

THE REPUBLIC OF ECUADOR

FEASIBILITY STUDY
ON
SMALL-SCALE FISHING PORT
DEVELOPMENT PROJECT
IN
MANABI PROVINCE

SUMMARY

MARCH 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to a request from the Government of the Republic of Ecuador, the Government of Japan decided to conduct a feasibility study on small scale fishing port development project in Manabi province and entrusted the study to the Japan International Cooperation Agency(JICA).

JICA sent to Ecuador a study team headed by Mr. Fujio Saigusa, Director of Transportation Engineering Department, Nippon Koei Co., Ltd. 2 times between November, 1990 and September, 1991.

The team held discussions with the officials concerned of the Government of Ecuador, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Ecuador for their close cooperation extended to the team.

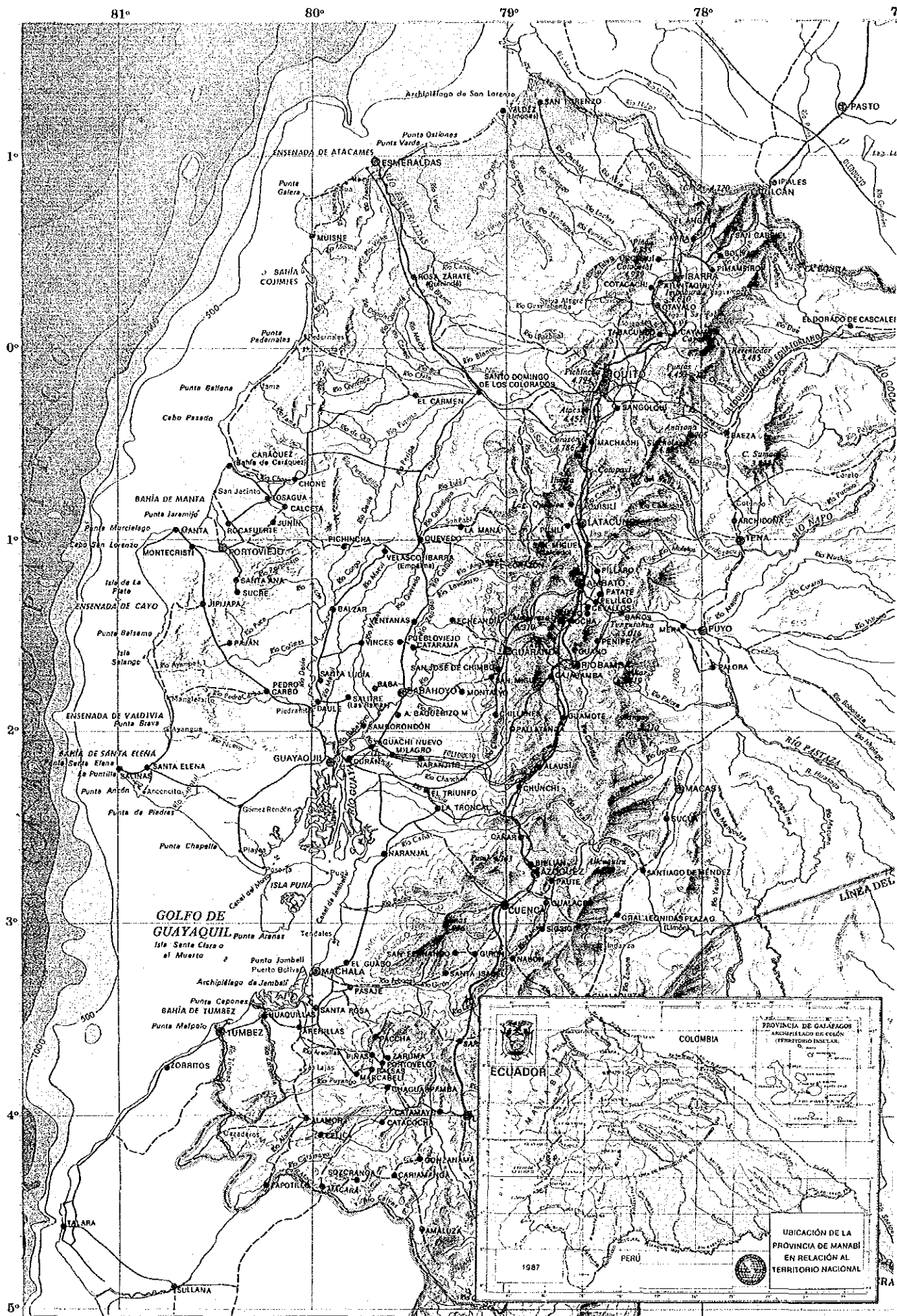
March, 1992

A handwritten signature in cursive script, reading "Kenzuke Yanagiya".

President

Japan International Cooperation Agency

REPÚBLICA DEL ECUADOR - MAPA FÍSICO





Fishermen at Manta Beach



Machalilla Beach



Fishing Village of San Mateo



Puerto Lopez Bay

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Conclusions and Recommendations

1. Introduction

This report is the final report for the Study on the Small-Scale Fishing Port Development Project in Manabi Province in the Republic of Ecuador. This report presents the results of feasibility study carried out by the Japan International Cooperation Agency (JICA) from December 1990 in close cooperation with the Ministry of Industries, Commerce, Integration and Fishery (MICIP).

The Scope of Work for the Study was agreed upon on April 12, 1990 between JICA and MICIP. It contains the outline of the feasibility study (hereinafter referred to as the Study) and defines the objective and the area of the Study.

Objective of the Study:

The objectives of the Study are to formulate a small-scale fishing port development plan and to conduct feasibility study on the selected priority project.

Study Area:

The Study covers coastal area of Manabi Province from Jaramijo to Puerto Lopez.

The feasibility study commenced from December 1990 and the following reports were submitted to MICIP.

- (1) Inception Report (December 1990)
- (2) Progress Report I (February 1991)
- (3) Interim Report (July 1991)
- (4) Progress Report II (August 1991)

This final report includes the results of the feasibility study for the Small-Scale Fishing Port Development Project in Manabi Province in accordance with a series of discussions with MICIP concerning above reports.

2. Background of the Project

The National Socioeconomic Development Plan for the period 1989-1992 has a target for the increase of GDP at a rate of 3.1% yearly, and has established some general objectives that have been summarized below:

To strengthen social co-operation as the best means of obtaining a balanced social and economic development.

To improve the access to natural resources and capital to overcome the levels of poverty in the rural populations.

The growth rate in the agricultural, fisheries and forestry sectors is projected at 3.8% annually.

The strategic outline for the Development of the Fishing Sector is to promote the industrial or artisanal fishery activities with the help of the specialized organs of the Country, in order to increase the production and distribution of fish products which corresponds to the domestic demand and increase the exports, by means of the construction of industrial and artisanal fishing ports.

At the year 1990, the total population of Ecuador is 9,620 thousand and its annual growth rate is 2.3%. The population at the year 2005 is expected at 1,390 thousand.

In the past 20 years, economic growth of Ecuador owed to oil sector largely. But recently, the fall in the oil price and the limited oil resources become serious problems to the economy. Under these circumstances, Ecuadorian Government sets up basis to overcome the excessive dependency of the economy upon the oil sector and lays the priority on the fishery sector.

By implementation of this project, effective fish landing, preservation and distribution system are established in southern Manabi. Furthermore, the stable and lasting development of the artisanal fishery is expected through the upgrade of the quality and the stable supply of the fish products.

The total fish catches volume of Ecuador is at the level between 700-800 thousand tons approximately and it fluctuates largely affected by oceanographic conditions. But the fish catches volume by the artisanal fishery is at the constant level between 80-90 thousand tons.

The artisanal fishery supplies the nutritious protein as an important source sharing around 20% of the domestic consumption of fishery products. The future demand for fishery products will be increased corresponding to the population increase and the national target for the increase of fish consumption per capita. Exports of fishery products are expected to be increased also according to the current tendency of exports.

3. Master Plan

The natural conditions, present conditions of the infrastructures concerned, fishery situation and the construction conditions were evaluated for each site at the study area, and Manta, San Mateo, Machalilla and Pto. Lopez were selected as the sites for Master Plans.

Small scale fishing boats and middle scale fishing boats were selected as planned fishing boats.

Planned number of small boats is all the boats at the project sites. Among the middle boats, boats with no more than 80 gross tonnages at Manta, Jaramijo and San Mateo, and all the boats at other sites are planned to be incorporated in the project.

4. Priority Plan

Manta was selected as the site of the Priority Plan aiming the construction at the target year 1995 and the Priority Plan was formulated. The planned site was selected evaluating the fishing port development potential and the emergent needs for the fishing port construction.

Planned number of small boats is all the boats at the target year. Among the middle boats, boats with no more than 40 gross tonnages which currently can not use the Manta commercial port and all the increased boats if less than 40 gross tonnages are planned to be incorporated in the project.

(Construction Cost)

The construction period of the short-term development plan is scheduled to be three years including the period for the detailed design. The total construction cost is estimated at 18,164 thousand US dollars, the local portion 9,377 thousand of US dollars and the foreign portion at 8,787 thousand of US dollars.

(Fishing Port Administration)

The fundamental concept in the management of the fishing port facilities is to secure the safety of the fishing boats, to give the sufficient services for usage of the fishing boats and to make use of the port facilities for smooth and efficient landing, storage, processing and distribution of fish catches and speedy supply of stores, provisions, and repairs.

The organization for the administration of the fishing port in this project is proposed to be established within APM and is composed of the followings.

- Administrative Committee of Fishing Port
- Administrative and Operational Department of Fishing Port

(Economic Viability)

The economic viability of the project is examined from the viewpoint of Ecuador's national economy. Cost-benefit analysis in which the quantifiable benefits derived from the construction of the Manta fishing port are compared with the project costs is adopted and an appropriate economic internal rate of return

(EIRR) is calculated to serve as a measure of the viability of the project. From the project costs and benefits calculated in this project, the EIRR has worked out at 3.6%, which is lower than the opportunity cost of capital in Ecuador. However, it is considered appropriate to implement the project, since it is an infrastructure project having the high public characteristics and is expected to contribute largely to the promotion of the regional development. From the view point of the economic analysis, that is, the benefit of the project to the nation, this project can be regarded as feasible.

The current account of the balance of payments shows the profits after depreciation at the year 1995. The durable years of the fishing port facilities are long, and from the viewpoint of the financial viability, this project is feasible for the fishing port management body.

5. Recommendations

The construction of the small-scale fishing port in Manabi Province promotes the improvement of fishery products quality and the stable supply of fishery products, and realize the increase of the income of the artisanal fishermen. And as a result, it contributes to the stable and lasting development of the artisanal fishery.

It is also expected that the construction of the fishing port brings the continuous effect for the socioeconomic progress not only for the construction site but also for Manabi Province and the country.

Especially, the short-term development plan for the Manta fishing port is feasible enough from the view points of the technical assessment and economic analysis. Therefore, this project should be started as early as possible jointly with the construction works concerning the urban development plan which currently started at the area adjoining the planned site of the Manta fishing port.

Furthermore, it is desirable that the feasibility study on the fishing ports of San Mateo, Machalilla and Puerto Lopez would follow this project aiming at the achievement of Master Plan.

1. ABBREVIATION

MICIP	Ministry of Industries, Commerce, Integration and Fishery Ministerio de Industrias, Comercio, Integración y Pesca
SRP	Subsecretary for Fisheries Resources Subsecretario de Recursos Pesqueros
DGP	General Directorate for Fisheries Dirección General de Pesca
INP	National Institute for Fisheries Instituto Nacional de Pesca
EPNA	National Fishery Company Empresa Pesquera Nacional
CONADE	National Development Council Consejo Nacional de Desarrollo
INEC	Institute of National Statistics and Census Instituto Nacional de Estadística y Censos
INEN	Normalization Ecuadorian Institute Instituto Ecuatoriano de Normalización
INOCAR	Oceanographic Institute of Army Instituto Oceanográfico de la Armada
DAC	Civil Aviation Office Dirección de Aviación Civil
EIU	Economic Intelligence Unit Unidad de Inteligencia Económica
IMF	International Monetary Fund Fondo Monetario Internacional
APM	Port Authority of Manta Autoridad Portuaria de Manta
ESPOL	Politechnic Littoral College Escuela Superior Politécnica del Litoral
BEDE	Ecuadorian Development Bank Banco Ecuatoriano de Desarrollo
FAO	Food and Agriculture Organization of the United Nations Organización de las Naciones Unidas para la Agricultura y la Alimentación
CIF	Cost Insurance and Freight Coste Seguro y Flete
FOB	Free on Board Franco a Bordo
BEDE	Ecuadorian Development Bank Banco Ecuatoriano de Desarrollo
GDP	Gross Domestic Product
PIB	Producto Interno Bruto
GRP	Gross Regional Product
PRB	Producto Regional Bruto
EAP	Economically Active Population
PEA	Población Económicamente Activa

CHAPTER 1 INTRODUCTION

1.1 Background of the Study

Until 1960's, agricultural products such as banana, cacao and coffee were mainly exported, but afterward oil found at Amazon area were produced and exported from 1972 increasingly. As a result, the national economic growth was performed remarkably owing to the oil production in 1970's. Ecuador became the oil production country, but in the agriculture and fishery sector, its products still share 17% of the GDP and its employees occupy 34% of the total economically active population. Therefore, the agriculture and fishery sector is expected to be developed by the technical evolution and to play the important roll along with the oil by using its energy and natural resources.

