and slight lower temperature (27.6 ^{o}C), and wind prevail from east to south-east section and are generally light to moderate (20 - 30 knots).

2. Soil:

The study area is an intertidal embayment fringed by mangrove forest and protected from oceanic swell by the

Jimbaran Peninsula to the west, Tanjung Benoa and Serangan Island in the east. The embayment is relatively shallow.

The soil is classified as an alluvial soil which is formed by the sidements and depocites. The sidements in the bay vary from coarse gravelly sands near the mouth of the bay to silty sands at its fringes.

Sediments in the north of the bay consist of the dark clays and silty sand, replecting the input materials of terrestial alluvium from the rivers (Tukad Badung and Tukad Mati) draining into the bay (See Map 3). Silty and clayey sand was found along the west coast of Serangan island.

The southern part of the study area comprises outwash plains consisting of clayey and sandy sediments eroded from Bukit and Jimbaran Peninsulas. Therefore, the soil along the south coast under the mangrove forest was very sticky.

1. Data of mangrove tree at line 1 (East Sawang 1)

r	Number tree	Distance (m)	Radius (cm)	surface trunk (cm2)	Height (m)	volume (m3)
	1	3.1	94.5	710.66767468	8.3	0.4128
	2	7.9	112	998.24924399	8.5	0.5939
	3	4.6	126	1263.4091994	8	0.7075
	4	4.3	96	733.40760783	8.5	0.4363
	5	1.06	98	764.28457743	10	0.5349
	6	1.7	90	644.59653032	9.6	0.4331
	7	2.04	90	644.59653032	9.7	0.4376
	8	1.47	93	688.28585071	10	0.4818
	9	1.8	25	49.737386599	6.4	0.0222
	10	4.1	24.5	47.767786089	6.6	0.0220
	11	1.6	23	42.097724017	6.8	0.0200
	12	2.4	23	42.097724017	6.9	0.0203
1	13	2.4	90	644.59653032	10.3	0.4647
	14	3.1	84.6	569.56549419	10	0.3986
	15	2.5	93.4	694.21932198	10.2	0.4956
	16	4	93.4	694.21932198	10.5	0.5102
5	17	2.64	130	1344.8989336	9.8	0.9226
	18	2.05	88.6	624.69839249	8.3	0.3627
	19	5.8	98.4	770.53636798	9	0.4854
	20	6.35	144	1650.1671176	10	1.1551
6	21	3.25	110.5	971.68947955	9.5	0.6461
	22	4.65	96	733.40760783	7.8	0.4004
	23	1.5	124	1223.6192901	8.9	0.7623
	24	5.7	88.2	619.07050772	7.5	0.3250
	Mean	3.33375	89.00	715.41192504	8.795	0.4605

Note :

1. Number is refer to the plants which are oberved in each point.
2. Distance is refer to the plant distance to the point obervation
3. The distance between point in each line is 50 m, and the number of point is depend on green belt (mangrove)
4. Radius is refer to the radius of main tree, and
5. Volume is equal to 0.7 X surface trunk X height.

abel 2. Data of mangrove tree at line II (East Suwung II)

Number Point	Number tree	Distance (m)	Radius (cm)	Surface trunk (cm2)	Height (m)	volume (m3)
1	1	4.85	160	2037.2433551	9	1.2834
	2	7	149	1766.7515518	10.5	1.2985
	3	6.1	448	15971.987903	11	12.298
	4	8.3	122	1184.4660194	10	0.8291
2	5	16.7	116	1070.8260385	10.5	0.7870
	6	12.6	212	3576.6353653	10	2.5036
	7	6.6	282	6328.505491	10.5	4.6514
	8	9	350	9748.5277734	9.5	6.4827
3	9	7.3	265	5588.4927582	13	5.0855
	10	5.5	343	9362.4860735	10	6.5537
	11	5.95	324	8353.9710329	9.5	5.5553
	12	8.2	291	6738.8986153	9	4.2455
	Mean	8.175	*255.1	*5977.3993315	*10.20	*4.2978

Tabel 3. Data Of mangrove tree at line III (East Sumung III)

Number Point	Number tree	Distance (m)	Radius (cm)	Trunk surface (cm2)	Height (m)	volume (m3)
1	1	17.15	404	12988.699665	4.8	4.3642
	2	7.25	196	3057.1383097	9	1.9259
	3	13.5	319	8098.1219163	8.5	4.8183
	4	19.2	160	2037.2433551	6.5	0.9269
2	5	2.3	112	998.24924399	6	0.4192
	6	16.4	383	11673.484004	6.5	5.3114
	7	13.1	210	3509.4699984	6.5	1.5968
	8	6.5	176	2465.0644597	6	1.0353
3	9	2.4	208	3442.9412701	5.5	1.3255
	10	3.8	196	3057.1383097	5	1.0699
	11	2.5	87	602.33964667	5	0.2108
	12	5.5	204	3311.7937291	5	1.1591
4	13	5.15	294	6878.5611969	6.5	3.1297
	14	14.9	215	3678.5771128	6	1.5450
	15	2.6	225	4028.7283145	6	1.6920
	16	2.2	138	1515.5180646	6	0.6365
5	17	5.25	401	12796.514403	6.5	5.8224
	18	4.9	288	6600.6684705	6	2.7722
	19	14.05	162	2088.4927582	6	0.8771
	20	7.1	192	2933.6304313	6	1.2321
	Mean	8.2875	*228.5	*4788.1187331	*6.165	*2.0935

Tabel 4. Data of mangrove tree at line IV (East Sweung IV)

Number Point	Number tree	Distance (m)	Radius (cm)	Trunk surface (cm2)	Height (m)	Volume (m3)
1	1	5	115.5	1061.6146745	4.8	0.3567
	2	7.57	142.5	1615.9676906	6.5	0.7352
	3	4.2	110.4	969.93156136	6.9	0.4684
	4	8.5	98.2	767.40728951	5.3	0.2847
2	5	23	64	325.95893681	3	0.0684
	6	12	108.5	936.83351902	4.5	0.2951
	7	7.4	115	1052.4431004	5.8	0.4272
	8	8.5	86.6	596.81362406	5	0.2008
3	9	14.25	188	2812.6691071	4.5	0.8859
	10	13.6	207	3409.9156454	5.2	1.2412
	11	12.1	150	1790.5459176	6	0.7520
	12	9.5	110	962.91580455	5	0.3370
4	13	1.76	100	795.79818558	7.2	0.4010
	14	6.26	138	1515.5180546	7	0.7426
	15	4.3	80	509.31083877	6.6	0.2353
	16	6.5	104	860.73531752	7.6	0.4579
5	17	3.57	96	733.40760783	3.8	0.1950
	18	9.98	80	509.31083877	4.5	0.1604
	19	17.5	114	1034.219322	5.7	0.4126
	20	15.6	106	894.15884132	6.3	0.3943
	Mean	9.5545	115.6	1157.7737944	5.56	0.4530

Tabel 5. Data of mangrove tree at line V (West Suwung 1)

Number Point	Number	Distance (m)	Radius (cm)	Trunk surface (cm2)	Height (m)	volume (m3)
1	1	2.6	23	42.097724017	5	0.0147
	2	4.3	46	168.39089607	5	0.0589
	3	7.5	41	133.773675	4.5	0.0421
	4	4.95	48	183.35190196	4.5	0.0577
2	5	2.8	461	16912.38262	3	3.5516
	6	18.2	390	12104.090402	6	5.0837
	7	27.5	48	183.35190196	4.5	0.0577
	8	20.1	120	1303.8357473	4	0.3650
3	9	4.8	58	267.70650963	2	0.0374
	10	2.7	91	659.00047748	2.5	0.1153
	11	12.7	357	10142.368295	12	8.5195
	12	7.9	126	1263.4091994	6	0.5306
4	13	5.05	360	10313.544485	8	5.7755
	14	5.3	504	20214.547191	8	11.320
	15	11.35	646	33209.931561	8.5	19.759
	16	6.95	390	12104.090402	7.5	6.3546
5	17	3.95	110	962.91580455	9	0.6066
	18	10.5	336	8984.2431959	12	7.5467
	19	13.1	306	7451.5358905	6	3.1296
	20	19.8	256	5215.342989	6.5	2.3729
6	21	7.1	441	15476.762693	11	11.917
	22	14.1	585	27234.203406	8.5	16.204
	23	17	86	580.57233806	5	0.2060
	24	8.9	424	14306.541461	10.5	10.515
	Mean	9.96458	260.8	8309.416202	6.645	4.7559

Tabel 6. Data of mangrove tree at line VI (West Sumang II)

Number Point	Number tree	Distance (m)	Radius (cm)	Trunk surface (cm2)	Height (m)	volume (m3)
1	1	1.9	82	535.09469998	11.3	0.4232
	2	3.73	35.5	100.29046633	8.5	0.0596
	3	3.68	38	114.91325799	7.8	0.0627
	4	5.74	75	447.63647939	11	0.3446
2	5	10.7	48	183.35190196	9.3	0.1193
	6	13.5	114	1034.219322	11.5	0.8325
	7	9.6	95	718.20786249	9.8	0.4926
	8	15	54	232.05475092	6.9	0.1120
3	9	3.66	25	49.737386599	6.8	0.0236
	10	5.66	96	733.40760783	12	0.6160
	11	5.2	36	103.13544485	7.3	0.0527
	12	5.3	36	103.13544485	8.4	0.0606
4	13	1.64	108	928.21900366	9.5	0.6172
	14	2.04	32	81.489734203	7	0.0399
	15	2.09	43	147.14308451	7.3	0.0751
	16	17.5	40	127.32770969	6.8	0.0606
5	17	5.4	86	588.57233806	8.5	0.3502
	18	10.6	225	4028.7283145	15	4.2301
	19	13.2	48	183.35190196	7.3	0.0936
	20	15.7	70	389.94111093	7.5	0.2047
6	21	6.93	416	13771.765080	15.4	14.845
	22	7.87	364	10544.007639	12.6	9.2998
	23	6.27	47	175.79181919	8	0.0984
	24	10.8	354	9972.6245424	12.2	8.5166
7	25	16.3	243	4699.108706	17	5.5919
	26	8.6	220	3851.6632182	12.6	3.3971
	27	11.8	84	561.51519975	8.5	0.3341
	28	5.6	75	447.63647939	6.7	0.2099
8	29	14	254	5134.1715741	15	5.3908
	30	85	136	1471.908324	11.8	1.2157
	31	15.6	48	183.35190196	2.9	0.0372
	32	8.15	95	718.20786249	7.3	0.3670
	Mean	10.8987	*116.3	*1948.8034428	*9.671	*1.8180

Tabel 7. Data of mangrove tree at line VII (Tuban 1)

Number Point	Number tree	Distance (m)	Radius (cm)	Trunk surface (cm2)	Height (m)	volume (m3)
1	1	5	95	718.20786249	7.5	0.3770
	2	5	136	1471.908324	8	0.8242
	3	8.22	280	6239.0577749	8.5	3.7122
	4	8.44	126	1263.4091994	8.5	0.7517
2	5	7.5	35.4	99.726245424	7	0.0488
	6	2.7	88.5	623.2890339	6.8	0.2966
	7	7.05	97.3	753.40522044	8.5	0.4482
	8	14.2	161	2062.7884768	7	1.0107
3	9	4.52	152	1838.612128	8	1.0296
	10	5.67	196	3057.1383097	7.5	1.6049
	11	10	149	1766.7515518	5.6	0.6925
	12	3.5	47	175.79181919	5.5	0.0676
4	13	4.4	26	53.795957345	5.7	0.0214
	14	4.32	50	198.9495464	5.4	0.0752
	15	4.3	34.5	94.719879039	5	0.0331
	16	2.57	80	509.31083877	6	0.2139
	Mean	6.08687	109.6	1307.9288055	6.906	0.7005

Tabel 8. Data of mangrove tree at line VIII (Tuban II)