The National Socioeconomic Development Plan (1989-1992) has a target to develop the fishery and aims to increase the fish products, to improve the collection and distribution system coping with the increase of the domestic consumption and exports.

The fishing activities are carried out around the areas where the Humboldt cold current and El Nino' current join, and the exports of the fish products amount to 449 million US dollars in 1988. The fishery industry contributes largely to the acquisition of foreign currency. The worldwide shrimp demand promoted the current fishery development although it depends on the development of the shrimp culture mainly. The production of shrimp has been enlarged as per the technical development of the culture.

On the other hand, the present conditions of the artisanal fishery are low level in the fish catches and the productivity in spite of it's important roll. So, the artisanal fishery is requested to increase the fishermen's income, to develop the fishing villages and to contribute to the regional development by means of the improvement of fishery conditions with the construction of the fishing ports and the functional facilities.

Under these circumstances, the cooperation relating to the study on the small-scale fishing port development project in Manabi Province was requested by the Ecuador Government to the Japanese Government. In compliance with the request, the implementation of the study was made based on the scope of work for the study agreed upon on April 12, 1990 between JICA and MICIP.

1.2 Objectives and Area of the Study

The objectives, the area and the implementation method of the study are as follows.

(1) Objectives of the Study

The objectives of the study are to formulate the small-scale fishing port development plan for the southern area of the Manabi Province and to conduct the feasibility study on the selected priority plan.

(2) The Study Area

The study covers the coastal area of Manabi Province extending from Jaramijo located at the north of Manta to Puerto Lopez in the southern part of Manabi Province.

(3) Implementation Method of the Study

The study is divided into the Phase I and Phase II. At the Phase I of the study, the sites for the fishing ports aiming the construction at the target year 2005 were selected and the Master Plans were formulated for each site by evaluating the fishery port development potential. The Priority Plan to be constructed urgently was also studied. The site for the fishing port aiming the construction at the target year 1995 was selected. At the Phase II, the supplementary field survey for the priority planned site was implemented and the feasibility study was carried out.

The field survey of the Phase I commenced at December 1990, and the Interim Report was made based on the field survey. In the Interim Report, Manta, San Mateo, Machalilla and Puerto Lopez were proposed as the sites for the Master Plan and the planned Master Plans were agreed. The site for the Priority Plan aiming the construction at the target year 1995 was discussed and agreed to select Manta.

The field survey of the Phase II commenced at July 1991, and the Draft Final Report was made based on the supplementary field survey. In the Draft Final Report, the feasibility study was conducted for Manta as the planned priority site.

The Final Report presents the results of all the studies, and contains natural conditions, socioeconomic conditions fisheries situation, basic concept and planning of small-scale fishing port development, construction plan, administration and operation of fishing port and results of economic analysis.

1.3 Implementation of the Study

The Subsecretary for Fisheries Resources (SRP), Ministry of Industries, Commerce, Integration and Fishery, was assigned as the counterpart executing agency of the Government of Ecuador while the Japan International Cooperation Agency (JICA) was assigned as the official agency responsible for the implementation of the technical cooperation programme of the Government of Japan.

The study was conducted from December, 1990 to March 1992. The members involved in the study are listed below.

(1) JICA Advisory Committee

Mr. Koji Mitsunashi : Chairman
Dr. Masaaki Yamamoto: Member
Mr. Syoichi Shikada : Member
Mr. Noboru Oshima : Member

(2) JICA Study Team

Mr. Fujio Saigusa : Team Leader
Dr. Francisco Medina: Analysis of Natural Conditions
Mr. Takuro Terashima: Littoral Drift Analysis
Mr. Iwao Mizuishi : Fishery Products Distribution Analysis
Mr. Shigeru Iwasaki : Fishery Products Distribution Analysis
Mr. Mamoru Watabe : Fishery Economic, Organization
Mr. Noboru Murai : Fishing Port Planning
Mr. Toyomitsu Terao : Fishing Facility
Mr. Katsumi Naito : Design of Fishing Port Facility

(3) Ecuadorian Counter Part

Mr. Max Aguirre Auad: Undersecretary of Fisheries Resources,
Ministry of Industries, Commerce,
Integration and Fishery (MICIP)
Ing. Torres : Technical Advisor,
Subsecretary for Fisheries Resources
(SRP),
Ing. Carlos Ormed : Technical Advisor, SRP,
Mr. Pablo Larrea : President, Manta Port Authority (APM)
Ing. Alfred Flores : Technical Dept. APM
Ing. Bolivar Ortiz : Technical Dept. APM
Ing. Jorge Palau : Director's Board, APM

1.4 Acknowledgement

The study team conducted two times of field surveys in Ecuador from December, 1990. During their stay, the study team got various support and cooperation from the related organizations under the Government of Ecuador and all the personnel concerned. On this occasion, the study team wishes to express its deep appreciation for the cooperation and assistance rendered by them through discussions and data collection.

The study team would also like to express its heartfelt gratitude to the officials of SRP and APM who gave valuable advice and provided various support for the performance of the study.

CHAPTER 2 BACKGROUND OF THE STUDY

2.1 Present Conditions of Ecuador

2.1.1 Natural Conditions

(1) Meteorology

1) Temperature

Temperatures of the study area are almost constant and the mean temperature is 24-25 degrees. Monthly mean temperatures of the observation stations (Manta, Jipijapa, Julcuy and Lopez) are shown in Table 2-1.(1970-1985)

2) Humidity

Humidity of Manta is about 77%. Humidity of Lopez is about 85%. Monthly mean humidity of Manta, Jipijapa, Julcuy and Lopez are shown in Table 2-2.

3) Velocity of the Wind

Monthly velocities of the wind at Manta, Julcuy, and Lopez are shown in Table 2-3. The wind is not so strong along the coast. Monthly mean velocity is less than 3 m/sec.

4) Precipitation

Precipitations of Ecuador coastal area are about 400-500 mm/year. But in 1983 precipitations of study area was about 2000 mm/year by big El Nino occurred in 1983.

Table 2-1 Monthly Average Temperature at Coastal Area

Station	Jan	Feb	Mar	Apl	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Manta	26.1	26.4	26.3	26.3	25.7	24.8	24.1	23.7	23.5	24.1	24.3	25.2	25.0
Julcuy	24.9	25.3	25.3	25.4	24.8	24.1	23.9	23.1	23.3	23.5	23.4	24.4	24.3
Lopez	25.1	26.3	26.2	26.1	25.2	25.6	22.4	22.2	22.4	22.7	23.5	24.3	24.3

Table 2-2 Monthly Average Humidity at Coastal Area

Station	Jan	Feb	Mar	Apl	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Manta	75.3	76.5	78.5	76.6	75.9	77.6	77.2	81.0	77.8	76.4	73.3	74.7	76.7
Julcuy	82.9	82.7	84.4	82.8	82.8	83.8	83.3	83.7	82.3	82.0	83.3	81.3	82.9
Lopez	81.3	80.5	83.5	83.3	82.3	86.8	86.6	88.5	87.8	88.6	87.1	84.0	85.0

Table 2-3 Monthly Average Wind Velocity at Coastal Area

Station	Jan	Feb	Mar	Apl	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Manta	2.4	2.2	2.2	2.4	2.9	2.9	3.2	3.3	3.6	3.3	3.2	3.4	2.9
Julcuy	1.2	0.9	1.0	1.2	1.6	1.5	1.8	1.8	1.9	1.8	1.8	1.7	1.5
Lopez	3.0	2.4	3.0	2.5	2.7	2.5	3.0	3.1	3.1	3.0	3.2	2.7	2.8

(2) Oceanography

1) Tide

The tide characteristic of Ecuador shows the two high and two low tides every 24 hours. The period interval is 12 hours. The highest tide amplitude between low and high tide is 2.96 m.

2) Wave

Wave visual observation was carried out along the Ecuadorian coast by ship liner between Guayaquil and Galapagos islands.

The report in which wave observation data of 1 year are comprised is shown in Table 2-1.

Wave directions and heights of Ecuadorian coast are observed by US Navy. According to these data, predominant deepwater wave direction of Ecuadorian coast is S-SW. The distributions of the wave heights are 16% for 0.5m, 74% for 0.6 to 0.2 m and 10% for over 2.0 m.