Number Point	Number tree	Distance (m)	Radius (cm)	Trunk surface (cm2)	Height (m)	Volume (m3)
1	1	3.95	174	2409.3585867	5	0.8432
	2	7.05	175	2437.1319433	4	0.6823
	3	6.6	224	3992.996976	5	1.3975
	4	6.1	23	42.097724017	2	0.0058
2	5	16.3	246	4815.8522999	4.5	1.5169
	6	31.7	88	616.26611491	5	0.2156
	7	42.1	64	325.95893681	4	0.0912
	8	6.2	105	877.3674996	5	0.3070
3	9	3.7	100	795.79818558	4	0.2228
	10	4.6	81	522.12318956	3.5	0.1279
	11	7.2	60	286.48734681	3.5	0.0701
	12	6.5	167	2219.4015598	5	0.7767
4	13	1.1	48	183.35190196	5.5	0.0705
	14	1.65	25	49.737386599	5	0.0174
	15	0.8	23	42.097724017	4.5	0.0132
	16	2.95	26	53.795957345	4.5	0.0169
	Mean	9.28125	*101.8	*1229.3639503	*4.375	*0.3985

Tabel 9. Data of mangrove tree at line IX (Jimbaran I)

Number Point	Number tree	Distance (m)	Radius (cm)	Trunk surface (cm2)	Height (m)	volume (m3)
1	1	9.5	40	127.32770969	6	0.0534
	2	11.3	40	127.32770969	2	0.0178
	3	5.6	42	140.37879994	4	0.0393
	4	7.2	25	49.737386599	3.5	0.0121
2	5	7.85	126	1263.4091994	4.5	0.3979
	6	4.45	156	1936.6544644	5	0.6778
	7	10.7	72	412.5417794	6.5	0.1877
	8	6.3	160	2246.060799	5	0.7861
3	9	2.95	34	91.994270253	2	0.0128
	10	4.45	34	91.994270253	3	0.0193
	11	4.95	126	1263.4091994	4.5	0.3979
	12	5.4	204	3311.7937291	5	1.1591
	Mean	6.72083	88.91	921.88577643	4.25	0.3134

Tabel 10. Data of mangrove tree at line X (Jimbaran II)

Number Point	Number tree	Distance (m)	Radius (cm)	Trunk surface (cm2)	Height (m)	volume (m3)
1	1	7.27	85	574.96418908	4	0.1609
	2	4.84	94	703.16727678	2.5	0.1230
	3	6.4	124	1223.6192901	3	0.2569
	4	7.15	81	522.12318956	4.5	0.1644
2	5	1.35	44	154.06652873	4.25	0.0458
	6	1.15	34	91.994270253	4	0.0257
	7	1.1	30	71.621836702	4.5	0.0225
	8	1.6	24	45.837975489	5.7	0.0182
3	9	8.25	115	1052.4431004	6.9	0.5083
	10	8.05	86	588.57233806	7.3	0.3007
	11	5.4	240	4583.7975489	7.8	2.5027
	12	4.15	310	7647.6205634	8.5	4.5503
	Mean	4.72583	*105.5	* 1438.319009	*5.245	*0.7233

Tabel 11. Data of mangrove tree at line XI (Nusa Dua I)

Number Point	Number tree	Distance (m)	Radius (cm)	Trunk surface (cm2)	Height (m)	volume (m3)
1	1	2.6	58	267.70650963	4	0.0749
	2	2.35	34	91.994270253	0.75	0.0048
	3	2.32	67	357.23380551	0.75	0.0187
	4	3.9	23	42.097724017	2.5	0.0073
2	5	7	87	602.33964667	5	0.2108
	6	3.1	163	2114.3561993	7.8	1.1544
	7	9.6	77	471.82874423	7.2	0.2378
	8	11.3	74	435.77908642	5.4	0.1647
3	9	6.88	264	5546.3950342	6.5	2.5236
	10	6.41	141	1582.1263728	7.2	0.7973
	11	6.29	66	346.64968964	8.3	0.2014
	12	6.74	85	574.96418908	8.5	0.3421
4	13	2.5	62	305.90482254	7.8	0.1670
	14	3.9	105	877.3674996	8	0.4913
	15	6.3	61	296.11650485	8.2	0.1699
	16	5.2	53	223.53971033	6	0.0938
5	17	8.65	128	1303.8357473	4.8	0.4380
	18	4.2	120	1145.9493872	2.8	0.2246
	19	4.15	86	588.57233806	5	0.2060
	20	8.77	30	71.621836702	3	0.0150
	Mean	5.46076	*92.38	*979.95200725	*5.515	*0.4542

Tabel 12. Data of mangrove tree at line XII (Nusa Dua II)

Number Point	Number tree	Distance (m)	Radius (cm)	Trunk surface (cm2)	Height (m)	volume (m3)
1	1	3.5	34	91.994270253	4.5	0.0289
	2	5.8	225	4028.7283145	5.5	1.5510
	3	8.55	84	561.51519975	6	0.2358
	4	7.75	191	2903.1513608	5	1.0161
2	5	0.85	76	459.65303199	6	0.1930
	6	2.3	31	76.476205634	6	0.0321
	7	3.8	75	447.63647939	5.5	0.1723
	8	3.65	32	81.489734203	6.5	0.0370
3	9	2.75	100	795.79818558	6	0.3342
	10	4.2	100	795.79818558	5.5	0.3063
	11	7.4	68	367.97708101	5	0.1287
	12	2.6	40	127.32770969	5	0.0445
4	13	6.25	120	1145.9493872	6	0.4812
	14	11.7	136	1471.908324	7.5	0.7727
	15	16	186	2753.1434028	7	1.3490
	16	6.8	86	588.57233806	9	0.3708
5	17	2.25	68	367.97708101	7	0.1803
	18	8.4	53	223.53971033	6	0.0938
	19	5.2	175	2437.1319433	5	0.8529
	20	6.3	83	548.22537005	6.5	0.2494
6	21	6.75	29	66.926627407	4	0.0187
	22	3	30	71.621836702	4	0.0200
	23	2.4	46	168.39089607	5.5	0.0648
	24	2.3	32	81.489734203	5	0.0285
7	25	10.85	126	1263.4091994	6.5	0.5748
	26	3	68	367.97708101	13	0.3348
	27	4.3	114	1034.219322	13	0.9411
	28	6.8	33	86.66242241	6.5	0.0394
8	29	13.25	88	616.26611491	7	0.3019
	30	42.6	55	240.72895114	6.5	0.1095
	31	3.2	38	114.91325799	6.5	0.0522
	32	9.7	46	168.39089607	7	0.0825
	Mean	7.00625	*83.37	*767.34342671	*6.406	*0.3437

Tabel 13. Data of mangrove Seedling at line I - XII

tation	Species	Sum of seedling	Sum of transex	Density per Ha	Total
ast Suwung I	Rizophora (R)	16	6	1066.666	
	Bruguiera (B)	0	6	0	
	Aegiceras (C)	0	6	0	
	Soneratia (S)	0	6	0	
	Avicennia (A)	1	6	66.66666	1133.
ast Suwung II	Rizophora (R)	4	3	533.3333	
	Bruguiera (B)	0	3	0	
	Aegiceras (C)	0	3	0	
	Soneratia (S)	0	3	0	
	Avicennia (A)	0	3	0	533.3
ast Suwung III	Rizophora (R)	10	5	800	
	Bruguiera (B)	0	5	0	
	Aegiceras (C)	0	5	0	
	Soneratia (S)	0	5	0	
	Avicennia (A)	0	5	0	
ast Suwung IV	Rizophora (R)	6	5	480	
	Bruguiera (B)	0	5	0	
	Aegiceras (C)	0	5	0	
	Soneratia (S)	0	5	0	
	Avicennia (A)	2	5	160	
est Suwung I	Rizophora (R)	19	6	1266.666	
	Bruguiera (B)	0	6	0	
	Aegiceras (C)	167	6	11133.33	
	Soneratia (S)	0	6	0	
	Avicennia (A)	0	6	0	12
est Suwung II	Rizophora (R)	32	8	1600	
	Bruguiera (B)	0	8	0	
	Aegiceras (C)	0	8	0	
	Soneratia (S)	4	8	200	
	Avicennia (A)	2	8	100	1
uban I	Rizophora (R)	2	4	200	
	Bruguiera (B)	0	4	0	
	Aegiceras (C)	0	4	0	
	Soneratia (S)	3	4	300	
	Avicennia (A)	0	4	0	
uban II	Rizophora (R)	28	4	2800	
	Bruguiera (B)	1	4	100	
	Aegiceras (C)	0	4	0	
	Soneratia (S)	26	4	2600	
	Avicennia (A)	0	4	0	5

Station	Species	Sum of seedling	Sum of transek	Density per Ha	Total
Jimbaran I	Rizophora (R)	1	3	133.3333	
	Bruguiera (B)	4	3	533.3333	
	Aegiceras (C)	0	3	0	
	Soneratia (S)	1	3	133.3333	
	Avicennia (A)	0	3	0	800
Jimbaran II	Rizophora (R)	12	3	1600	
	Bruguiera (B)	2	3	266.6666	
	Aegiceras (C)	123	3	16400	
	Soneratia (S)	1	3	133.3333	
	Avicennia (A)	0	3	0	18400
Nusa Dua I	Rizophora (R)	0	5	0	
	Bruguiera (B)	0	5	0	
	Aegiceras (C)	0	5	0	
	Soneratia (S)	3	5	240	
	Avicennia (A)	0	5	0	240
Nusa Dua II	Rizophora (R)	0	8	0	
	Bruguiera (B)	0	8	0	
	Aegiceras (C)	12	8	600	
	Soneratia (S)	0	8	0	
	Avicennia (A)	0	8	0	600

Tabel 14. Data of mangrove Covering at line I - XII

Station	Species	Total Persentage	Total transex	Covering per Ha (%)	Tota per
East Suwung I	Rizophora (R)	98	6	16.333333	
	Bruguiera (B)	0	6	0	
	Aegiceras (C)	0	6	0	
	Soneratia (S)	0	6	0	
	Avicennia (A)	0	6	0	
	Ceriop (T)	0	6	0	16.3
East Suwung II	Rizophora (R)	62	3	20.666666	
	Bruguiera (B)	0	3	0	
	Aegiceras (C)	0	3	0	
	Soneratia (S)	0	3	0	
	Avicennia (A)	0	3	0	
	Ceriop (T)	0	3	0	20.6
East Suwung III	Rizophora (R)	103	5	20.6	
	Bruguiera (B)	0	5	0	
	Aegiceras (C)	0	5	0	
	Soneratia (S)	0	5	0	
	Avicennia (A)	0	5	0	
	Ceriop (T)	0	5	0	20
East Suwung IV	Rizophora (R)	143.8	5	28.76	
	Bruguiera (B)	0	5	0	
	Aegiceras (C)	2	5	0.4	
	Soneratia (S)	0	5	0	
	Avicennia (A)	30	5	6	
	Ceriop (T)	0	5	0	35:
West Suwung I	Rizophora (R)	245.5	6	40.916666	
	Bruguiera (B)	0	6	0	
	Aegiceras (C)	142	6	23.666666	
	Soneratia (S)	0	6	0	
	Avicennia (A)	0	6	0	
	Ceriop (T)	0	6	0	64.5
West Suwung II	Rizophora (R)	377	8	47.125	
	Bruguiera (B)	0	8	0	
	Aegiceras (C)	0	8	0	
	Soneratia (S)	0	8	0	
	Avicennia (A)	0	8	0	
	Ceriop (T)	0	8	0	47.1
Buban I	Rizophora (R)	55	4	13.75	
	Bruguiera (B)	0	4	0	
	Aegiceras (C)	5	4	1.25	
	Soneratia (S)	0	4	0	
	Avicennia (A)	0	4	0	
	Ceriop (T)	0	4	0	

tation	Species	Total Persentage	Total transex	Covering per Ha (%)	Tota per
uban II	Rizophora (R)	50.5	4	12.625	
	Bruguiera (B)	0	4	0	
	Aegiceras (C)	0	4	0	
	Soneratia (S)	0	4	0	
	Avicennia (A)	0	4	0	
	Ceriop (T)	0	4	0	12.6
imbaran I	Rizophora (R)	25	3	8.3333333	
	Bruguiera (B)	7	3	2.3333333	
	Aegiceras (C)	0	3	0	
	Soneratia (S)	25	3	8.3333333	
	Rizophora (X)	13	3	4.3333333	
	Ceriop (T)	85	3	28.333333	51.6
imbaran II	Rizophora (R)	107	3	35.666666	
	Bruguiera (B)	10	3	3.3333333	
	Aegiceras (C)	109.5	3	36.5	
	Soneratia (S)	49	3	16.333333	
	Avicennia (A)	3	3	1	
	Ceriop (T)	0	3	0	92.8
usa Dua I	Rizophora (R)	4	5	0.8	
	Bruguiera (B)	0	5	0	
	Aegiceras (C)	75	5	15	
	Soneratia (S)	12	5	2.4	
	Avicennia (A)	0	5	0	
	Ceriop (T)	0	5	0	18
usa Dua II	Rizophora (R)	0	8	0	
	Bruguiera (B)	0	8	0	
	Aegiceras (C)	145	8	18.125	
	Soneratia (S)	0	8	0	
	Avicennia (A)	0	8	0	
	Ceriop (T)	0	8	0	18.1

Tabel 15. The mangrove Situation over station on Benoa Bay

Number LINE	Location	Mean Distance (m)	Density per Ha	Mean Volume (M3)	Potential Wood Production per Ha (M3)
I	East Suwung I	3.333	900.180	0.461	414.983
II	East Suwung II	8.175	149.632	2.511	375.726
III	East Suwung III	8.287	145.615	2.093	304.772
IV	East Suwung IV	9.554	109.554	0.453	49.628
V	West Suwung I	9.764	100.724	4.756	479.043
VI	West Suwung II	10.898	84.199	1.818	153.074
VII	Tuban I	6.087	269.894	0.701	189.196
VIII	Tuban II	9.281	116.094	0.398	46.205
IX	Jimbaran I	6.721	221.377	0.313	69.291
X	Jimbaran II	4.726	447.726	0.723	323.706
XI	Nusa Dua I	5.46	335.440	0.454	152.290
XII	Nusa Dua II	7.006	203.732	0.344	70.084

Tabel 16. Phytoplankton Composition at station I

NUMBER	PHYTOPLANKTON SPECIES	Total	ABOUNDANCE CELL/l	pi	ln pi	- pi ln pi	(pi x pi)
1	Coscinodiscus linetus	51	136.17	0.237209	-1.43881	0.3412996	0.056268
2	Rhizosolenia setigera	35	93.45	0.162790	-1.81528	0.2955123	0.026500
3	Fragilaria interaedia	9	24.03	0.041860	-3.17341	0.1328405	0.001752
4	Guinardia sp	0	0	0	0	0	0
5	Hemiaulus hauckii	0	0	0		0	0
6	Tintinnopsis beroidea	7	18.69	0.032558	-3.42472	0.1115027	0.001060
7	Ceratium setaceus	17	45.39	0.079069	-2.53742	0.2006335	0.006252
8	Thalassionema nitchioides	0	0	0	0	0	0
9	Melosira sp	0	0	0		0	0
10	Hyalodiscus stelliger	2	5.34	0.009302	-4.67749	0.0435115	0.000086
11	Nitzschia aigua	25	66.75	0.116279	-2.15176	0.2502049	0.013520
12	Skletonema costatus	40	106.8	0.186046	-1.68175	0.3128853	0.034613
13	Rhabdonema adriaticum	0	0	0		0	0
14	Granatophora serpentina	0	0	0		0	0
15	Sinedra sp	5	13.35	0.023255	-3.76120	0.0874697	0.000540
16	Streptothea indica	0	0	0		0	0
17	Granatophora marina	11	29.37	0.051162	-2.97274	0.1520938	0.002617
18	Euphausia brevis	0	0	0		0	0
19	Leptocylindrus danicus	4	10.68	0.018604	-3.98434	0.0741273	0.000346
20	Favella mariacea	0	0	0		0	0
21	Tintindium sp	0	0	0		0	0
22	Striatella unipunctata	0	0	0		0	0
23	Ceratium belone	0	0	0		0	0
24	Helicostomella subulata	0	0	0		0	0
25	Triceracium sp	6	16.02	0.027906	-3.57887	0.0998756	0.000778
26	Surirella fastuora	3	8.01	0.013953	-4.27202	0.0596096	0.000194
27	Chaetoceros sp	0	0	0		0	0
28	Bacteriastrum elongatum	0	0	0		0	0
29	Planktonella sol	0	0	0		0	0
30	Branchyseelus sp	0	0	0		0	0
31	Polydora sp	0	0	0		0	0
	Jualah		574.05	1	-39.4698	2.1615669	0.144532

SUM OF SPECIES (S) 13
H = 2.161566
E = 0.842732

Tabel 17. Phytoplankton Composition at Station 11

NUMBER	PHYTOPLANKTON SPECIES	Total	ABOUNDANCE CELL/l	pi	ln pi	- pi ln pi	(pi x pi)
1	Coscinodiscus linetus	58	154.86	0.374193	-0.98298	0.3678255	0.140020
2	Rhizosolenia setigera	33	88.11	0.212903	-1.54691	0.3293437	0.045327
3	Fragilaria intermedia	4	10.68	0.025806	-3.65713	0.0943775	0.000665
4	Guinardia sp	1	2.67	0.006451	-5.04342	0.0325382	0.000041
5	Hemiaulus hauckii	1	2.67	0.006451	-5.04342	0.0325382	0.000041
6	Tintinnopsis beroidea	10	26.7	0.064516	-2.74084	0.1768283	0.004162
7	Ceratium setacium	21	56.07	0.135483	-1.99890	0.2708190	0.018355
8	Thalassionema nitchioides	3	8.01	0.019354	-3.94481	0.0763512	0.000374
9	Melosira sp	2	5.34	0.012903	-4.35027	0.0561326	0.000166
10	Hyalodiscus stelliger	1	2.67	0.006451	-5.04342	0.0325382	0.000041
11	Nitzschia aigaa	3	8.01	0.019354	-3.94481	0.0763512	0.000374
12	Skletonema costatum	9	24.03	0.058064	-2.84620	0.1652632	0.003371
13	Rhabdonema adriaticum	1	2.67	0.006451	-5.04342	0.0325382	0.000041
14	Gramatophora serpentina	1	2.67	0.006451	-5.04342	0.0325382	0.000041
15	Sinedra sp	2	5.34	0.012903	-4.35027	0.0561326	0.000166
16	Streptothea indica	5	13.35	0.032258	-3.43398	0.1107737	0.001040
17	Gramatophora marina						
18	Euphausia brevis						
19	Leptocylindrus danicus						
20	Favella mariacea						
21	Tintindium sp						
22	Striatella unipunctata						
23	Ceratium belone						
24	Helicostomella subulata						
25	Triceracium sp						
26	Surirella fastuora						
27	Chaetoceros sp						
28	Bacteriastrum elongatum						
29	Planktonella sel						
30	Branchyseelus sp						
31	Polydora sp						
	Jumlah		413.85	1		-59.0142	0.9428901	0.214235

SUM OF SPECIES (S) 16
H = 1.94289
E = 0.700749

Tabel 18. Phytoplankton Composition at Station III

NUMBER	PHYTOPLANKTON SPECIES	Total	ABOUNDANCE CELL/l	pi	ln pi	- pi ln pi	(pi x pi)
1	Coscinodiscus linestus	59	157.53	0.295	-1.22077	0.3601300	0.087025
2	Rhizosolenia setigera	26	69.42	0.13	-2.04022	0.2652287	0.0169
3	Fragilaria interaedia	6	16.02	0.03	-3.50655	0.1051967	0.0009
4	Guinardia sp	4	10.68	0.02	-3,91202	0.0782404	0.0004
5	Hemiaulus hauckii	0	0	0		0	0
6	Tintinnopsis beroidea	6	16.02	0.03	-3.50655	0.1051967	0.0009
7	Ceratium setacium	43	114.81	0.215	-1.53711	0.3304802	0.046225
8	Thalassioneaa nitchioides	0	0	0		0	0
9	Melosira sp	0	0	0		0	0
10	Hyalodiscus stelliger	4	10.68	0.02	-3.91202	0.0782404	0.0004
11	Nitzschia aigaa	10	26.7	0.05	-2.99573	0.1497866	0.0025
12	Skletonema costatua	17	45.39	0.085	-2.46510	0.2095338	0.007225
13	Rhabdoneaa adriaticua	0	0	0		0	0
14	Graaatophora serpentina	0	0	0		0	0
15	Sinedra sp	0	0	0		0	0
16	Streptothea indica	0	0	0		0	0
17	Granatophora marina	8	21.36	0.04	-3.21887	0.1287550	0.0016
18	Euphausia brevis	0	0	0		0	0
19	Leptocylindrus danicus	0	0	0		0	0
20	Favella mariacea	0	0	0		0	0
21	Tintindiua sp	0	0	0		0	0
22	Striatella unipunctata	0	0	0		0	0
23	Ceratium belone	0	0	0		0	0
24	Helicostomella subulata	0	0	0		0	0
25	Triceraciua sp	0	0	0		0	0
26	Surirella fastuora	0	0	0		0	0
27	Chaetoceros sp	6	16.02	0.03	-3.50655	0.1051967	0.0009
28	Bacteriastrua elongatua	2	5.34	0.01	-4.60517	0.0460517	0.0001
29	Planktonella sol	4	10.68	0.02	-3.91202	0.0782404	0.0004
30	Branchyseelus sp	2	5.34	0.01	-4.60517	0.0460517	0.0001
31	Polydora sp	3	8.01	0.015	-4.19970	0.0629955	0.000225
	SUM		534	1	-49.1436	2.1493250	0.1658

SUM OF SPECIES (S) 15
H = 2.149325
E = 0.793679

Tabel 19. Phytoplankton Composition at Station IV

NUMBER	PHYTOPLANKTON SPECIES	Total	ABOUNDANCE CELL/l	pi	ln pi	- pi ln pi	(pi x pi)
1	Coscinodiscus linestus	90	240.3	0.332103	-1.10230	0.3660805	0.110292
2	Rhizosolenia setigera	60	160.2	0.221402	-1.50777	0.3338245	0.049018
3	Fragilaria interaedia	6	16.02	0.022140	-3.81035	0.0843621	0.000490
4	Guinardia sp		0	0		0	0
5	Hemiaulus hauckii		0	0		0	0
6	Tintinnopsis beroidea	12	32.04	0.044280	-3.11721	0.1380315	0.001960
7	Ceratium setaciua	38	101.46	0.140221	-1.96453	0.2754695	0.019662
8	Thalassionema nitchioides		0	0		0	0
9	Melosira sp		0	0		0	0
10	Hyalodiscus stelliger	9	24.03	0.033210	-3.40489	0.1130776	0.001102
11	Nitzschia aigna	1	2.67	0.003690	-5.60211	0.0206720	0.000013
12	Skletonema costatum	33	88.11	0.121771	-2.10561	0.2564028	0.014828
13	Rhabdonema adriaticum	1	2.67	0.003690	-5.60211	0.0206720	0.000013
14	Granatophora serpentina		0	0		0	0
15	Sinedra sp		0	0		0	0
16	Streptothea indica		0	0		0	0
17	Granatophora marina		0	0		0	0
18	Euphausia brevis		0	0		0	0
19	Leptocylindrus danicus		0	0		0	0
20	Favella mariacea		0	0		0	0
21	Tintindium sp		0	0		0	0
22	Striatella unipunctata		0	0		0	0
23	Ceratium belone		0	0		0	0
24	Helicostomella subulata	7	18.69	0.025830	-3.65620	0.0944408	0.000667
25	Triceracium sp	3	8.01	0.011070	-4.50350	0.0498543	0.000122
26	Surirella fastuora		0	0		0	0
27	Chaetoceros sp	7	18.69	0.025830	-3.65620	0.0944408	0.000667
28	Bacteriastrua elongatua		0	0		0	0
29	Planktonella sel		0	0		0	0
30	Branchyseelus sp		0	0		0	0
31	Polydora sp		0	0		0	0
32	Amphilithicua clavariua	1	2.67	0.003690	-5.60211	0.0206720	0.000013
33	Licmophora sp	1	2.67	0.003690	-5.60211	0.0206720	0.000013
34	Sigena tenaria	2	5.34	0.007380	-4.90897	0.0362205	0.000054
	SUM		723.57	1	-56.1460	1.9249014	0.198921