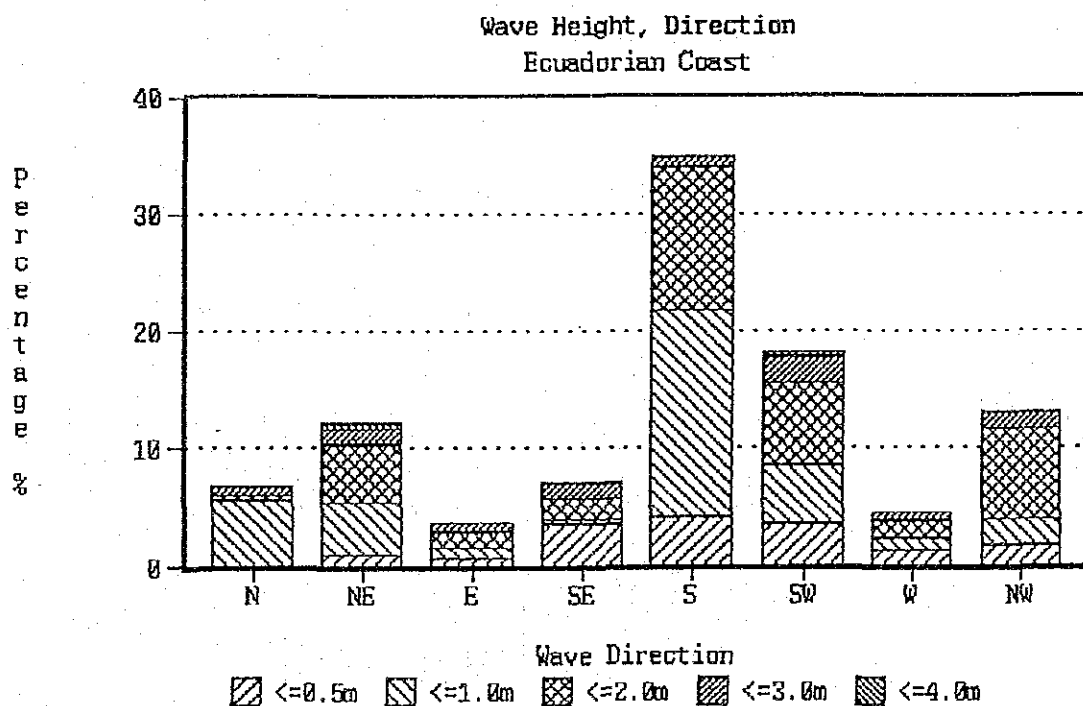


Fig.2-1 Wave Height and Direction at Ecuadorian Sea

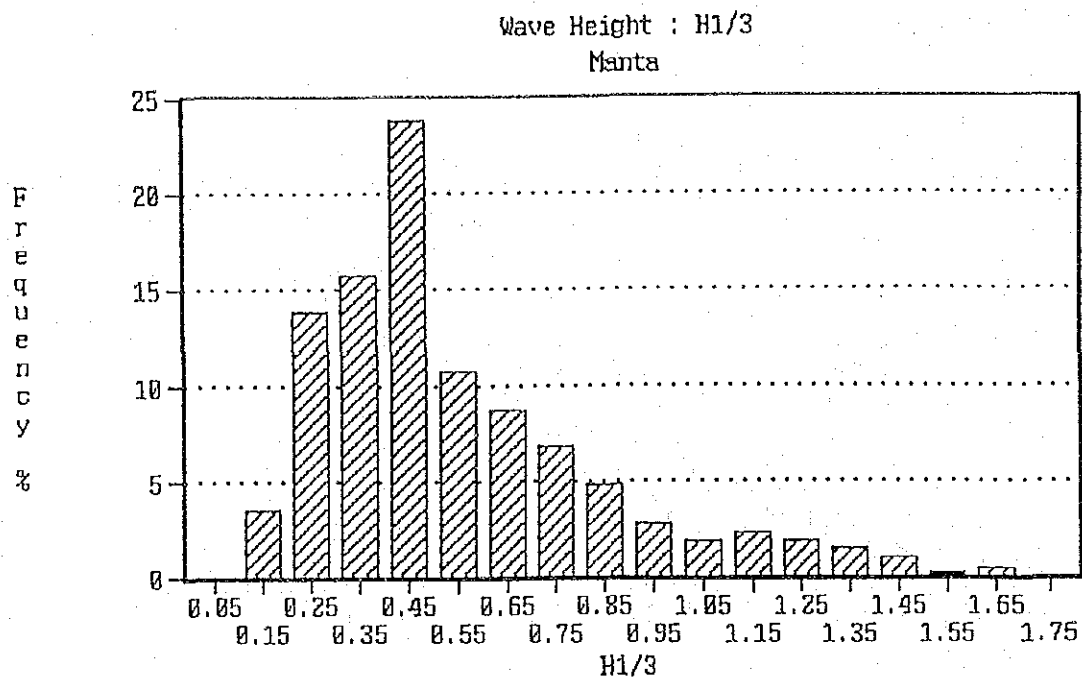


Fig.2-2(1) Wave Heights at Manta

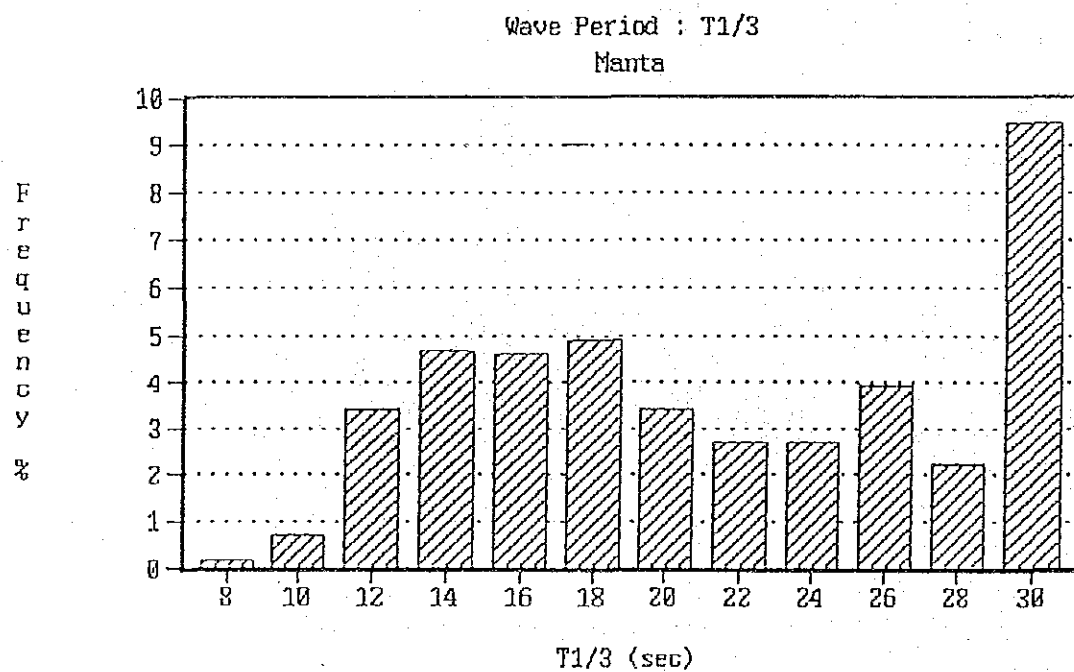


Fig.2-2(2) Wave Period at Manta

(3) El Nino Phenomenon

In the past century El Nino occurred in (1981), 1912, (1917), (1925-26), (1940-41), 1953, (1957-58), 1965, 1969, (1972-73), 1976, (1982-83), and 1986-87. The parentheses had the greatest effects. Each El Nino has its own particularities, the effects are also somewhat different; for example, rainfall is not a constant parameter, the El Nino of 1982-83 being probably the wettest since 1925. The 1982-83 El Nino has been the strongest event of this century. In 1982-83 rainfall data reached 5-10 times values greater than the average value of ordinary year. According to these data, medium El Nino occurred about every 5 years, but it is very difficult to make an appropriate prediction of next strong El Nino event.

While annual average precipitation is 320mm at Manta, 1983's record was 2,022mm owing to the influence of El Nino. To analysis these records statistically, this probability occurs per 150 years. (Fig.2-3)

Return Period	Probability of nonexceedence	Random Variable	Expectation Precipitation
Rp(year)	P[H<=X]	rv	H(mm)
200	0.9897	7.5937	2027
150	0.9863	6.9641	2029
100	0.9794	6.1005	1784
70	0.9706	5.3652	1576
50	0.9588	4.6939	1386
30	0.9314	3.7196	1111
10	0.7941	1.8407	579

Weibull Distribution

(k=0.75)

$H=283*rv+58$

Correlation Coefficient

r:0.935

Effective Statistical Year

K:35

Numbers of Data

N:17

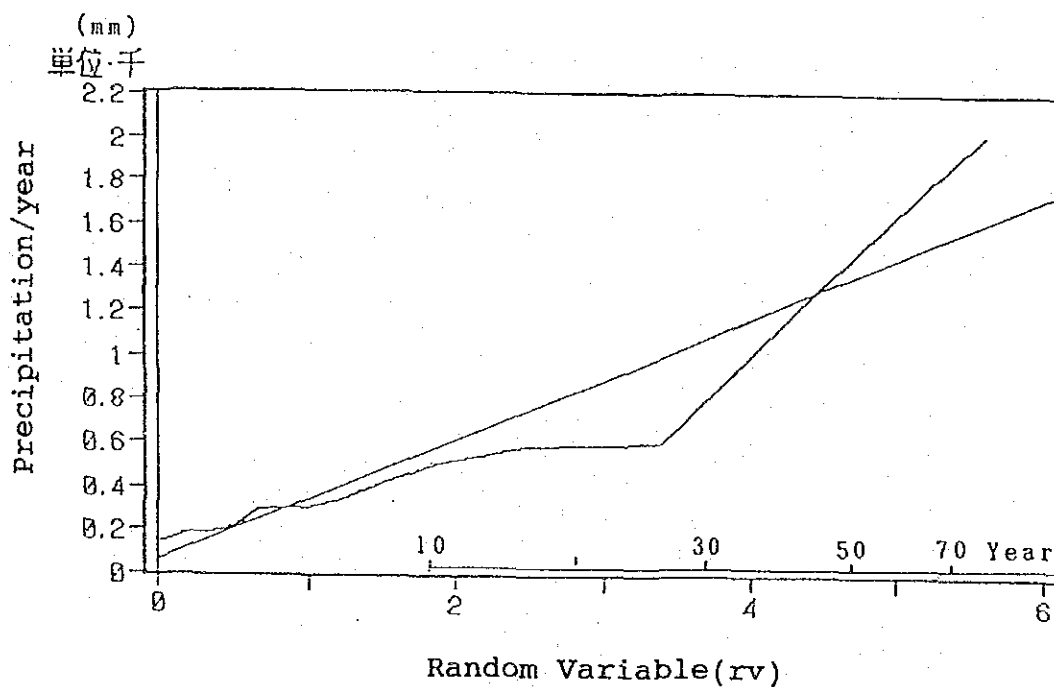


Fig.2-3 Probability of Precipitation at Manta

2.1.2 Socioeconomic Conditions of Ecuador

(1) Demography

The total population of Ecuador based on the 1990 census is shown in Table 2-4. Country's total is 9,622,608 in 1990. The rate of population growth from 1982 is 2.27%.

Over 95% of the country's total population is concentrated in the coastal and highland regions. Particularly, about 54% of the total population is concentrated in three provinces: In Guayas where Guayaquil is located; Pichincha where Quito the capital is located; and Manabi where Manta is, an important port, and Portoviejo the capital of the province.

(2) Economically Active Population

The economically active population (EAP) for 1987 was 3,340,000 inhabitants. The most important sector of the EAP, with 35%, corresponding to Agriculture, Forestry, Hunting and Fishing; followed by community services, social and personal with 24%; and 16% for industrial manufacturers. These three sectors share over 70% of the total EAP.

(3) Gross Domestic Product (GDP)

The GDP in 1989 reached 5,464,613 million S/. (in nominal terms) which is the equivalent to 10,080 millions of dollars, using the exchange rate of S/.542 per dollar. The Gross Domestic Product (per capita) for 1988 was calculated at S/.520,000 that converted into US\$960, according to "CONADE" determinations.

According to the historical Gross Domestic Product in real terms, at constant prices in 1975, the actual increase of GDP reached a rate of 1.9% per year in the period 1985-1989. However, the increase rate of population for the same period was 2.27% which means the decrease tendency of GDP per capital.

(4) Foreign Trade

In 1985, Ecuador registered highest export value of 2,905 million of US dollars, the contribution of oil reached 63% of the total amount of exports.

From 1980, Ecuador began to export shrimp. In 1987, shrimp and fish exports reached 409 million of US dollars, and it was placed in second place among export products, after oil.

In 1990, the total value of export reached 2,714 millions of US dollars. The exports was composed of: 46% for oil; 13% for shrimp and fish; 17% for banana; 4% for coffee; 3% for cocoa and 1% for tuna. These six products constituted the 84% of the exports.

Table 2-4 Ecuador's Population by Area, according to Regions and Provinces - 1990 Census

(Poblacion del Ecuador por areas, segun regiones y provincias)
Datos Provisionales - Censo 1990

Provincias	Total	%	Urban	%	Rural	%
Total Republica	9,622,608	100	5,305,911	55.1	4,316,697	44.9
Region Sierra	4,416,427	100	2,261,612	51.2	2,154,815	48.8
Azuay	506,546	100	219,407	43.3	287,139	56.7
Bolivar	170,593	100	32,852	19.3	137,741	80.7
Canar	189,102	100	55,541	29.4	133,561	70.6
Carchi	141,992	100	57,322	40.4	84,670	59.6
Chimborazo	360,600	100	117,823	32.7	242,777	67.3
Cotopaxi	283,236	100	66,274	23.4	216,962	76.6
Imbabura	273,261	100	129,770	47.4	143,491	52.5
Loja	389,632	100	156,340	40.1	233,292	59.9
Pichincha	1,734,942	100	1,274,352	73.5	460,590	26.5
Tungurahua	366,523	100	151,931	41.5	214,592	58.5
Region Costa	4,742,596	100	2,937,640	61.9	1,804,956	38.1
El Oro	415,073	100	290,902	70.1	124,171	29.9
Esmeraldas	307,190	100	134,379	43.7	172,811	56.3
Guayas	2,463,423	100	1,878,750	76.3	584,673	23.7
Los Rios	530,844	100	201,999	38.1	328,845	61.9
Manabi	1,026,066	100	431,610	42.1	594,456	57.9
Region Amazonica	383,201	100	98,750	25.8	284,451	74.2
Morona Santiago	95,685	100	23,557	24.6	72,128	75.4
Napo	102,623	100	23,712	23.1	78,911	76.9
Pastaza	40,714	100	14,802	36.4	25,912	63.6
Sucumbios	77,450	100	20,328	26.2	57,122	73.8
Zamora Chinchipe	66,729	100	16,351	24.5	50,378	75.5
Region Insular	9,749	100	7,909	81.1	1,840	18.9
Galapagos	9,749	100	7,909	81.1	1,840	18.9
Zonas no Delimitad.	70,635	100			70,635	100.0

(5) Exchange Rate

The applicable exchange rate, from 1970 to 1988, of the US currency, has been summarized as follows:

The sucre had the exchange rate of 25 sucres per US\$, for a long period, on 1970's. However, since 1982, the sucre was devaluated several times and in August, 1986, a floating exchange system was introduced. In January, 1991, the exchange rate was around S/. 910 per US\$1 (monthly average) in the open market.

Quotation for the US\$
(in the open market, annual average)

Concept	1970	1975	1980	1985	1986	1987	1988
Purchase	23.14	25.24	27.41	115.52	148.08	193.23	435.03
Sale	23.18	25.33	27.97	116.29	148.51	193.80	436.19

Source: Planning Office, CONADE

(6) Development Plan of Fishery Sector by the Ecuadorian Government

The development plan of the fishery sector is prescribed in the national development plan as follows.

1) National Socioeconomic Development Plan

The national socioeconomic development plan for the period 1989-1992 has targets for the fishery development such as:

- Annual growth rate of GDP by agriculture and fishery sector at a rate of 3.8%
- To improve the access to natural resources and to promote the fishery products for exports
- To increase the domestic consumption of the fishery products

2) Development Plan of the Fishery Sector in the National Development Plan

In order to achieve the national development goal, strategic outline for the development of the fishery sector is set as follows.

- To increase the size of fishing boats and modernize the fishing boats
- To construct the fishing port and center of the culture to give the fishermen the necessary services in for their catching activities, processing and commercialization.
- To intensify the investigation to obtain a rational evaluation, capture and efficient utilization of the bioquatic resources.

- To promote the fishing technology, based on the investigation and the training of the personal who work in the fishery sector.
- To seek the balance of the installed capacity of the industrial plants, in relation to the availability of the bioaquatic resources.
- To benefit the installation of repairing berths for maintenance and repair of fishing boats.
- To promote the domestic consumption of the fishery products and to increase the exports of the fishery products.
- To revise the legislation and strengthen the organization of management, coordination and control of the fishing activities.