SUM OF SPECIES (S) 15
H = 1.924901
E = 0.710806

Tabel 20. Phytoplankton Composition at Station V

NUMBER	PHYTOPLANKTON SPECIES	Total	ABOUNDANCE CELL/l	pi	ln pi	- pi ln pi	(pi x pi)
1	Coscinodiscus linestus	42	112.14	0.242774	-1.41562	0.3436770	0.058939
2	Rhizosolenia setigera	44	117.48	0.254335	-1.36910	0.3482109	0.064686
3	Fragilaria intermedia	1	2.67	0.005780	-5.15329	0.0297878	0.000033
4	Guinardia sp	1	2.67	0.005780	-5.15329	0.0297878	0.000033
5	Hemiaulus hauckii	0	0	0		0	0
6	Tintinnopsis beroidea	0	0	0		0	0
7	Ceratium setaciue	21	56.07	0.121387	-2.10876	0.2559777	0.014734
8	Thalassionema nitchioides	0	0	0		0	0
9	Melosira sp	0	0	0		0	0
10	Hyalodiscus stelliger	2	5.34	0.011560	-4.46014	0.0515623	0.000133
11	Nitzschia aigaa	6	16.02	0.034682	-3.36153	0.1165849	0.001202
12	Skletonema costatum	20	53.4	0.115606	-2.15755	0.2494288	0.013364
13	Rhabdonema adriaticum	0	0	0		0	0
14	Grammatophora serpentina	0	0	0		0	0
15	Sinedra sp	0	0	0		0	0
16	Streptothea indica	2	5.34	0.011560	-4.46014	0.0515623	0.000133
17	Grammatophora marina	10	26.7	0.057803	-2.85070	0.1647807	0.003341
18	Euphausia brevis	1	2.67	0.005780	-5.15329	0.0297878	0.000033
19	Leptocylindrus danicus	3	8.01	0.017341	-4.05467	0.0703123	0.000300
20	Favella mariacea	2	5.34	0.011560	-4.46014	0.0515623	0.000133
21	Tintindium sp	12	32.04	0.069364	-2.66838	0.1850902	0.004811
22	Striatella unipunctata	2	5.34	0.011560	-4.46014	0.0515623	0.000133
23	Ceratium belone	3	8.01	0.017341	-4.05467	0.0703123	0.000300
24	Helicostomella subulata	1	2.67	0.005780	-5.15329	0.0297878	0.000033
25	Triceracium sp	0	0	0		0	0
26	Surirella fastuora	0	0	0		0	0
27	Chaetoceros sp	0	0	0		0	0
28	Bacteriastrum elongatum	0	0	0		0	0
29	Planktonella sol	0	0	0		0	0
30	Branchyseelus sp	0	0	0		0	0
31	Polydora sp	0	0	0		0	0
	SUM		461.91	1	-62.4947	2.1297758	0.162350

SUM OF SPECIES (S) 17

H = 2.129775

E = 0.751717

Tabel 21. Phytoplankton Composition all of Station

NUMBER	PHYTOPLANKTON SPECIES	ABOUNDANCE (CELL/L)					
		STATION I	STATION II	STATION III	STATION IV	STATION V	STATION MEAN
1	Coscinodiscus linestus	136	155	158	240	112	160.2
2	Rhizosolenia setigera	93	80	69	160	117	105.4
3	Fragilaria intermedia	24	11	16	16	3	14
4	Guinardia sp	0	3	11	0	3	3.4
5	Hemiaulus hauckii	0	3	0	0	0	0.6
6	Tintinnopsis beroidea	19	27	16	32	0	18.8
7	Ceratium setacium	45	56	115	101	56	74.6
8	Thalassioneaa nitchioides	0	8	0	0	0	1.6
9	Melosira sp	0	5	0	0	0	1
10	Hyalodiscus stelliger	5	3	11	24	5	9.6
11	Nitzschia aigma	67	8	27	3	16	24.2
12	Skletoneaa costatua	107	24	45	80	53	63.4
13	Rhabdoneaa adriaticum	0	3	0	3	0	1.2
14	Grasatophora serpentina	0	3	0	0	0	0.6
15	Sinedra sp	13	5	0	0	0	3.6
16	Streptothea indica	0	13	0	0	5	3.6
17	Grasatophora marina	29	0	21	0	27	15.4
18	Euphausia brevis	0	0	0	0	3	0.6
19	Leptocylindrus danicus	11	0	0	0	8	3.8
20	Favella mariacea	0	0	0	0	5	1
21	Tintindium sp	0	0	0	0	32	6.4
22	Striatella unipunctata	0	0	0	0	5	1
23	Ceratium belone	0	0	0	0	8	1.6
24	Helicostomella subulata	0	0	0	19	3	4.4
25	Triceracium sp	16	0	0	8	0	4.8
26	Surirella fastuora	8	0	0	0	0	1.6
27	Chaetoceros sp	0	0	16	19	0	7
28	Bacteriastrum elongatum	0	0	5	0	0	1
29	Planktonella sol	0	0	11	0	0	2.2
30	Branchyseelus sp	0	0	5	0	0	1
31	Polydora sp	0	0	8	0	0	1.6
32	Amphilithicum clavarium	0	0	0	3	0	0.6
33	Licmophora sp	0	0	0	3	0	0.6
34	Sigena tenaria	0	0	0	5	0	1
	SUM OF CELL	573	415	534	724	461	541.4
	SUM OF SPECIES	13	16	15	15	17	34

Tabel 22. Zooplankton Composition at Station I

NUMBER	ZOOPLANKTON SPECIES	Total	ABOUNDANCE Ind/l	pi	ln pi	- pi ln pi	(pi x pi)
1	Balanus aapritite	12	32.04	0.279069	-1.27629	0.3561749	0.077879
2	Rhincalanus sp	6	16.02	0.139534	-1.96944	0.2748056	0.019469
3	Calanus sp	13	34.71	0.302325	-1.19625	0.3616572	0.091400
4	Sacculina sp	3	8.01	0.069767	-2.66258	0.1857619	0.004867
5	Evadne spinifera	2	5.34	0.046511	-3.06805	0.1427001	0.002163
6	Podon sp	0	0	0		0	0
7	Shrimps larva	2	5.34	0.046511	-3.06805	0.1427001	0.002163
8	Cypridina sp	2	5.34	0.046511	-3.06805	0.1427001	0.002163
9	Leganyctiphanas	0	0	0		0	0
10	Microcyclops varians	3	8.01	0.069767	-2.66258	0.1857619	0.004867
	SUM		114.81	1	-18.9713	1.7922620	0.204975

SUM OF SPECIES (S) 8
H = 1.792262
E = 0.861895

Tabel 23. Zooplankton Composition at Station II

NUMBER	ZOOPLANKTON SPECIES	Total	ABOUNDANCE Ind/l	pi	ln pi	- pi ln pi	(pi x pi)
1	Balanus aapritite	56	149.52	0.241379	-1.42138	0.3430930	0.058263
2	Rhincalanus sp	43	114.81	0.185344	-1.68553	0.3124056	0.034352
3	Calanus sp	53	141.51	0.228448	-1.47644	0.3372914	0.052188
4	Sacculina sp	11	29.37	0.047413	-3.04884	0.1445571	0.002248
5	Evadne spinifera	32	85.44	0.137931	-1.98100	0.2732415	0.019024
6	Podon sp	3	8.01	0.012931	-4.34812	0.0562257	0.000167
7	Shrimps larva	34	90.78	0.146551	-1.92037	0.2814345	0.021477
8	Cypridina sp	0	0	0		0	0
9	Leganyctiphanas	0	0	0		0	0
10	Microcyclops varians	0	0	0		0	0
	SUM		619.44	1	-15.8817	1.7482491	0.187722

SUM OF SPECIES (S) 7
H = 1.748249
E = 0.898422

Tabel 24. Zooplankton Composition at Station III

NUMBER	ZOOPLANKTON SPECIES	Total	ABOUNDANCE Ind/l	pi	ln pi	- pi ln pi	(pi x pi)
1	Balanus aapritite	13	34.71	0.209677	-1.56218	0.3275549	0.043964
2	Rhincalanus sp	9	24.03	0.145161	-1.92990	0.2801481	0.021071
3	Calanus sp	25	66.75	0.403225	-0.90825	0.3662332	0.162591
4	Saccutina sp	3	8.01	0.048387	-3.02852	0.1465413	0.002341
5	Evadne spinifera	0	0	0		0	0
6	Podon sp	0	0	0		0	0
7	Shrimps larva	0	0	0		0	0
8	Cypridina sp	0	0	0		0	0
9	Leganyctiphanes	12	32.04	0.193548	-1.64222	0.3178505	0.037460
10	Microcyclops varians	0	0	0		0	0
	SUM		165.54	1	-9.07110	1.4383283	0.267429

SUM OF SPECIES (S) 5
H = 1.438328
E = 0.893683

Tabel 25. Zooplankton Composition at Station IV

NUMBER	ZOOPLANKTON SPECIES	Total	ABOUNDANCE Ind/l	pi	ln pi	- pi ln pi	(pi x pi)
1	Balanus ampritite	19	50.73	0.296875	-1.21444	0.3605380	0.088134
2	Rhincalanus sp	10	26.7	0.15625	-1.85629	0.2900465	0.024414
3	Calanus sp	29	77.43	0.453125	-0.79158	0.3586879	0.205322
4	Sacculina sp	3	8.01	0.046875	-3.06027	0.1434501	0.002197
5	Evadne spinifera		0	0		0	0
6	Podon sp		0	0		0	0
7	Shrimps larva	3	8.01	0.046875	-3.06027	0.1434501	0.002197
8	Cypridina sp		0	0		0	0
9	Leganyctiphanas		0	0		0	0
10	Mitrocyclops varians		0	0		0	0
	SUM		170.88	1	-9.98287	1.2961730	0.322265

SUM OF SPECIES (S) 5
H = 1.296173
E = 0.805357

Tabel 26. Zooplankton Composition at Station V

NUMBER	ZOOPLANKTON SPECIES	Total	ABOUNDANCE ind/l	pi	ln pi	- pi ln pi	(pi x pi)
1	Balanus ampritite	15	40.05	0.277777	-1.28093	0.3558149	0.077160
2	Rhincalanus sp	8	21.36	0.148148	-1.90954	0.2828951	0.021947
3	Calanus sp	19	50.73	0.351851	-1.04454	0.3675251	0.123799
4	Sacculina sp	3	8.01	0.055555	-2.89037	0.1605762	0.003086
5	Evadne spinifera	2	5.34	0.037037	-3.29583	0.1220680	0.001371
6	Podon sp	1	2.67	0.018518	-3.98898	0.0738700	0.000342
7	Shrimps larva	5	13.35	0.092592	-2.37954	0.2203283	0.008573
8	Cypridina sp	1	2.67	0.018518	-3.98898	0.0738700	0.000342
9	Leganyctiphanas	0	0	0		0	0
10	Microcyclops varians	0	0	0		0	0
	SUM		144.18	1	-20.7787	11.6569479	10.236625

SUM OF SPECIES (S) 8
H = 1.656947
E = 0.796823

Tabel 27. Zooplankton Composition at all Station

NUMBER	ZOOPLANKTON SPECIES	ABOUNDANCE (IND/L)					
		STATION					
		I	II	III	IV	V	MEAN
1	Balanus ampritite	32	150	35	51	40	61.6
2	Rhincalanus sp	16	115	24	27	21	40.6
3	Calanus sp	35	142	67	77	51	74.4
4	Sacculina sp	8	29	8	8	8	12.2
5	Evadne spinifera	5	85	0	0	5	19
6	Podon sp	0	8	0	0	3	2.2
7	Shrimps larva	5	91	0	8	13	23.4
8	Cypridina sp	5	0	0	0	3	1.6
9	Leganyctiphanas	0	0	32	0	0	6.4
10	Microcyclops varians	8	0	0	0	0	1.6
	SUM OF INDIVIDU	114	620	166	171	144	243
	SUM OF SPECIES	8	7	5	5	8	10

Tabel 28. Composition of Zoobenthos at Station I

NUMBER	ZOOBENTHOS SPECIES	ABOUNDANCE Ind/m2	pi	ln pi	- pi ln pi	(pi x pi)
1	Cerithidea cingulata (Potamidae)	114	0.808510	-0.21256	0.1718501	0.653689
2	Circe nana (Veneridae)	0	0		0	0
3	Engina alveolata (Buccinidae)	0	0		0	0
4	Vexillua rugosua (Mitridae)	0	0		0	0
5	Asprella siebuldi (Conidae)	0	0		0	0
6	Tellina philipinarua (Tellinidae)	0	0		0	0
7	Bentharca xenophoricola (Arcidae)	3	0.021276	-3.85014	0.0819180	0.000452
8	Venus sp (Veneridae)	3	0.021276	-3.85014	0.0819180	0.000452
9	Melanoides tuberculata (Thiaridae)	3	0.021276	-3.85014	0.0819180	0.000452
10	Assiminea brefícula (Assimineidae)	3	0.021276	-3.85014	0.0819180	0.000452
11	Placoaen sp (Veneridae)	6	0.042553	-3.15700	0.1343404	0.001810
12	Calpurnus lactens (Uratonidae)	3	0.021276	-3.85014	0.0819180	0.000452
13	Euplica versicolor (Pyrenidae)	3	0.021276	-3.85014	0.0819180	0.000452
14	Cacing (Oligochaeta)	0	0		0	0
15	Scylla serrata (Decapoda)	3	0.021276	-3.85014	0.0819180	0.000452
16	Niotha venusta (Nassanidae)	0	0		0	0
17	Decorifer insignis (Restusidae)	0	0		0	0
	SUN	141	1	-30.3205	0.8796248	0.658669