2.2 Socioeconomic Conditions of Manabi Province

The Manabi Province is located in the northwestern part of Ecuador. It occupies a territorial extension of 18,744 km² and is the second largest province in the Ecuadorian coast after Guayas. The Manabi Province faces the Pacific Ocean, and it extends 80 km from East to West, and 190 km from North to South. The middle-western part of the province is a plain that extends slightly toward the East gaining elevation until it turns into a mountainous range with 300-800 m height.

According to the demographic census of 1982, the population of the Manabi Province was 906,700 inhabitants, with 144,400 homes. It is estimated that for the middle of 1989 the population of Manabi will be over one million.

A comparative analysis of various demographic economic indicators between the Manabi Province and the Country are shown below:

Comparison of Characteristics between Manabi and the Country

Item		Country	Manabi	%(M/C)
Population,	1982	8,606,116	906,676	10.5
	1990	9,622,608	1,026,066	10.7
Density (hab/km ²),	1982	32	48	150.0
	1990	36	54	150.0
GDP/GRP (1987, *1000 S/.)		159,016	10,514	6.6
GDP/GRP (per capita S/.)		16,030	10,110	63.0
EAP,		3,340,000	300,000	9.0

Source: Oficina de Planificacion, CONADE

GDP = Gross Domestic Product

GRP = Gross Regional Product

EAP = Economically Active Population

2.3 Outline of the Fishery in Ecuador

2.3.1 Fishery Production

(1) Introduction

The fishing boats fisheries in Ecuador can be classified into the artisanal fishery and industrial fishery by the scale of fishing boats or by the category of fishing permit. It is essential, for the examination of the justification of the Small-scale Fishing Port Development Project, to study the nature and present situation of these fishing boats fisheries. In this section, the study results on the fishing boats and fishery production at provincial level are reported.

1) Artisanal fishery: There is no measurable or quantitative definition at present in Ecuador on the category of artisanal fishermen nor on artisanal fishing boats. "Ley de Pesca y Desarrollo Pesquero" (D.178, 1974) defines the artisanal fishery as follows;

Art. 22.- La pesca puede ser:

a) Artesanal, cuando la realizan pescadores independientes u organizados en cooperativas o asociaciones, que hacen de la pesca su medio habitual de vida o la destinan a su consumo domestico, utilizando artes manuales menores y pequenas embarcaciones.

2) Industrial fishery: The above Fishery Law also defines the industrial fishery as follows;

Art. 22.- La pesca puede ser:

b) Industrial, cuando se efectua con embarcaciones provistas de artes mayores y persigue fines comerciales o de procesamiento.

3) Fishing vessels: Some terminology to classify artisanal fishing vessels as well as ways of classification for them are seen in the recent research works on this sector in Ecuador. The ways of classification are usually based on construction design of vessels and sometimes on their size or hull materials. The way of classification is not commonly defined at present. One of the examples is summarized as follows;

a) Bongo Small rowing or sailing canoe which has the bottom made of one single wood and the sides are constructed from wooden panels.

b) Panga Skiff boat with or without outboard engine which is used as an auxiliary boat for the purse seine fishery, or open deck type wooden boat which is driven by outboard engine or by sails and engaged in fisheries of various fishing methods

c) Lancha Panga which is constructed from FRP (glass fiber reinforced plastic)

d) Barco Decked vessel usually equipped with inboard engine

4) Fishing methods: Many type of fishing method are reportedly practiced in the artisanal fishery in Ecuador. Among these methods the principal ones include;

Palangre, espinel	-Long line
Línea de mano, cordel	-Hand line
Trasmallo, agallero, enmolle	-Gill net, trammel net
Red de cerco, chinchorro	-Purse seine
Red de arrastre	-Trawl net
Red(or chinchorro) de playa	-Beach seine

(2) Fishery Resources

According to a study carried out on the fish landing by the artisanal fishery in the mainland of Ecuador (Herdson, et al, INP, 1985), over 170 species of marine fish were observed during its field survey. It is also reported that there are more than 500 species of fish identified from the waters of Ecuador and that most of these are caught in the artisanal sector (ditto, 1985). By another study (J.Martinez, CEPLAES, 1987), principal species caught by the artisanal fishery are classified to demersal fish of the first and second grade, small pelagic fish, medium and large pelagic fish, crustacean, and mollusc.

(3) Fishing Vessel

1) Artisanal Fishing Vessels

According to a recent study (INP:Fallows & Contreras, 1990) on the artisanal fishery sector in Ecuador, the numbers of the artisanal fishing vessels in the coastal provinces are as shown in the following table.

Table 2-5 Number of Artisanal Fishing Vessels
by Fallows & Contreras (1990)

Province	Fishing Vessels	
	FRP boats	Wooden boats
Esmeraldas	423	1515
Manabi(North)	82	449
Manabi(South)	669	270
Guayas	301	2093
El Oro	78	980
Galapagos	n.a	n.a
National Total	1553	5307

Source: Work papers, INP, 1991

2) Industrial Fishing Vessels

By the present statistics on the industrial fishing boats by UNEPE, the provincial breakdowns are not available. The statistics book (UNEPE:1988, etc.) gives the total numbers of the industrial fishing vessels (508 vessels in 1989) and the provincial breakdowns of the personal fishing permits for the industrial sector. Dividing the former in proportion to the yearly average of the latter, the provincial breakdowns of the industrial fishing vessels are estimated.

Table 2-6 Estimated Numbers of Industrial Fishing Vessels

Province	Numbers of Vessels
Esmeraldas	78
Manabi	196
Guayas	226
El Oro	6
Galapagos	2
National Total	508

Source: UNEPE, the statistics book, Table 9

(4) Fish Landing

1) Fish Landing by the Artisanal Fishery

Table 2-7 Estimated Landing Volumes
in the Artisanal Sector (INP, unit:metric tons)

Province	Catch per vessel Landing Vol.	
	MT/boat/year	MT/year
Esmeraldas Prov.	12	23,000
Manabi: North	11	6,000
: South	18	17,000
Guayas	13	31,000
El Oro	11	11,000
Guayas	11	(200)
National Total		88,000

2) Fish Landing by the Industrial Fishery

Fishery companies are required to report, through the inspector's office, to DGP on monthly production, export and domestic sales records. Regarding the export products, export documents are submitted to the Central Bank and INP in relation to export permit or quality control.

Following table shows the fishery production by the industrial fishery, the primary data of which are reported by fishery companies.

Fishery Production by the Industrial Sector
(unit:1000 metric tons)

Year Average	1981	'82	'83	'84	'85	'86	'87	'88	'89	'90
Total	667	331	905	1518	1019	679	872	682	390	782
Small pelagic	546	201	734	1257	770	416	603	479	146	575
Others	121	130	171	261	249	263	269	203	244	207

Source: UNEPE, statistics book (table #17, etc.)

(5) Fishermen

According to the study by Fallows, et al. (1990), the numbers of artisanal fishermen in Ecuador are estimated as following table.

Table 2-8 Artisanal Fishermen by Fallows (1990)

Province	Number of Fishermen
	persons
Esmeraldas	5130
Manabi: North	910
: South	3500
Guayas and El Oro	6030
Galapagos	n.a
National Total	17250

Source: INP, working report (1991)

2.3.2 Exports of Fishery Products

In 1988, the export volume of fishery products in Ecuador is 220,000 tons; of this volume, one quarter is frozen shrimp. Following that, the frozen or canned tuna has a big volume. In recent years, the exports of fresh white meat fish have increased. (Table-9) Usually, these export commodities are transported to Guayaquil or Quito and exported to United States, Canada or Europe. Otherwise, they are exported by ship from Guayaquil, Manta or Esmeraldas. Sometimes, they are exported by land to the countries in Latin America such as Mexico, Colombia etc.

Table 2-9 Exports of Fishery Products

(unit: MT)

	1980	1981	1982	1983	1984	1985	1986	1987	1988
Total	145,841	148,011	162,443	69,781	155,042	308,102	268,952	200,128	219,791
Food	63,304	58,602	60,340	45,297	56,833	65,139	85,228	110,684	96,805
Canned	34,817	36,247	31,529	9,654	10,254	14,696	13,648	21,959	14,131
Tuna	3,055	4,028	3,873	2,508	2,816	3,238	3,224	5,179	6,186
Sardine	29,764	28,845	25,588	6,258	7,264	10,865	10,006	16,532	7,480
Mackerel	1,991	3,374	2,068	888	170	586	412	238	460
Bivalve	7	-	-	-	4	7	6	10	5
Frozen	28,364	22,178	28,712	35,577	46,432	50,070	69,261	83,060	76,662
Shrimp	9,643	12,133	16,966	23,535	19,073	20,172	30,683	48,912	49,746
Tuna	11,111	6,400	5,473	8,215	21,748	25,710	30,609	26,871	18,561
Sardine	423	525	-	-	575	-	1,175	1,117	2,916
Mackerel	5,827	2,154	5,239	3,300	2,980	2,450	5,269	4,026	3,937
White fish	1,314	924	1,004	497	1,966	1,641	1,401	1,971	1,219
Lobster	31	34	30	28	90	94	81	84	13
Squid	14	8	-	2	-	-	41	37	14
Others	0.5	-	-	-	-	2.96	2.05	42	256
Fresh	-	-	-	-	58	251	2,117	5,510	5,839
Tuna	-	-	-	-	5	26	70	400	518
White Fish	-	-	-	-	53	225	2,041	5,110	5,321
Lobster	-	-	-	-	-	-	6	-	-
Others	-	-	-	-	-	0	1	-	-
Dried & Salted	120	176	98	66	83	104	192	152	159
Shark Fin	57	52	70	51	62	63	61	74	93
Others	63	124	28	15	21	41	131	78	66
Living	3	1	1	-	6	18	10	3	14
Lobster	2	-	-	-	5	5	10	3	2
Others	1	1	1	-	1	13	-	-	12
Fish Meal	82,537	89,409	102,103	24,484	98,209	232,924	176,506	89,444	122,986
Fish Oil	-	-	-	-	-	10,039	7,218	-	-

Source: Institute Nacional de Pesca.

2.3.3. Domestic Consumption of Fishery Products

(1) Per Capita Consumption of Fishery Products

Using the fishery statistics by INP and the population statistics, per capita consumption of fishery products in Ecuador between 1980 - 1988 is estimated by the following formula:

$$S = (L - M - E) / P$$

where

- S : Supply of Fishery Products of Food Uses
- L : Fish Landing Volume
- M : Fishery Products of Non-food Uses
- E : Exports of Fishery Products of Food Uses
- P : Population

Per capita fish consumption depends largely on the tendency of fish landing which may be affected by El Nino phenomenon. As shown in Fig.2-10, it fluctuates between 8 - 16 kg/year with a cycle of 2 - 3 years.

(2) Collection and Distribution System of Fishery

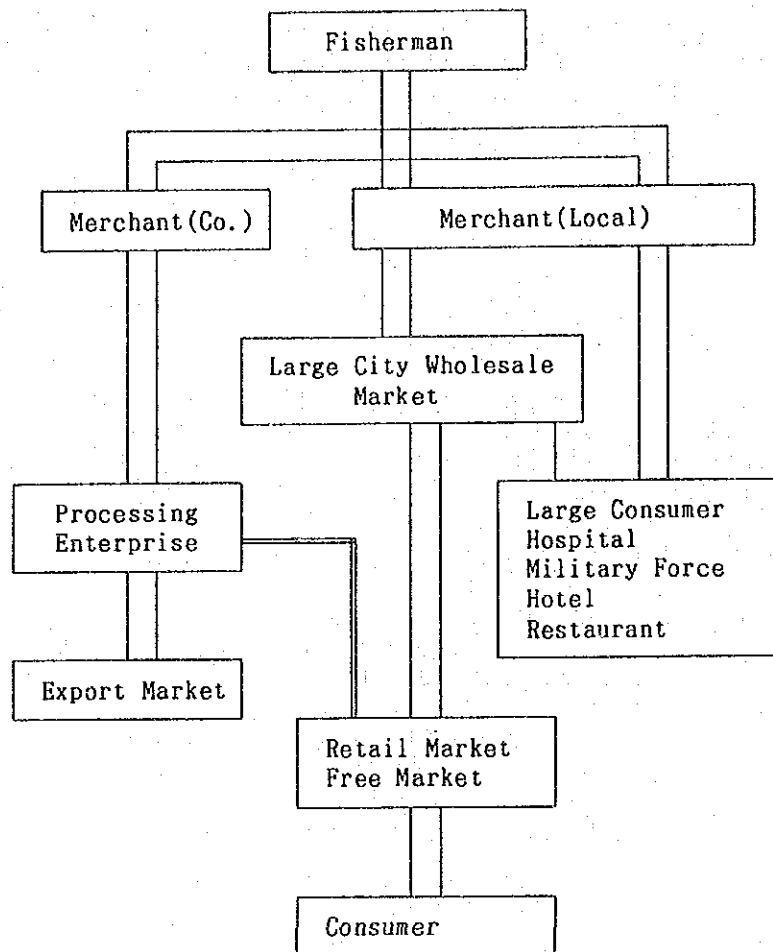
In Ecuador, majority of marine products caught by the artisanal fishermen is handled at the fishing villages and distributed to consumer markets and exporters through the merchants (fish-broker and wholesaler).

The merchants play an important role for the commercialization of fishery products of the artisanal fishermen. All the merchants are authorized and licensed by the Government authority. The licenses are issued and given every year to the merchants.

Table 2-10 Fish Consumption per Capita

Year	Landing Volume (MT)	Non-food (MT)	Exports (MT)	Supply for Food (MT)	Population (x 1000)	Per Capita (Kg/Year)
1980	565,061	383,210	90,633	91,218	8,123	11.2
1981	751,623	534,242	86,857	130,524	8,361	15.6
1982	667,027	473,117	86,991	106,919	8,606	12.4
1983	331,085	182,832	60,999	87,254	8,857	9.9
1984	904,909	692,564	76,075	136,270	9,115	15.0
1985	1,517,606	1,315,093	88,369	114,144	9,378	12.2
1986	1,019,304	811,337	112,336	95,631	9,647	9.9
1987	679,335	447,101	149,408	82,826	9,923	8.3
1988	871,985	654,467	129,970	87,548	10,204	8.6

Marketing Channel for Products of Artisanal Fishermen



2.4 Fisheries in Manabi Province

2.4.1 Fishery Production

(1) Fishing Vessels

1) Artisanal Fishing Vessels

According to the study (Fallows & Contreras, 1990) on the artisanal fishery sector in Ecuador, the numbers of the artisanal fishing vessels in north and south Manabi Province are as shown in the following table.

Table 2- -11 Number of Artisanal Fishing Vessels
by Fallows & Contreras (1990)

Landing Spots (Beach/port)	Fishing Vessels	
	FRP boats	Wooden boats
(1) North Manabi	(82)	(449)
Cojimies	-	-
Pedernales	-	-
Don Juan	10	40
El Matal	0	30
Cabova	5	10
Canoa	0	10
San Vicente	40	100
Salinas	2	150
Bahia de Caragues	5	50
San Clemente	3	22
San Jacinto	15	7
Crucita	2	30
(2) South Manabi	(669)	(270)
Jaramijó	40	100
Manta	317	24
San Mateo	178	5
Sta. Marianita	30	20
Ligüique	0	6
San Lorenzo	0	15
Las Pinas	3	6
Sta. Rosa	6	6
Pto. Cayo	20	30
Machalilla	13	40
Pto. López	61	10
Salango	1	8
Manabi Province	751	719

Source: Work papers, INP, 1991

2) Industrial Fishing Vessels

The captania office keeps registration records of fishing vessels in this area which are classified by the size of vessel; small fishing boats less 5 GT (AI class) and medium or large fishing boats greater than 5 GT (P class).

Table 2-12 Number of P class Fishing Vessels
from Rio Chico to Rio Ayampe (1991)

Districts	No. of Fishing Vessels
Jaramijó	24
Manta	78
San Mateo	0
Sta. Marianita	0
Ligüique	0
Sta. Rosa	0
San Lorenzo	0
Pto. Cayo	0
Machalilla	16
Pto. López	8
Salango	2
Unidentified or Others	14
Total	142

Source :Captania at Manta

Remarks: This table does not include vessels
under the examination of registration.

(2) Fish Landing

1) Landing by the Artisanal Fishery

By a method as described in the previous section; the method to estimate landing volumes from the ratios of the numbers of wooden boats to FRP boats, the landing volumes by the artisanal fishery in south Manabi were estimated as the following table.

Table 2-13 Estimated Landing Volumes
by the Artisanal Fishery in South Manabi

Districts	Catch/vessel	Landing Vol.
	Tons/vessel	Tons
Jaramijó	11	1,500
Manta	24	8,200
San Mateo		4,600
San Mateo	22	4,000
Sta. Marianita	19	1,000
Ligüique	11	70
Las Pinas	11	100
Sta. Rosa	11	130
San Lorenzo	11	160
Pto. Cayo	11	550
Machalilla	11	470
Pto. López	22	1,600
Total	-	17,000

Remarks: Catch per boat at Manta and San Mateo is based on the INP study (1990).

2) Landing by the Industrial Fishery

Table 2-14 Estimated Production Volumes by the Industrial
Sector in Manabi Province in the Average Year

Districts	Total boats	Purse seiner	Long liner	Landing
	No.	No.	No.	tons/yr.
Manta & Jaramijó				
Large fishing boat	20	(20)	-	36,000
Other boats	80	50	30	57,100
Machalilla	16	16	0	17,600
Puerto López	8	6	2	6,700
Others & Unidenti- fied	16	16	0	17,600
Total	140	108	32	135,000

(3) Artisanal Fishermen

1) Artisanal Fishermen

According to the study by Fallows and Contreras (1990), the numbers of the artisanal fishermen in Manabi Province are estimated as shown in the following table.

Table 2-15 Number of Artisanal Fishermen
in the Province Manabi
by Fallows & Contreras (1990)

(1) North Manabi	(912)
Cojimies	-
Pedernales	-
Don Juan	100
El Matal	80
Cabova	22
Canoa	60
San Vicente	200
Salinas	80
Bahia de Caragues	80
San Clemente	90
San Jacinto	50
Crucita	150
(2) South Manabi	(3500)
Jaramijó	500
Manta	700
San Mateo	750
Sta. Marianita	250
Ligüique	15
Las Pinas	20
Sta. Rosa	40
San Lorenzo	40
Pto. Cayo	150
Machalilla	400
Pto. López	500
Salango	150
Total	4,412

Source: Work papers, INP, 1991

2.4.2 Collection and Distribution System of Fishery in Manabi Province

(1) Activities of Merchants in Manabi Province

Throughout fish landing places of artisanal villages in Manabi province, these merchants come from Manta, Jipijapa, Portoviejo, Guayaquil and Sierras of highland towns of the Republic.

Number of Merchants visiting each landing place

Landing Place	Merchant	
	Local	Others
MANABI PROVINCE (SOUTH)		
Jaramijo	30	20
Manta	30	50
San Mateo	10	20
Sta. Marianita	2	?
Liquique	5	1
Sta. Rosa	4	6
San Lorenzo	3	1
Puerto Cayo	5	4
Machalilla	20	20
Puerto Lopez	100	?
Others	63	14
Total	272	136
Nation Wide other than S.MANABI	732	321
Grand Total	1,004	457

Source: Direction General de Pesca

2.5 Present Conditions at the Study Area

2.5.1 Study Area

(1) The Study area extends from Jaramijo which is located east of Manta city in Manabi Province, to Puerto Lopez includes 10 fishing villages. (Jaramijo, Manta, San Mateo, Santa Marianjta, Liguique, San Lorenzo, Santa Rosa, Puerto Cayo, Machalilla and Puerto Lopez).

2.5.2 Natural Conditions

The study area is located at the tropical zone around the equator but it's climate mild and it's temperature is almost constant and mean temperature is 24-25 degrees centigrade. There are two seasons divided into rainy season (November-April) and dry season (May-October). Precipitation at the coastal area is only about 300-500 mm/year at the average year. But, in 1983 precipitation at the study area was about 2000 mm/year caused by the El Nino Phenomenon. The abnormal precipitations have been caused by the middle class El Nino with a cycle of around 5 years. The precipitation in 1983 is 4-7 times as much as the average year and is presumed to be the biggest in this century.

There are many rivers at study area. Water currents are not observed except rainy season, but, these rivers cause the sediment discharges by El Nino. Average sediment discharges are listed below for each site. These rates of sediment discharges are much at Manta, Pto.Cayo and Pto.Lopez.

Sediment Discharges by Rivers

(unit:M3/year)

Jaramijo	Manta	San Mateo	St.Marianita	Liguique	San Lorenzo
8,000	46,000	3,000	3,000	1,000	3,000
	(Rio Manta)				
	8,000				
	(Rio Bravo)				

Santa Rosa	Pto.Cayo	Machalilla	Pto.Lopez
	42,000	10,000	42,000
		(Rio Panteros)	(Rio Buenavista)
		3,000	4,000

Tide of Ecuador represents two high and two low tide every 24 hours. The period interval is around 12 hours. The highest tide amplitude between low and high tide is 2.90 m. The tide differences at Manta Port are as follows.

MHWS	=	3.46m
MHW	=	2.99m
MSL	=	2.08m
MLW	=	1.21m
MLWS	=	0.49m

2.5.3 Fish Catches Destinations and Transportation

Fish catches landed at 10 fishing villages in the study area are collected by the merchants and distributed to various destinations after sorted into domestic and exports use.

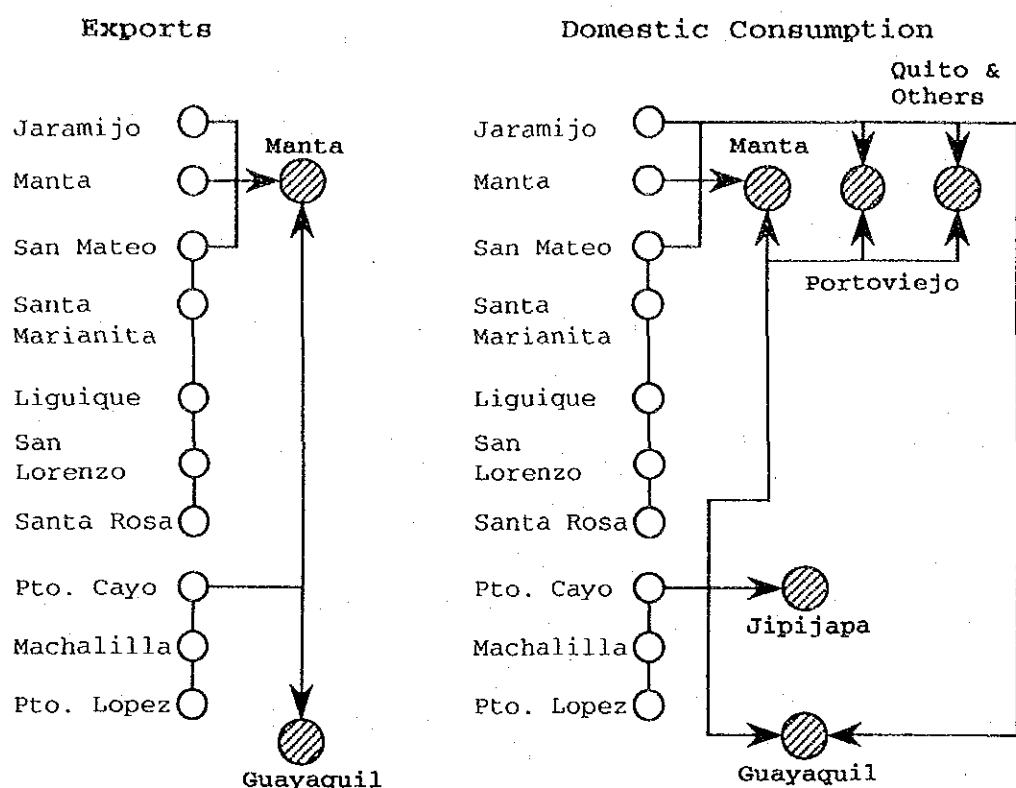
The main destinations of the domestic use products coming from the 10 fishing villages are Manta, Portoviejo, Jipijapa, Guayaquil and Quito including highland area. According to the field survey, it is actual that the supply routes to those consumption places are complicated.

The fish products for domestic consumption are generally distributed as per the demands, the only exception being that most of the products from the 3 southern villages is mainly consumed in Jipijapa.

With regard to exports, the exports products from 3 northern fishing villages and 4 central fishing villages are mainly sent to Manta, while the products from 3 southern villages are sent to both Manta and Guayaquil.

The distribution routes for domestic consumption and exports use products are shown in the following diagram.

Guayaquil and Jipijapa are the consumer markets as well as the exports bases.



Distribution Route

2.5.4 Cooperatives of Fishermen

According to MICIP's information, 101 Cooperative Pesqueras Artesanales (hereinafter referred to as 'CPA') had been formed in the artisanal sector between 1974 and 1988, and 2,413 fishermen joined to those CPAs.

Manabi Province has 24 CPAs legally recognized and 688 members, of these CPAs 9 CPAs being in the study area. (Table 2-16) But, among these CAPs, only several CPAs are currently active, and only 10% or more of fishermen are associated with CPAs.

MICIP promotes to organize CPAs and gives CPAs various assistance such as technical training, administrative seminars and orientations, etc., except financial aid. Ministry of Social Wellbeing also plans to organize artisanal fishermen positively in the view point of upgrading the fishermen's livings.