SUM OF SPECIES 12
H = 0.879624
E = 0.353986

Tabel 29. Composition of Zoobenthos at Station II

NUMBE	ZOOBENTHOS SPECIES	ABOUNDANCE Ind/a2	pi	ln pi	- pi ln pi	(pi x pi)
1	Cerithidea cingulata (Potamididae)	19	0.395833	-0.92676	0.3668433	0.156684
2	Circe nana (Veneridae)	8	0.166666	-1.79175	0.2986265	0.027777
3	Engina alveolata (Buccinidae)	0	0		0	0
4	Vexillum rugosum (Mitridae)	0	0		0	0
5	Asprella sieboldi (Conidae)	0	0		0	0
6	Tellina philipinarum (Tellinidae)	0	0		0	0
7	Bentharca xenophoricola (Arcidae)	6	0.125	-2.07944	0.2599301	0.015625
8	Venus sp (Veneridae)	3	0.0625	-2.77258	0.1732867	0.003906
9	Melanoides tuberculata (Thiaridae)	6	0.125	-2.07944	0.2599301	0.015625
10	Assiminea brevicula (Assimineidae)	0	0		0	0
11	Placomen sp (Veneridae)	3	0.0625	-2.77258	0.1732867	0.003906
12	Calpurnus lactens (Uratonidae)	3	0.0625	-2.77258	0.1732867	0.003906
13	Euplica versicolor (Pyrenidae)	0	0		0	0
14	Cacing (Oligochaeta)	0	0		0	0
15	Scylla serrata (Decapoda)	0	0		0	0
16	Niotha venusta (Nassanidae)	0	0		0	0
17	Decorifer insignis (Restusidae)	0	0		0	0
	SUM	48	1	-15.1951	1.7051906	0.227430

SUM OF SPECIES 7
H = 1.70519
E = 0.876294

Tabel 30. Composition of Zoobenthos at Station III

NUMBER	ZOOBENTHOS SPECIES	ABOUNDANCE Ind/m2	pi	ln pi	- pi ln pi	(pi x pi)
1	Ceritithidea cingulata (Potamididae)	72	0.418604	-0.87082	0.3645328	0.175229
2	Circe nana (Veneridae)	0	0		0	0
3	Engina alveolata (Buccinidae)	0	0		0	0
4	Vexillum rugosum (Mitridae)	0	0		0	0
5	Asprella siebaldi (Conidae)	0	0		0	0
6	Tellina philipinarum (Tellinidae)	8	0.046511	-3.06805	0.1427001	0.002163
7	Bentharca xenophoricola (Arcidae)	0	0		0	0
8	Venus sp (Veneridae)	36	0.209302	-1.56397	0.3273437	0.043807
9	Melanoides tuberculata (Thiaridae)	8	0.046511	-3.06805	0.1427001	0.002163
10	Assiminea brevicula (Assimineidae)	0	0		0	0
11	Placamen sp (Veneridae)	0	0		0	0
12	Calpurnus lactens (Uratonidae)	0	0		0	0
13	Euplica versicolor (Pyrenidae)	6	0.034883	-3.35573	0.1170605	0.001216
14	Cacing (Oligochaeta)	17	0.098837	-2.31428	0.2287370	0.009768
15	Scylla serrata (Decapoda)	16	0.093023	-2.37490	0.2209214	0.008653
16	Niotha venusta (Nassanidae)	3	0.017441	-4.04888	0.0706200	0.000304
17	Decorifer insignis (Nestusidae)	6	0.034883	-3.35573	0.1170605	0.001216
	SUM	172	1	-24.0204	1.7316764	0.244524

SUM OF SPECIES 9

H = 1.731676

E = 0.788119

abel 31. Composition of Zoobenthos at Station IV

NUMBER	ZOOBENTHOS SPECIES	ABOUNDANCE Ind/m2	pi	ln pi	- pi ln pi	(pi x pi)
1	Cerithidea cingulata (Potamidae)	281	0.805157	-0.21671	0.1744915	0.648278
2	Circe nana (Veneridae)	6	0.017191	-4.06331	0.0698563	0.000295
3	Engina alveolata (Buccinidae)	0	0		0	0
4	Vexillua rugosum (Mitridae)	0	0		0	0
5	Asprella siebaldi (Conidae)	3	0.008595	-4.75645	0.0408864	0.000073
6	Tellina philipinarua (Tellinidae)	3	0.008595	-4.75645	0.0408864	0.000073
7	Bentharca xenophoricola (Arcidae)	0	0		0	0
8	Venus sp (Veneridae)	8	0.022922	-3.77563	0.0865474	0.000525
9	Melanoides tuberculata (Thiaridae)	6	0.017191	-4.06331	0.0698563	0.000295
10	Assiminea breficula (Assimineidae)	0	0		0	0
11	Placomen sp (Veneridae)	0	0		0	0
12	Calpurnus lactens (Uratonidae)	0	0		0	0
13	Euplica versicolor (Pyrenidae)	0	0		0	0
14	Cacing (Oligochaeta)	14	0.040114	-3.21601	0.1290091	0.001609
15	Scylla serrata (Decapoda)	22	0.063037	-2.76402	0.1742368	0.003973
16	Niotha venusta (Nassanidae)	0	0		0	0
17	Decorifer insignis (Restusidae)	0	0		0	0
	SUM	343	0.982808	-27.6119	0,7857706	0.655125

SUM OF SPECIES 9
H = 0.78577
E = 0.357619

Tabel 32. Composition of Zoobenthos at Station V

NUMBER	ZOOBENTHOS SPECIES	ABOUNDANCE Ind/m2	pi	ln pi	- pi ln pi	(pi x pi)
1	Cerithidea cingulata (Potamidae)	36	0.428571	-0.84729	0.3631276	0.183673
2	Circe nana (Veneridae)	6	0.071428	-2.63905	0.1885040	0.005102
3	Engina alveolata (Buccinidae)	3	0.035714	-3.33220	0.1190073	0.001275
4	Vexillum rugosum (Mitridae)	3	0.035714	-3.33220	0.1190073	0.001275
5	Asprella sieboldi (Conidae)	3	0.035714	-3.33220	0.1190073	0.001275
6	Tellina philipinarum (Tellinidae)	6	0.071428	-2.63905	0.1885040	0.005102
7	Bentharca xenophoricola (Arcidae)	6	0.071428	-2.63905	0.1885040	0.005102
8	Venus sp (Veneridae)	3	0.035714	-3.33220	0.1190073	0.001275
9	Melanoides tuberculata (Thiaridae)	3	0.035714	-3.33220	0.1190073	0.001275
10	Assiminea brevicula (Assimineidae)	3	0.035714	-3.33220	0.1190073	0.001275
11	Placoaen sp (Veneridae)	3	0.035714	-3.33220	0.1190073	0.001275
12	Calpurnus lactens (Uratonidae)	0	0		0	0
13	Euplica versicolor (Pyrenidae)	0	0		0	0
14	Cacing (Oligochaeta)	3	0.035714	-3.33220	0.1190073	0.001275
15	Scylla serrata (Decapoda)	6	0.071428	-2.63905	0.1885040	0.005102
16	Niotha venusta (Nassanidae)	0	0		0	0
17	Decorifer insignis (Restusidae)	0	0		0	0
	SUM	84	1	-38.0611	2.0692024	0.214285

SUM OF SPECIES 13
H = 2.069202
E = 0.806722

Tabel 33. Composition of Zoobenthos at all Station

NUMBER	ZOOBENTHOS SPECIES	ABOUNDANCE (IND/M2)					
		STATION					MEAN
		I	II	III	IV	V	
1	Cerithidea cingulata (Potamididae)	114	19	72	281	35	104.4
2	Circe nana (Veneridae)	0	8	0	6	6	4
3	Engina alveolata (Buccinidae)	0	0	0	0	3	0.6
4	Vexillum rugosum (Mitridae)	0	0	0	0	3	0.6
5	Asprella sieboldi (Conidae)	0	0	0	3	3	1.2
6	Tellina philipinarum (Tellinidae)	0	0	8	3	6	3.4
7	Dentharca xenophoricola (Arcidae)	3	6	0	0	6	3
8	Venus sp (Veneridae)	3	3	36	8	3	10.6
9	Melanoides tuberculata (Thiaridae)	3	6	8	6	3	5.2
10	Assiminea oreficula (Assimineidae)	3	0	0	0	3	1.2
11	Placamen sp (Veneridae)	6	3	0	0	3	2.4
12	Calpurnus lactens (Uratonidae)	3	3	0	0	0	1.2
13	Euplica versicolor (Pyrenidae)	3	0	6	0	0	1.8
14	Cacing (Oligochaeta)	0	0	17	14	3	6.8
15	Scylla serrata (Decapoda)	3	0	16	22	6	9.4
16	Niotha venusta (Nassanidae)	0	0	3	0	0	0.6
17	Decorifer insignis (Restusidae)	0	0	6	0	0	1.2
	SUM OF INDIVIDUAL	141	48	172	343	84	157.6
	SUM OF SPECIES	12	7	9	9	13	17

Tabel 34. Composition of phytobenthic in Benoa Harbour

NUMBER	SPECIES OF PHYTOBENTHIC	STATION				
		1	2	3	4	5
1	Gracilaria licinoides	++	++	++	+	+
2	Gracilaria sp	+	+	–	–	–
3	Thallasia sp	++	+	+	++	++
4	Caulerpa sp	++	–	–	++	++
5	Padina sp	++	++	++	+	+
6	Enhalus sp	+	++	++	+	+

Tabel 35. Index value of phytoplankton

STATION	D	H	E	RID
I	0.1445	2.1616	0.8427	0.8555
II	0.2142	1.9428	0.7008	0.7858
III	0.1658	2.1493	0.7936	0.8342
IV	0.1989	1.9249	0.7108	0.8011
V	0.1623	2.1297	0.7517	0.8377

NOTE :

D = DOMINANTION INDEX
H = DIVERSITY INDEX
E = EQUITABILITY INDEX
RID = RECIPROCAL INDEX OF DIVERSITY

Tabel 36. Index value of Zooplankton

STATION	D	H	E	RID
I	0.205	1.7923	0.8619	0.795
II	0.1877	1.7482	0.8984	0.813
III	0.2674	1.4383	0.8936	0.7326
IV	0.3223	1.2962	0.8054	0.6777
V	0.2366	1.6569	0.7968	0.7634

NOTE :

D = DOMINANTION INDEX
H = DIVERSITY INDEX
E = EQUITABILITY INDEX
RID = RECIPROCAL INDEX OF DIVERSITY

Tabel 37. Index value of Zoobenthos

STATION	D	H	E	RID
I	0.6587	0.8796	0.3539	0.3413
II	0.2274	1.7052	0.8729	0.7726
III	0.2445	1.7317	0.7081	0.7555
IV	0.6551	0.7858	0.3576	0.3449
V	0.2143	2.0692	0.8067	0.7857

NOTE :

D = DOMINANTION INDEX
H = DIVERSITY INDEX
E = EQUITABILITY INDEX
RID = RECIPROCAL INDEX OF DIVERSITY

Tabel 30. The common fishes living around the mangrove ecosystem

No.	Local Name	Scientific Name
1	Belodo / Belodok	(*Periopthalmus dipus*,Blkr)
2	Beloso / Boso	(*Glossogobius giceris*)
3	Bandeng	(*Chanmos chanmos*)
4	Pajos/payos	(*Silligo sihama*)
5	Belanak	(*Mugil dussmieri*)
6	Mujair	(*Oreochromis mossambicus*)
7	Belut	(*Pluta alba*)
8	Kerong-kerong	(*Therapon theraps*)
9	Bulan - bulan	(*Megalops cyprinoides*)
10	Udang Windu	(*Penaens monodon,Fab*)
11	Udang Manis	(*Metapenaeus Sp.*)
12	Udang Putih	(*Penaus Merguensis*)
13	Kepiting Bakau	(*Scylla Serrata*)

Tabel 39. The common fishes living around the Benoa Bay

NO.	Local Name	Scientific Name
1.	Peperek	(*Leiognathus splendens*)
2.	Belanak	(*Mugil dessumeiri*)
3.	Bandeng	(*Chanos chanos*)
4.	Kerapu	(*Epinephelus tauvina*)
5.	Swangi	(*Priacanthus tayenus*)
6.	Lingkis	(*Siganus canaliculatus*)
7.	Ekor Kuning	(*Caesio erythrogoster*)
8.	Udang Windu	(*Penaeus monodon*)
9.	Udang Putih	(*Penaeus merguensis*)
10.	Bronang	(*Siganus javus*)

Tabel 40. The species of birds over mangrove forest at East Suwung.