Table 2-16 Present Conditions of CPAs in the Study Area

Areas	Name of CPA	Members of CPA	Activity
Jaramijo	Alajuela	35	good
Manta	Los Esteros	23	good
San Mateo	San Mateo	42	excellent
Santa Marianita	Santa Marianita	78	not-working
Liquique	—	—	—
San Lorenzo	—	—	—
Santa Rosa	—	—	—
Pto. Cayo	Pto. Cayo	25	excellent
Machalilla	—	—	—
Pto. Lopez	Progreso	18	excellent
	Daniel Lopez	28	excellent
	Tulio Campozano	18	excellent
Salango *	20 de Enero	17	excellent

Note:

CPA at Santa Marianita is not working, and administrative concerned are trying to motivate for activity. Road conditions at Santa Marianita are very poor. They often deliver the fish catches using marine transport. Salango is 5km. apart from Puerto Lopez. 4 CPAs (Progreso, Daniel Lopez, Tulio Campozano, 20 de Enero) are now under negotiation to unite.

2.5.5 Fishermen's Household Management

In order to make more detailed study, Manta and San Mateo from the north and Machalilla and Puerto López from the south were selected among 10 project sites, all of which holds large number of fishing vessels. Based on the results by the socioeconomic survey for the fishermen's household which has been carried out with this study, these four sites were given the further examination on the regional difference in the household's management for the fishery production.

Target interviewees have been selected subject to two conditions; 1) the head of a household engaged in the artisanal fishery and, 2) for assessing fishermen's attitude to a planned fishing port, the owner of fishing vessel or the master fisherman.

(1) Fishing Methods

Fishing methods have been interviewed with the principal species targeted. It is observed that, in Manta and San Mateo located in the vicinity of Manta, the long line operation by lanchas is active, and that in Machalilla the purse seine fishery is more active than in other sites.

By another study, it has been found that most of the purse seiners in Machalilla are owned by the individuals who obtain the industrial fishing permit.

Table 2-17 Fishing Methods

Districts	Major Fishing Methods	ER
Manta	Long line targeted to large pelagic fish. Gill net in part.	96%
San Mateo	Mostly long line for large pelagic fish. Pole and line in part.	100%
Machalilla	Mostly purse seine aimed to small pelagic fish.	88%
Pto.López	Selected by aimed species. Mostly gill net and long line. Partly purse seine.	100%

Remarks: ER(Enumerated ratio) means a ratio of effective answers to a total sample number in the sites

(2) Landing Volumes

Annual landing volumes, with breakdowns divided to domestic consumption and abandoned portion, have been interviewed. In all of the districts, the principal species are albacora, dorado, picudo, and tiburón. Most of the households also catch demersal species such as corvina, lenguado and bagre. In Machalilla where the households operating purse seine are sampled to a large extent, the principal species are small pelagic fish such as pinchagua, carita, etc.

Table 2-18 Average Annual Landing Volume and Others

Descriptions	Manta	San Mateo	Machalilla	Pto.López
Landing volume	31,674 Kg	42,080 Kg	959,260 Kg	58,549 Kg
(ER)	100 %	100 %	100 %	100 %
Domestic consumption	871	485	2,172	919
(ER)	100 %	100 %	100 %	100 %
Abandoned	901	489	-	-
(ER)	20 %	34 %	0 %	0 %

Remarks: Interviewed results for 1990.

(3) Buyers of Catch

The buyers who had bought during past two years the catch fished by the sampled households have been interviewed. The results of this survey show the consignment is made to middleman or wholesaler in all cases. There is no case that indicates the direct consignment to the retail markets. The results are classified by the numbers of the interviewees to mention single trader; plural traders; not to name but reply just "varios" or "comerciantes", and are shown in the following table.

Table 2-19 Buyers of Catch

Descriptions	Manta	San Mateo	Machalilla	Pto.López
Single trader	42 %	63 %	16 %	54 %
Plural traders	10	33	8	18
Not specified	48	3	76	24
(Enumerated ratio)	100 %	100 %	100%	96 %

San Mateo shows the highest ratio (63%) in the group of the households that mentioned single trader, and Machalilla shows the lowest (16%). Such difference shown in a form of consignment should be noted.

(4) Fishery Income

The above features in the fishery production or difference in the management scale of fishery result in a large gap in the amount of fishery income. As indicated in the next table, an average annual gross fishery income of the sampled households in Machalilla is markedly larger than in other districts. This does not result from the regional difference but from the difference of fishing operation or the scale of fishery management as stated previously; in Machalilla many households sampled practice the purse seine.

Table 2-20 Average Annual Gross Fishery Income
(Unit: thousand Sucres)

Descriptions	Manta	San Mateo	Machalilla	Pto.López
Gross fish- ery income	33,418	50,900	204,622	33,320
Enumerated ratio	100 %	100 %	100 %	98 %

Remarks: Includes estimate based on annual landing volumes.
US\$ = 920 Sucres (January 1991)

Table 2-21 Net Fishery Income and the Ratio of
Expenditure to Gross Fishery Income
(Unit: thousand Sucres)

Descriptions	Manta	San Mateo	Machalilla	Pto.López
Annual net fish- ery income	19,138	(34,297)	117,441	11,237
Expenditure ratio to gross income	43%	(33%)	43%	66%

The gap of net fishery income between Machalilla and Puerto López, as shown in the above table, extends to around ten times. This may directly reflect the difference in the scale of the fishery management.

(5) Households Expenses

The following table shows the average of numbers of family members, amounts of income tax, and household expenses. Enumerated ratio for numbers on family member and households expenses is almost 100%, and one for tax is 77%.

Table 2-22 Average Households Expenses and Others
(Unit: thousand Sucres)

Descriptions	Manta	San Mateo	Machalilla	Pto.López
Family member	7 persons	7 persons	7 persons	7 persons
Annual income tax	32	40	178	38
Annual households expenses	1,463	619	2,587	1,962

As shown in the above table, in Machalilla where the largest average of the net fishery income is shown, the average amount of tax and households expenses are also highest among all of the districts. Meanwhile, in San Mateo, despite its relatively high gross fishery income, the average of households expenses shows a remarkably low amount.

Minimum monthly wage for the private sector in Ecuador has been revised to 48,000 Sucres in January 1991. It should also be noted that an opinion was reported in a newspaper to claim that the monthly households expenses in the urban area were estimated at least 160,000 Sucres and to say that the revised minimum wage was still not enough.

(6) Improvement of Production Facilities and Others

In the socioeconomic survey, opinions of the head of the households was sampled on what is required at present to increase the fishery income. The choices of answer were not prepared in the questionnaire to know the opinions as widely as possible. The results are shown in the following table.

In the four districts, strong hopes were observed for the improvement or expansion of production facilities such as fishing vessels, engine and fishing gear. Following this, opinions to expect the financial support were also observed. It may be an interest of a further study that in Machalilla a higher ratio for further expansion of the production facilities were observed where more households practice the purse seine than other districts.

Table 2-23 What is Required or Expected
to Increase the Fishery Income

Descriptions	Manta	San Mateo	Machalilla	Pto.López	Total
To improve or enlarge;					
Fishing vessel:					
FRP boat	3 %	0 %	0 %	0 %	3 %
Enlargement	1	1	5	14	21
Others	4	0	0	1	5
Engine	2	1	1	3	7
Fishing gear	1	0	5	4	10
To expect or reform;					
Finance	1	3	5	3	12
Distribution	0	1	0	0	1
Fishing port	1	0	0	2	3
Others	1	1	0	0	2
No opinions	19	12	1	6	38

Remarks: Percentages are derived by dividing applicable answers by total sample numbers. Fractions down decimal point are rounded.

CHAPTER 3 MASTER PLAN

3.1 Principles of Fishing Port Planning

The following are the basic aims of the Manabi fishing port construction plan. They are the result of consideration of the present state and future trends of the fishery, and the present fish landing methods used.

1) The master plans will be made harmonizing with the present and future fishing activities as well as the present conditions of infrastructures at the sites.

2) The target year of master plans is 2005.

3) Site of priority development is selected from master plans. The target year for construction of priority plan is 1995.

4) The priority plan should form the stage plan of the master plan. The priority plan should be limited to the facilities of which construction is urgently needed.

5) The fishing port built under the priority plan will be expected as model fishing port for artisanal fishery. The model fishing port will be planned in such a way that it plays the leading role in improving the production environment of the artisanal fishery as well as the present storage and distribution systems.

6) The planned port facilities will supply the needs of fishing boats under five tons considering the present conditions of the artisanal fishery.

7) Considering the trends of increased off shore fishing operations, the planned port facilities will be designed to cater for middle scale boats. Such provisions will also ensure the efficient employment of public capital. However, the facilities will be open only to middle boat operators who are independent in accordance with the original aims of the plan. (to support the small scale fishery)

8) In the master plan, port facility layout in Manabi will be arranged to supply the needs of middle scale boats.

9) All planned port facilities will be coordinated with adjacent infrastructures as well as land usage of surrounding areas.

10) Necessary facilities for the improvement of product quality and distribution rationalization will be planned. Functional facilities should also be adjusted with the existing private facilities.

11) Planned Facilities

The following are basic facilities to be constructed; handling space, icemaking plant, cold storage, fresh water tank, fuel oil

tank, workshop, fishing gear handling space, administration building and others (warehouse, electrical facilities, road, greenbelt, etc.)

3.2 Site Selection and the Premise of Master Plan

(1) Site Selection

The natural conditions, present conditions of the infrastructures concerned, fishery situation and the construction conditions were evaluated for each site at the study area, and Manta, San Mateo, Machalilla and Pto.Lopez were selected as the sites for Master Plans.

(2) Planned Fishing Boat

Planned numbers of fishing boats at each site for Master Plans are shown as follows.

Planned Number of Fishing Boats

Small Scale Fishing Boats:

Year	Manta	San Mateo	Machalilla	Pto.Lopez	Total
1990	341	183	53	71	648
2005	341	183	53	71	648

Middle Scale Fishing Boats:

Year	Manta	San Mateo	Machalilla	Pto.Lopez	Total
1990	23	0	16	8	47
2005	50	40	45	45	180

* Manta includes Jaramijo.

* Planned midde boats are under 80 GT at Manta, San Mateo.

(3) Planned Landing Volume

Landing volume for each site are planned as follows.

Planned Landing Volume (2005)

Descriptions	Manta	San Mateo	Machalilla	Pto.López
Annual Landing : Mt/year				
Artisanal fishing permit.....1)	8,200	4,400	1,300	1,700
Industrial fishing permit				
Purse seiner.2)	27,500	22,000	24,200	24,200
Long liner...3)	1,800	1,400	1,600	1,600
Daily Landing : Mt/day				
1) + 3)	35.7	20.7	10.4	11.8
2)	98	79	86	86

Remarks : 1) Demersal fish, large pelagic fish
2) Small pelagic fish
3) Large pelagic fish

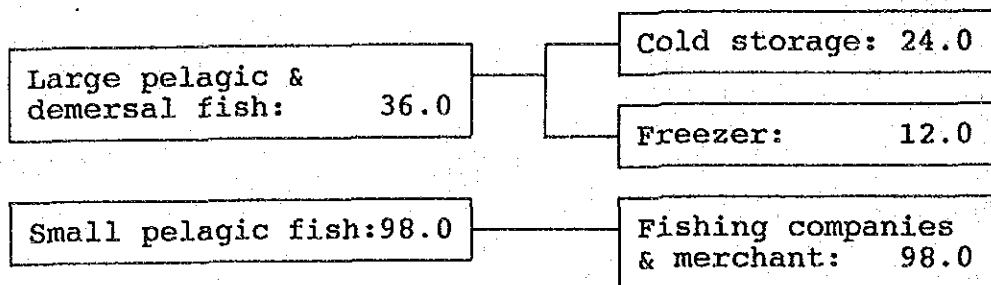
(4) Distribution of the Fish

Considering the present distribution of the fish at each site, fish catches by planned facility are allocated as follows.

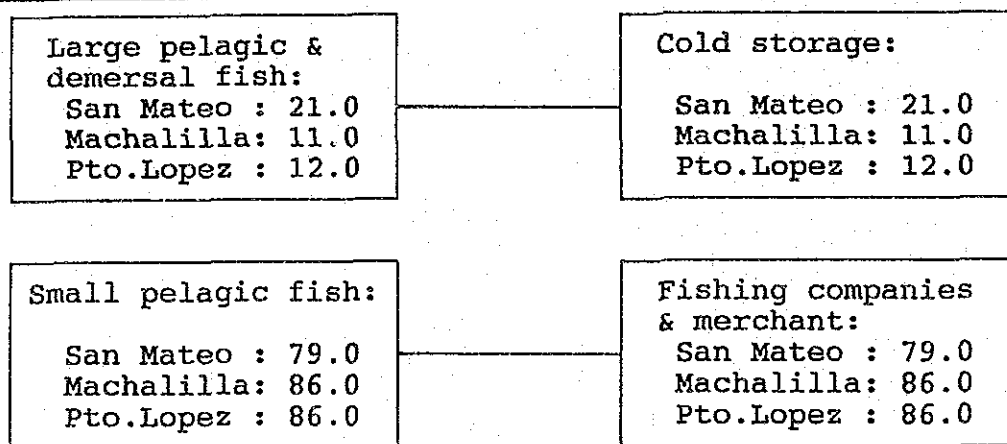
Allocation of fish Catches by planned Facility

Manta

(unit:tons/day)



San Mateo, Machalilla, Pto.Lopez



3.3 Fishing Port Layout Plan

Fishing port layout plans of Manta, San Mateo, Machalilla and Pto.Lopez are made. (Fig.3-1, 2, 3, 4)

Main port facilities for each site are summarized as follows.

		Main Port Facilities			
		(unit:m)			
Fishing Facilities	Boat	Manta	San Mateo	Machalilla	Pto.Lopez
Breakwater		280	700	430	560
Training Jetty		1,180	-	80	-
Small-Scale	Landing	150	90	50	50
	Outfitting	150	90	50	50
	Idling	700	370	100	150
Middle Scale	Landing	110	80	80	90
	Outfitting	50	50	50	50
	Idling	350	280	320	320

Functional Facilities

Descriptions	Manta	Puerto López
(1) Cold storage(0°C)	240 cu.m	120 cu.m
(-30°C)	340 cu.m	-
Blast Freezer	12 Mt/day	-
Building area	300 sq.m	70 sq.m
(2) Ice making plant	70 Mt/day	20 Mt/day
Building area	400 sq.m	150 sq.m
(3) Ice storage	420 cu.m	120 cu.m
Building area	700 sq.m	200 sq.m
(including a platform)		
(4) Fish handling space	400 sq.m	200 sq.m
(5) Fishing gear repairing space	1000 sq.m	1000 sq.m
(6) Warehouse	100 sq.m	100 sq.m
(7) Workshop	100 sq.m	100 sq.m
(8) Fuel oil tank:		
Gasoline	150 Kltrs	30 Kltrs
Diesel oil	190 Kltrs	180 Kltrs
Building area	150 sq.m	80 sq.m
(9) Freshwater tank	15 Kltrs	10 Kltrs
Building area	20 sq.m	20 sq.m
(10)Administration Bld.	150 sq.m	150 sq.m
(11)Parking space	40 vehicles	20 vehicles
	600 sq.m	300 sq.m
Total	4000 sq.m	2500 sq.m

Functional Facilities

Descriptions	Machalilla	San Mateo
(1) Cold storage	110 cu.m	210 cu.m
Building area	70 sq.m	100 sq.m
(2) Ice making plant	20 Mt/day	40 Mt/day
Building area	150 sq.m	250 sq.m
(3) Ice storage	120 cu.m	240 cu.m
Building area	200 sq.m	400 sq.m
(including a platform)		
(4) Fish handling space	200 sq.m	300 sq.m
(5) Fishing gear repairing space	1000 sq.m	1000 sq.m
(6) Warehouse	100 sq.m	100 sq.m
(7) Workshop	100 sq.m	100 sq.m
(8) Fuel oil tank:		
Gasoline	20 Kltrs	80 Kltrs
Diesel oil	180 Kltrs	160 Kltrs
Building area	80 sq.m	100 sq.m
(9) Freshwater tank	5 Kltrs	10 Kltrs
Building area	10 sq.m	20 sq.m
(10) Administration Bld.	150 sq.m	150 sq.m
(11) Parking space	20 vehicles	20 vehicles
	300 sq.m	300 sq.m
Total	2500 sq.m	3000 sq.m

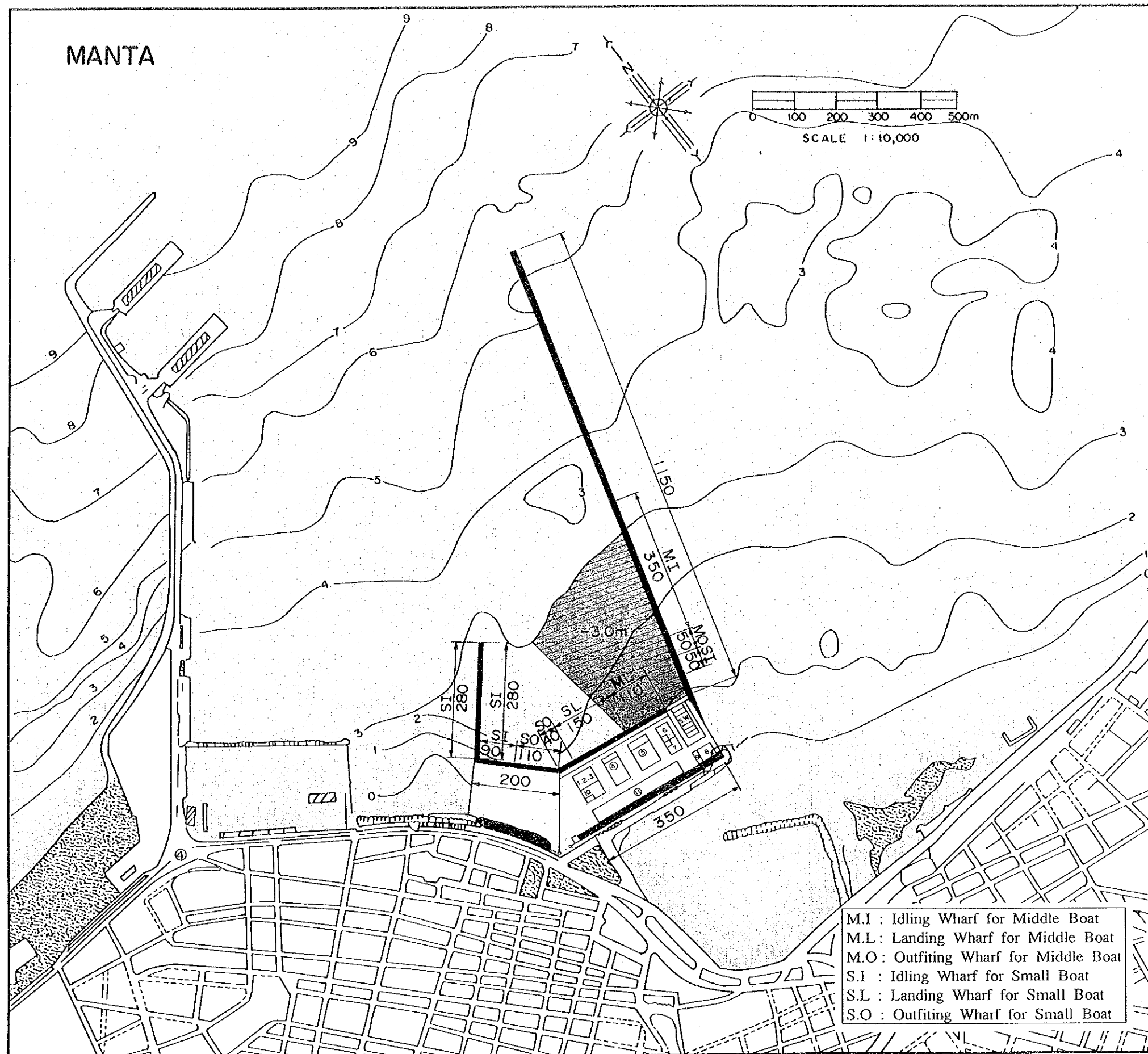


Fig.3-1 Master Plan (Manta)

MACHALILLA

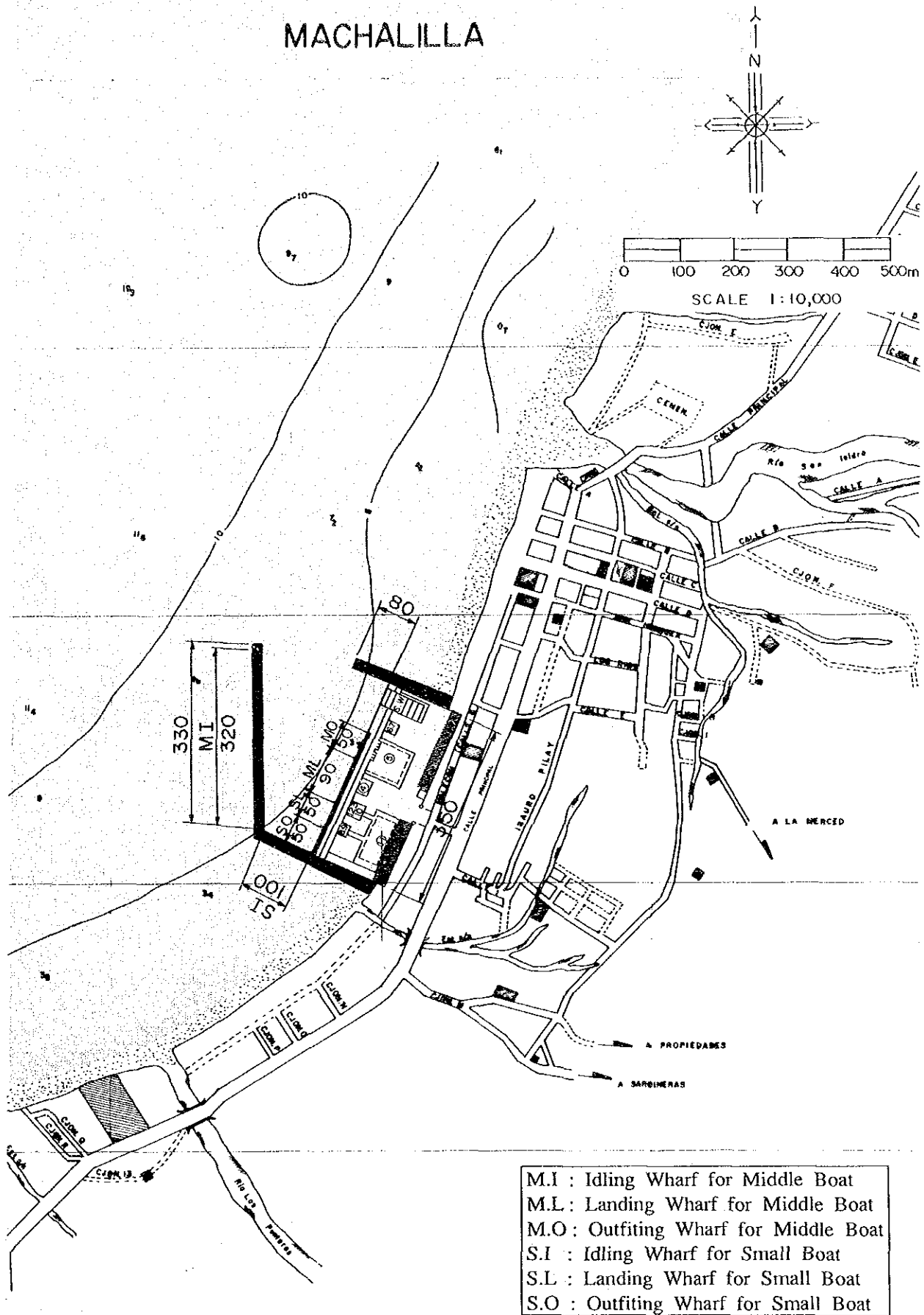
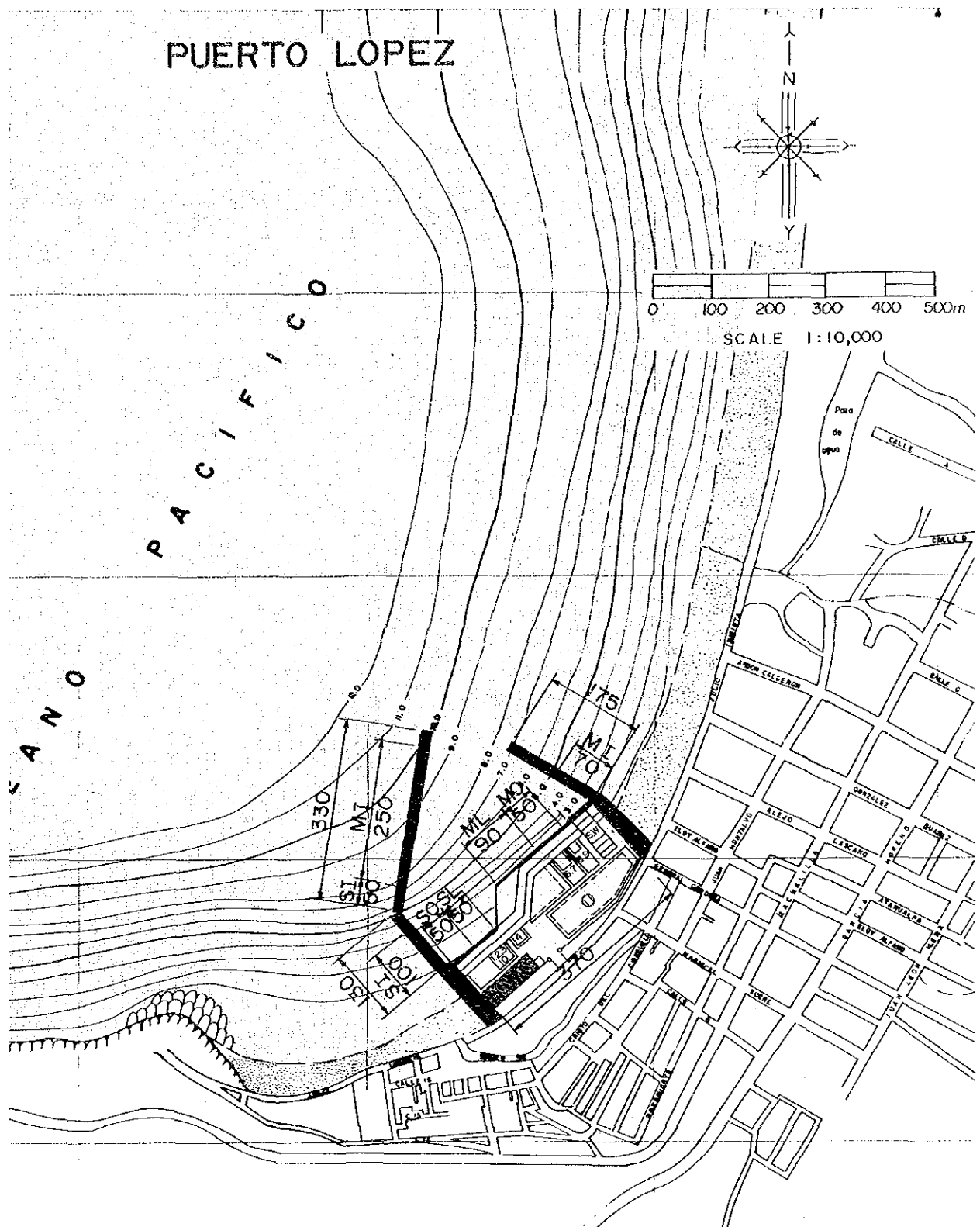