NO.	Local Name	Scientific Name	Family
1.	Pecuk Ular	(*Anhinga anhinga melanogaster*)	Phalacrocoracidae
2.	Cangak	(*Ardea cinerea rectirostris*)	Ardeidae
3.	Kuntul	(*Egretta garzettanigripes*)	Ardeidae
4.	Blekok	(*Ardeola speciosa*)	Ardeidae
5.	Kuntul malam	(*Nyeticorax nyeticorax*)(Linn)	Ardeidae
6.	Kokokan	(*Ixobrychus cinnamomeus cinnamomeus*)(Gmell)	Ardeidae
7.	Tekukur	(*Streptopelia chinensis tigrina*) (Temm)	Cuculidae
8.	Perkutut	(*Geopelia striata*)(Linn)	Cuculidae
9.	Kucica	(*Copsychus saularis javensis*)	Muscicapidae
10.	Perenjak	(*Prinia familiaris olivacea*)	Muscicapidae
11.	Walet	(*Collocalia gigas*)(Hart&Butt)	Apodidae
12.	Walet	(*Collocalia esculenta linchi*) (Horsf & Moore)	Apodidae
13.	Walet coklat	(*Collocalia inexpectata bartelsi*) (Stres)	Apodidae
14.	Burung rangkong	(*Aceros undulatus*)	Bucerotidae
15.	Burung leher kuning	(*Zosterops palpebrosa williamsoni*)	Zosteropidae
16.	Ulung ulung	(*Spizaetus cirhatus limnaetus*)	Accipitridae
17.	Elang	(*Haliastur indus intermedius*) (Gurney)	Accipitridae
18.	Tilil	(*Tringa glareola*) (Linn)	Scalopacidae
19.	Prit	(*Lonchura leucogastroides*) (Horsf & Moore)	Sturnidae
20.	Burung madu	(*Antreptes singalensis phoenicotis*) (Temm)	Nectariniidae

21. Burung manyar	(*Ploceus manyar*)	Ploceidae
22. Cerucuk	(*Pynonotus analis*)	Pycnonotidae
23. Gagak	(*Corvus enca*)	Curvidae

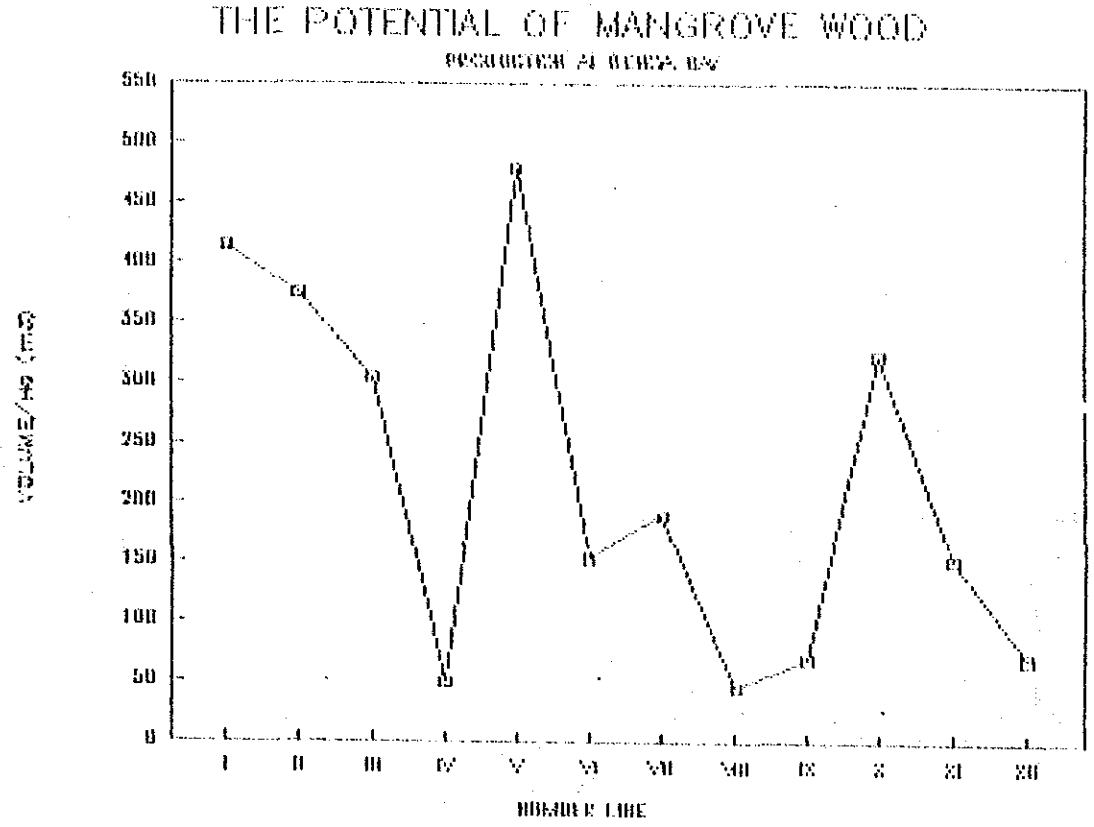


Figure 1. The Potential of Mangrove Wood Production at Benoa Bay

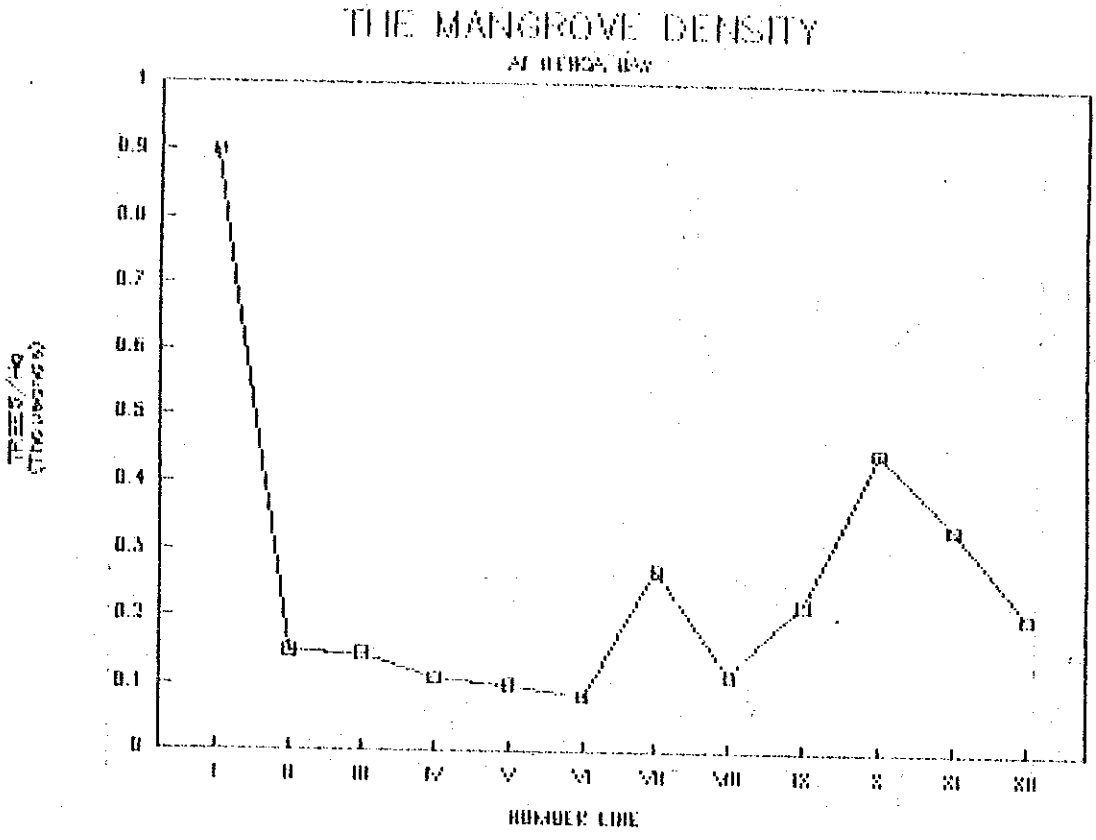


Figure 2. The Mangrove Density at Benoa Bay

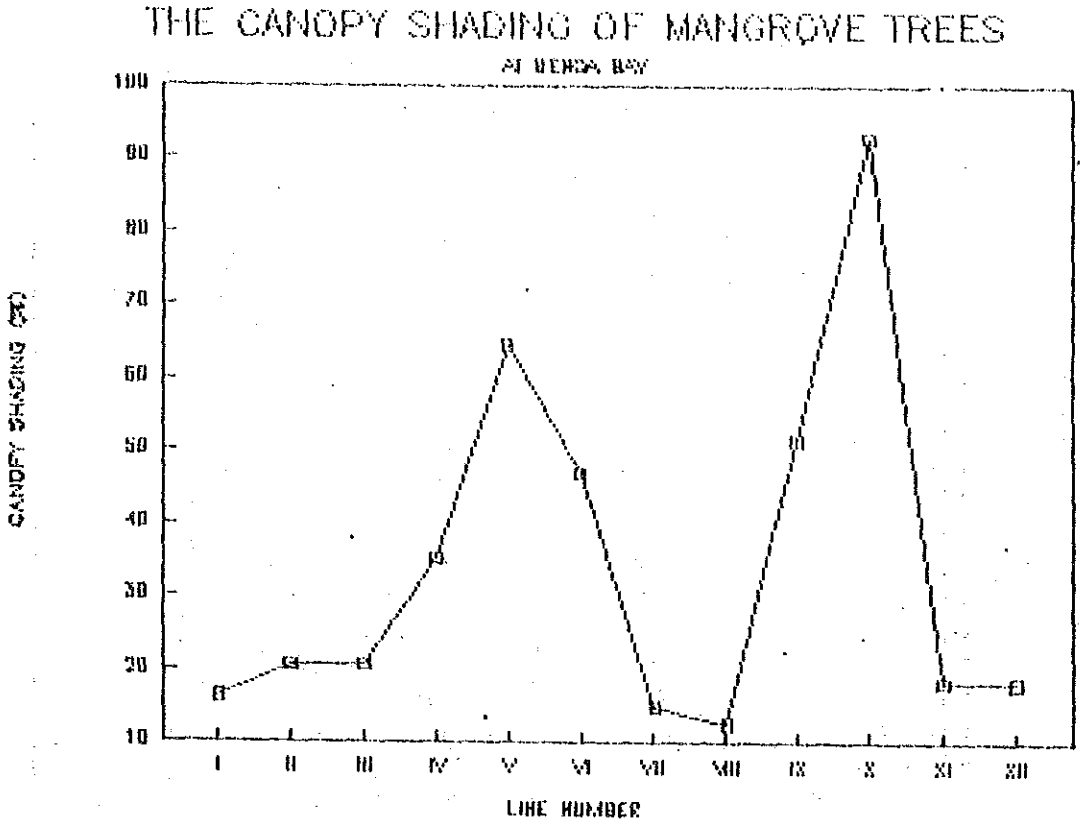


Figure 3. The Canopy Shading of Mangrove tree at Denoa Bay

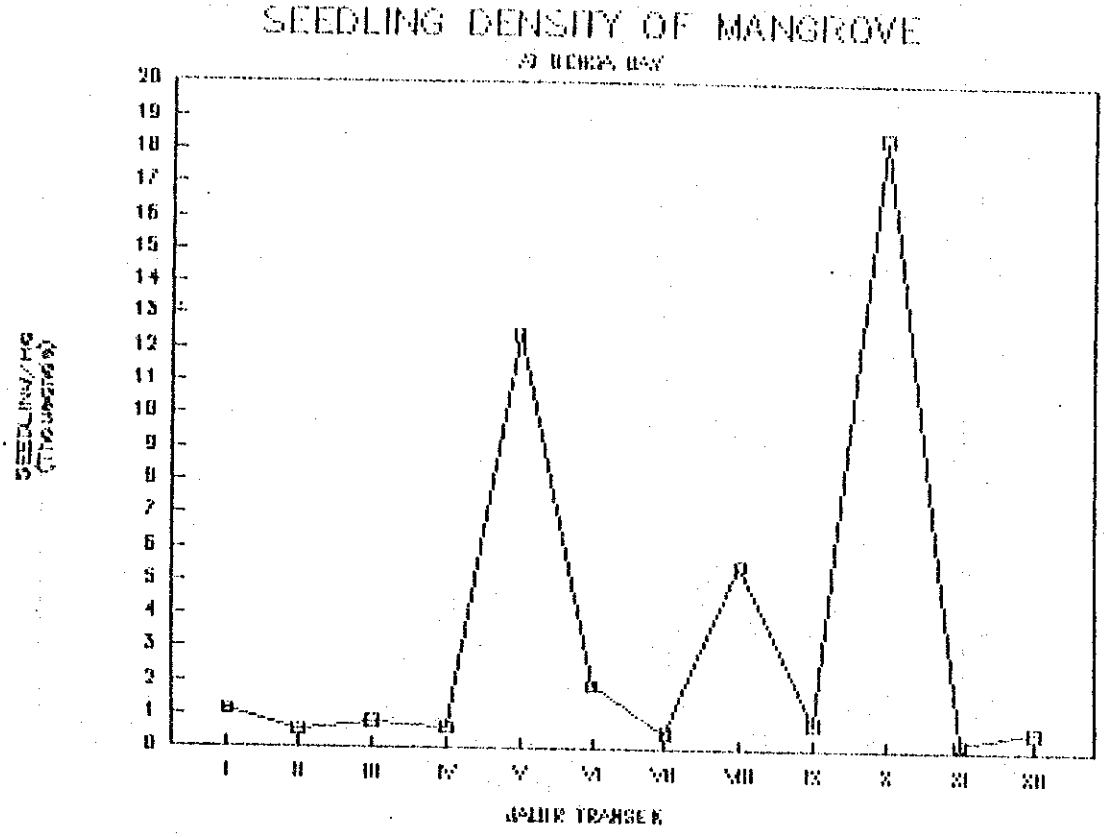


Figure 4. Seedling Density of Mangrove at Benoa Bay

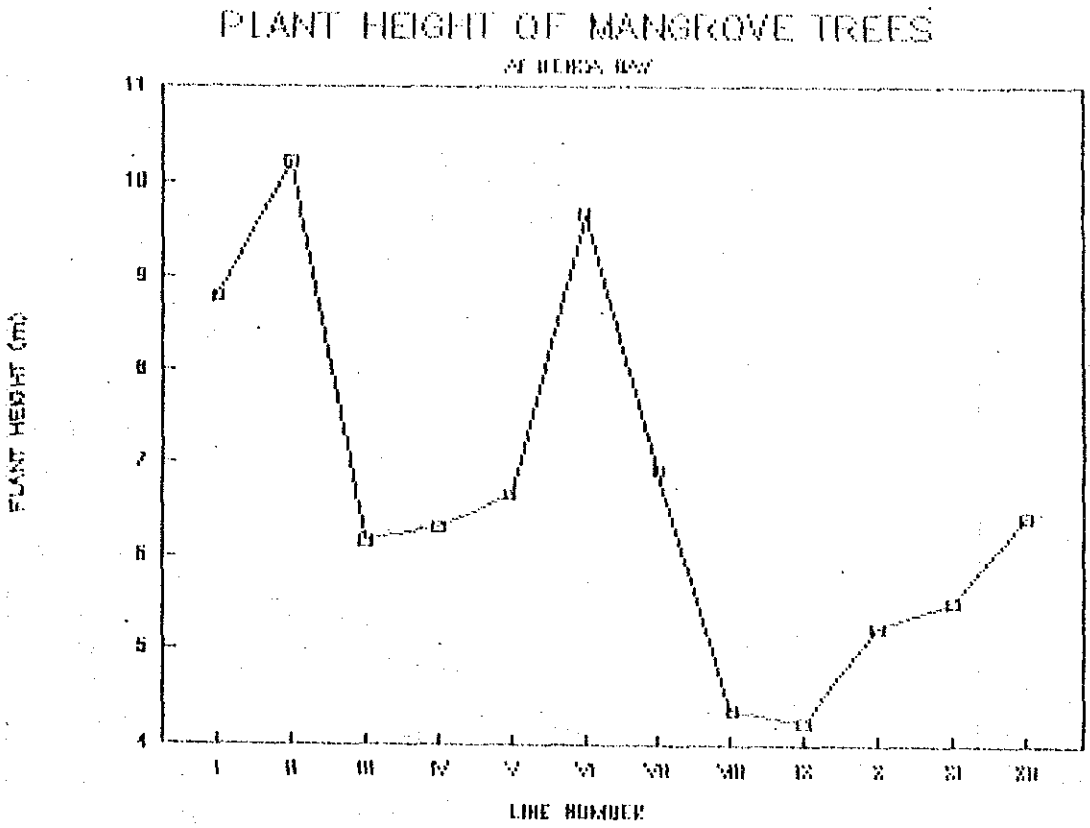


Figure 5. Plant Height of Mangrove trees at Benoa Bay

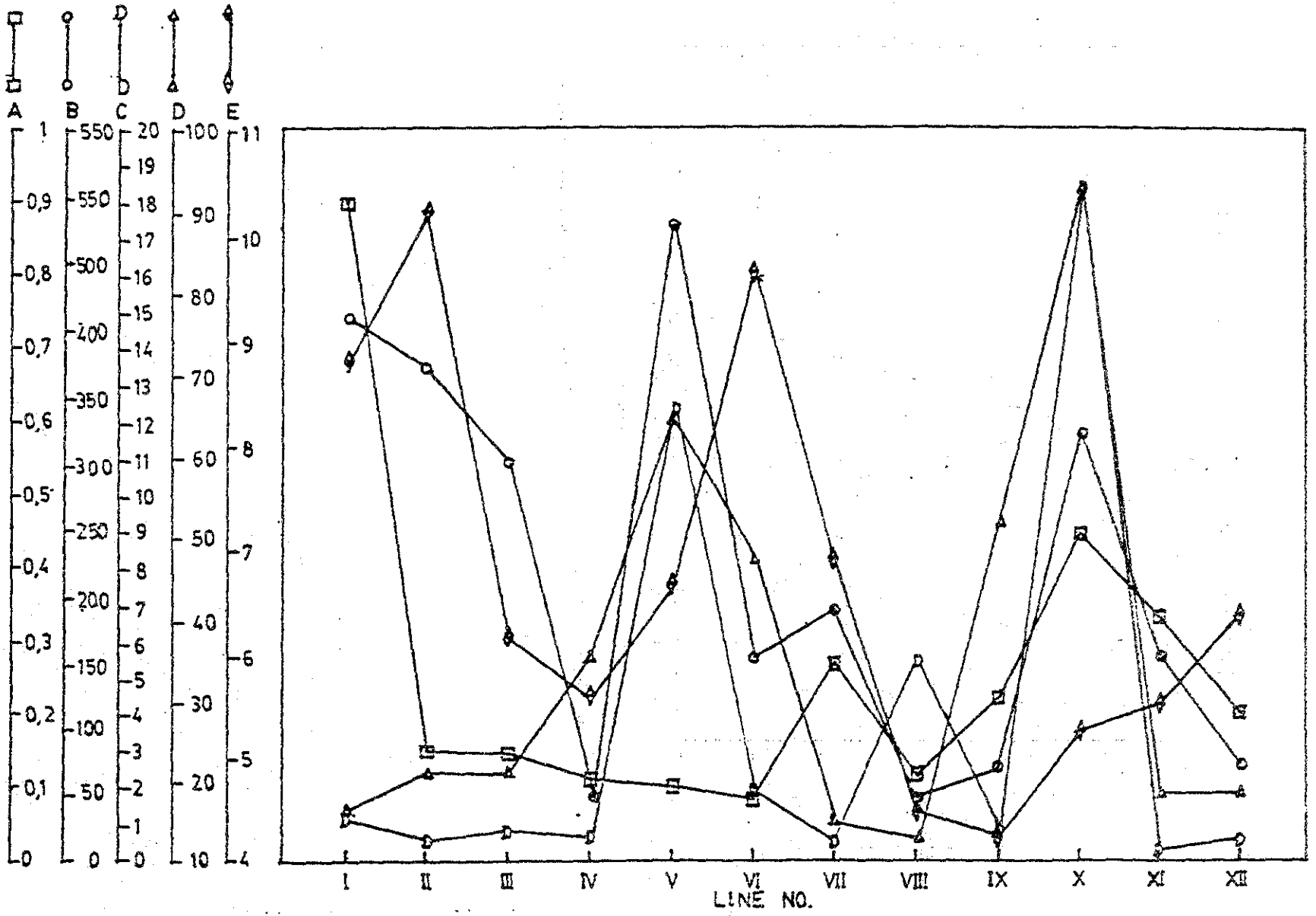


Figure 6: Composition of mangrove tree, seedling and canopy shading at Benoa Bay.
A : mangrove density (trees/ha), B:wood production(m^3)
C : seedling, D: canopy shading (%), E: plant height (m)

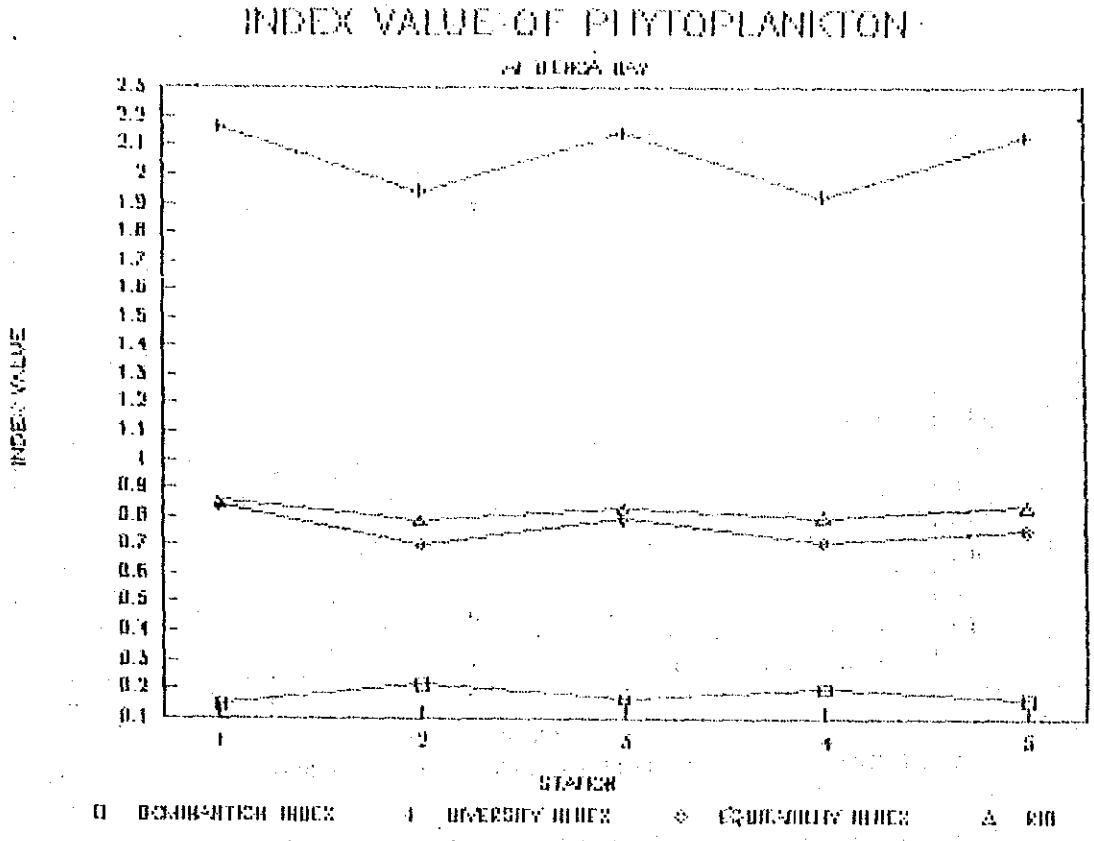


Figure 7. Index Value of Phytoplankton at Benoa Bay

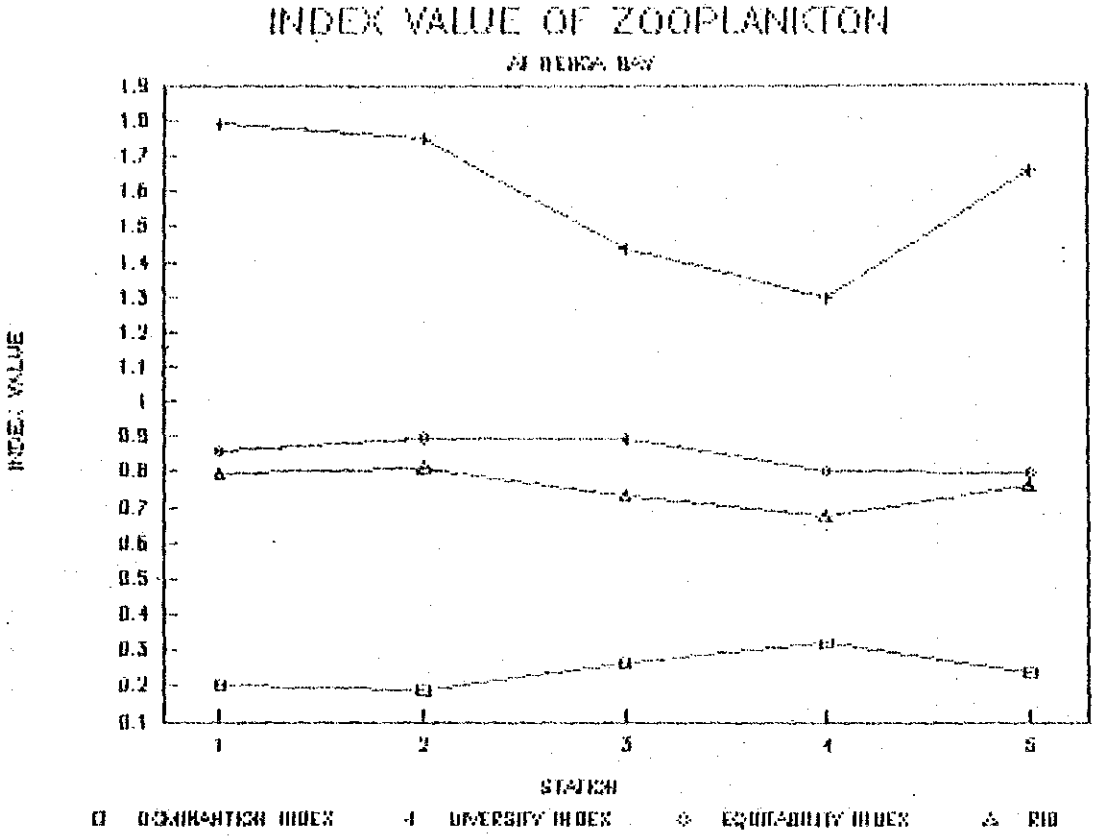


Figure 8. Index Value of Zooplankton at Benoa Bay

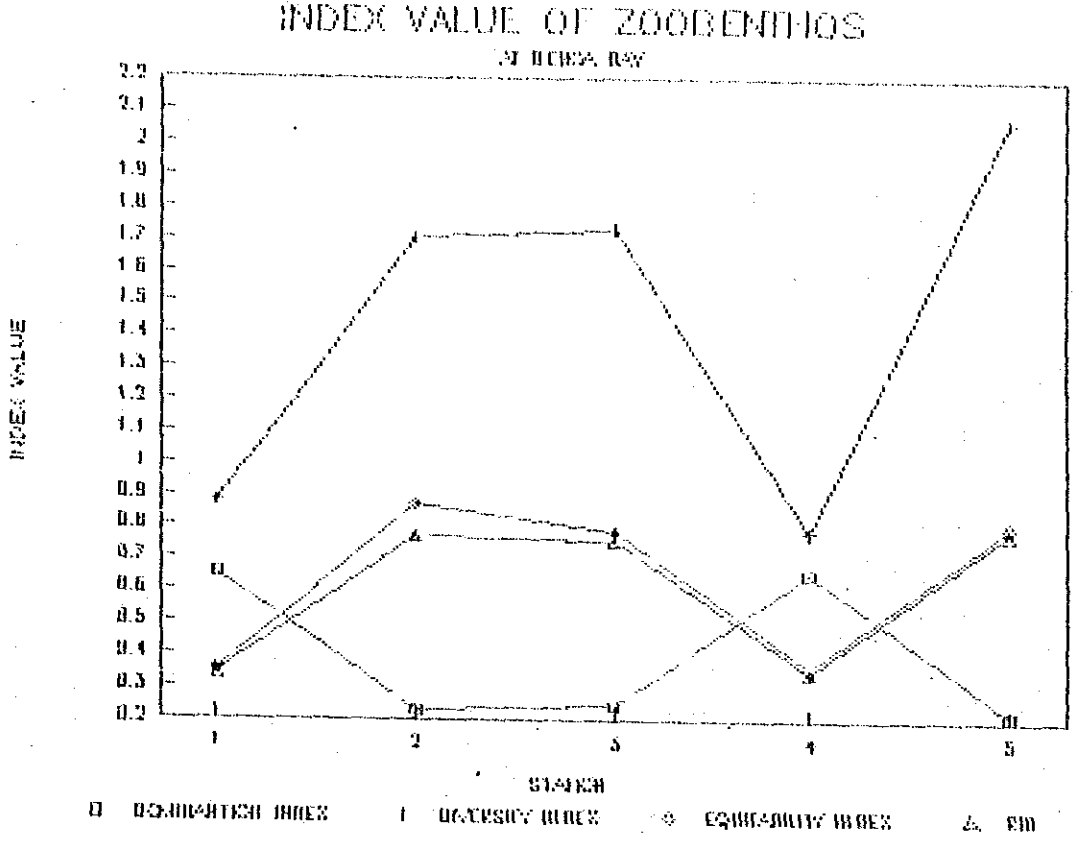


Figure 9. Index Value of Zoobenthos at Benoa Bay

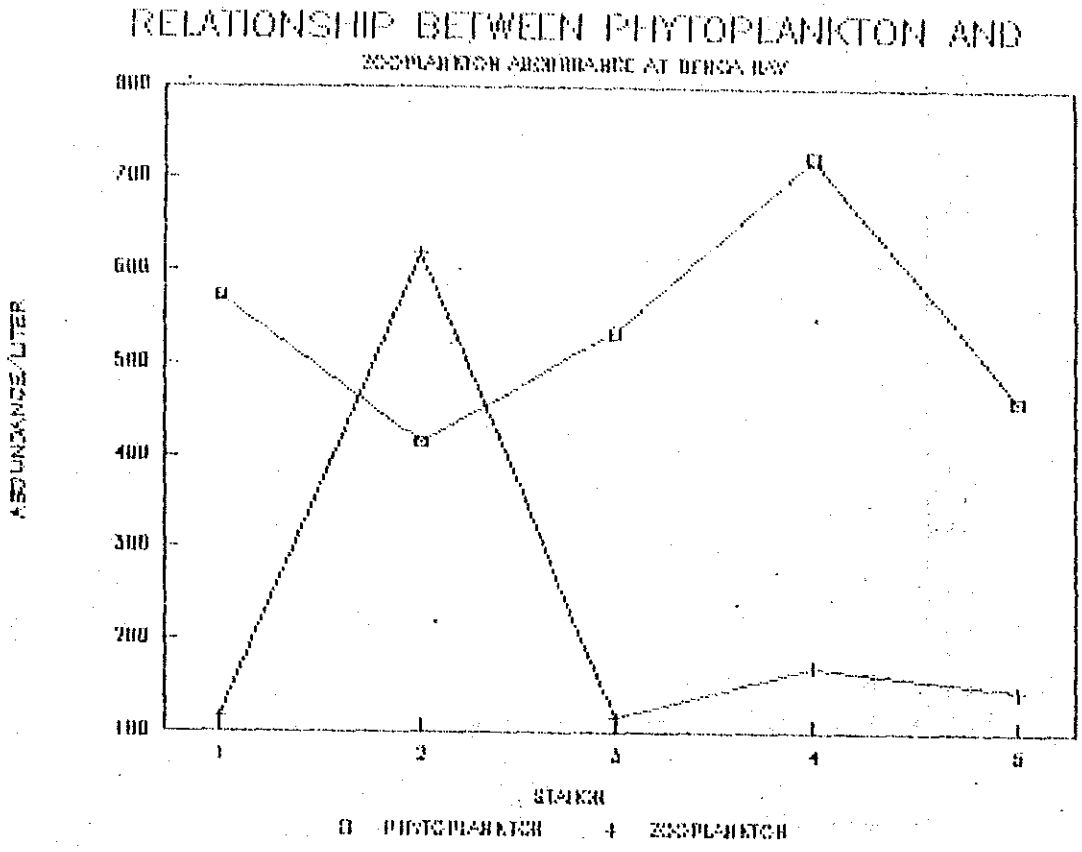


Figure 10. Relationship Between Phytoplankton and Zooplankton Abundance at Benoa bay

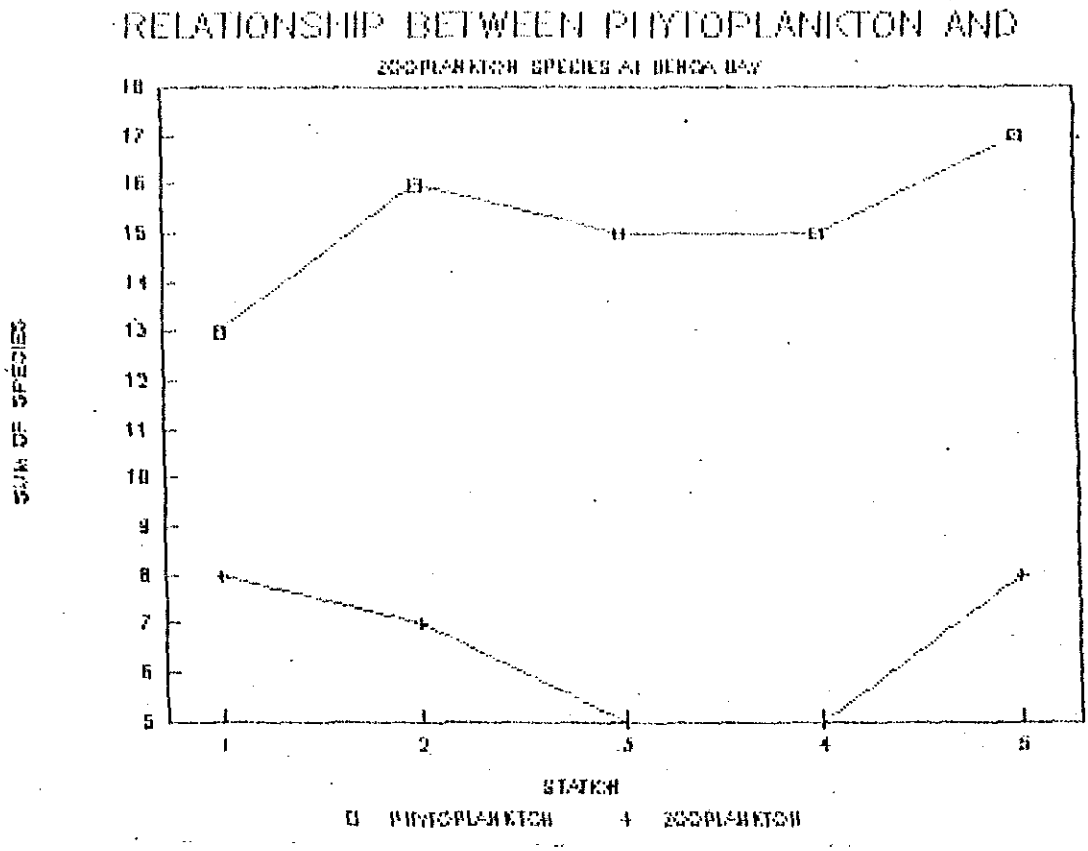


Figure 11. Relationship Between Phytoplankton and Zooplankton Species at Benoa bay