Fig.3-3 Master Plan (Machalilla)



M.I : Idling Wharf for Middle Boat
 M.L: Landing Wharf for Middle Boat
 M.O: Outfitting Wharf for Middle Boat
 S.I : Idling Wharf for Small Boat
 S.L: Landing Wharf for Small Boat
 S.O : Outfitting Wharf for Small Boat

520000

520800

521000

521500

Fig.3-4 Master Plan (Pto.Lopez)

3.4 Preliminary Design

1) Design of gravity type quaywall (Manta, San Mateo)

(i) Design conditions

- Purpose: landing fish catches for middle boats
- Length of quaywall: Manta; 110m, San Mateo; 80m
- Tidal level: MHWS +2.96 (D.L.)
MLWS +0.00 (D.L.)
- Planned depth: -3.0m
- Crest level: +3.50m (+3.456 \pm +3.5)
- Width of apron: 10m, 3%
- Bearing layer of base: Sand or sand with gravel

(ii) Principal dimension of the structure

Designed typical cross section is shown in Fig. 3-5.

2) Design of open-type quay with vertical piles (Pto.Lopez, Machalilla)

(i) Design Conditions

- Purpose: landing fish catches for middle boats
- Length of quaywall: Pto.Lopez; 90m, Machalilla; 90m
- Tide level: MHWS +2.96 (D.L.)
MLWS +0.00 (D.L.)
- Planned depth: -3.0m (D.L.)
- Crest level: +3.50m
- Width of apron: 10.0m 3%
- Dimensions of the fishing boat: 40GT Draft 2.20m
- Bearing layer of base: Sand, N value is 5.

(ii) Principal dimension of the structure

Designed typical cross section is shown in Fig. 3-6.

3) Design of breakwater(Manta, San Mateo, Machalilla, Pto.Lopez)

(i) Design conditions

- Wave height: shown below
- Water depth: shown below
- Tide level: MHWS +2.96m
- Soil of seabed: sand

Site	Manta	San Mateo	Machalilla	Pto.Lopez
Planned depth	-3.0m	-5.0m	-7.0m	-7.0m
Wave height	3.7m	4.2m	3.4m	4.0m

(ii) Crest elevation

Crest elevation is calculated to add M.H.WS and R_L
where $R_L = 0.8 H$

Site	Manta	San Mateo	Machalilla	Pto.Lopez
RL	3.0m	3.4m	2.7m	3.2m
Crest elevation	8.0m	8.4m	5.7m	6.2m

(iii) Structure

Side slopes of rubble mound breakwater are as follows;

Slope of sea side: 1 : 1.5

Slope of harbour side: 1 : 1.25

(iv) Weight of rubble covering the slope surface of the structure receiving the action of the wave forces is decided as follows.

Site	Manta	San Mateo	Machalilla	Pto.Lopez
W(ton)	3.0	4.5	2.4	3.9
Planned weight	3ton	5ton	3ton	4ton

(v) Principal dimension of the structure

Designed typical cross section is shown in Fig. 3-7.

Fig.3-5 Typical Cross Section of Gravity Type Quay
(MANTA, SAN MATEO)

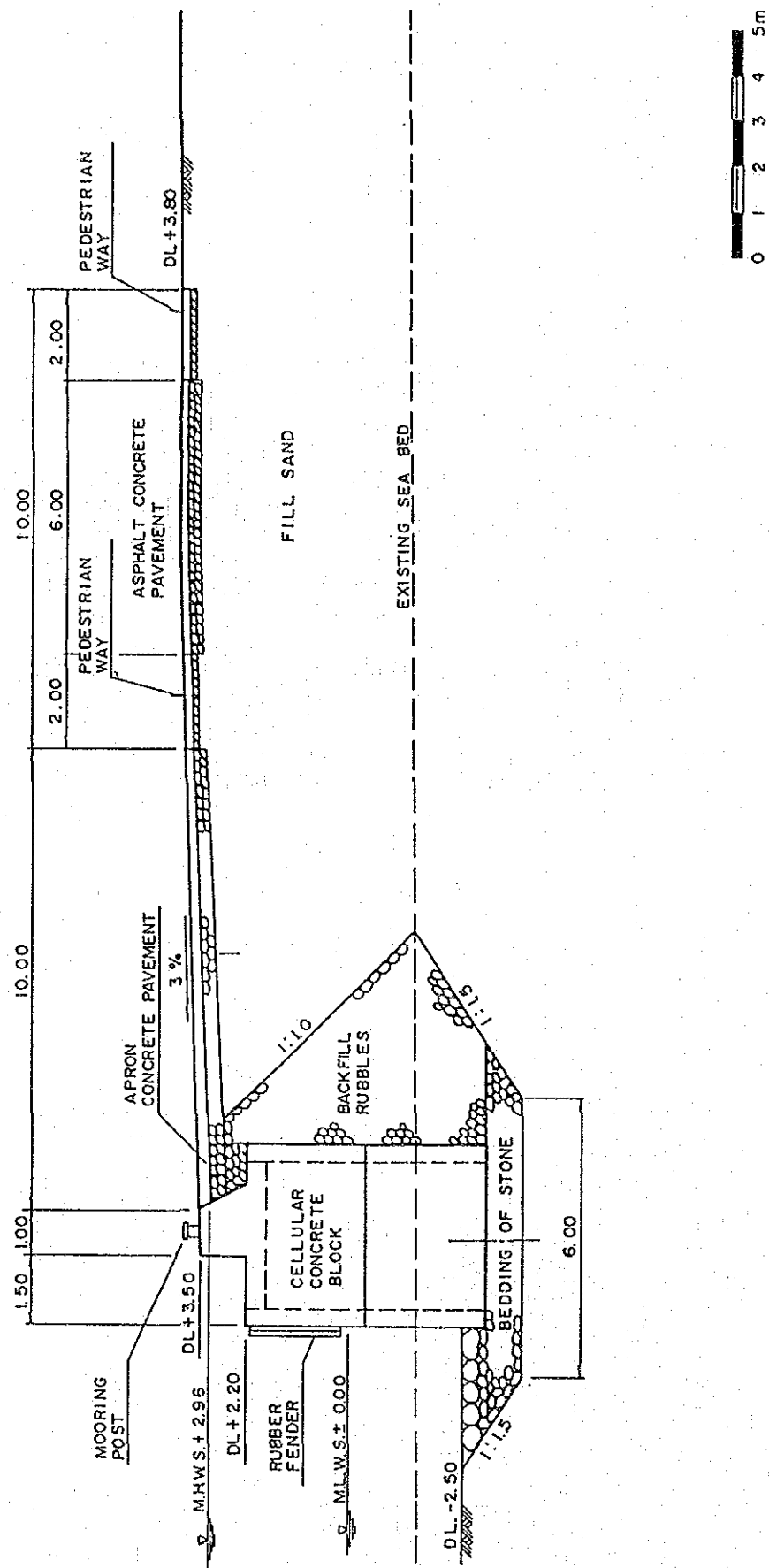


Fig.3-6 Typical Cross Section of Open Type Quay
(PUERTO LOPEZ, MACHALILLA)

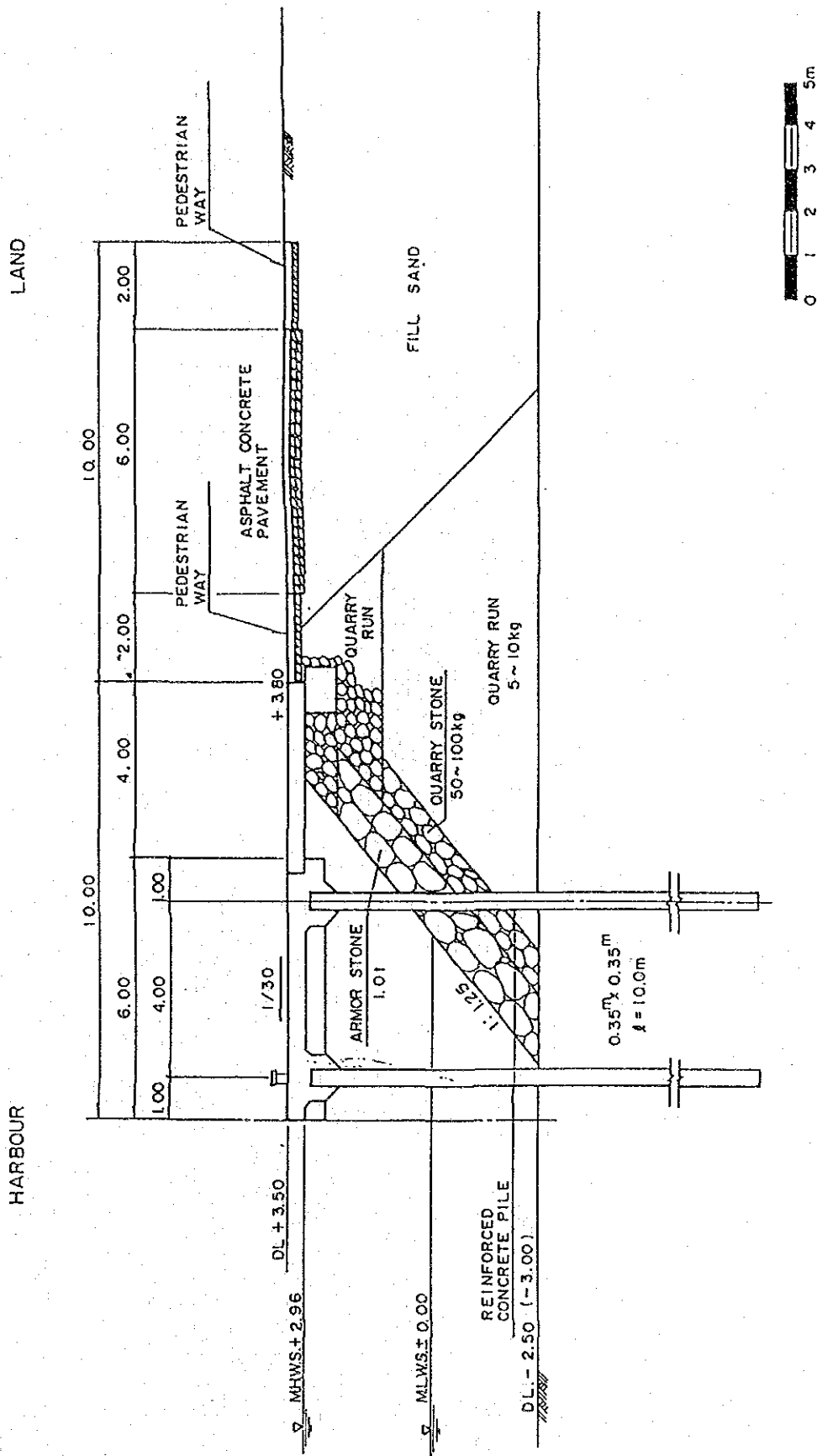


Fig.3-7(1) Typical Cross Section of Breakwater(1)
MANTA (MACHALILLA)

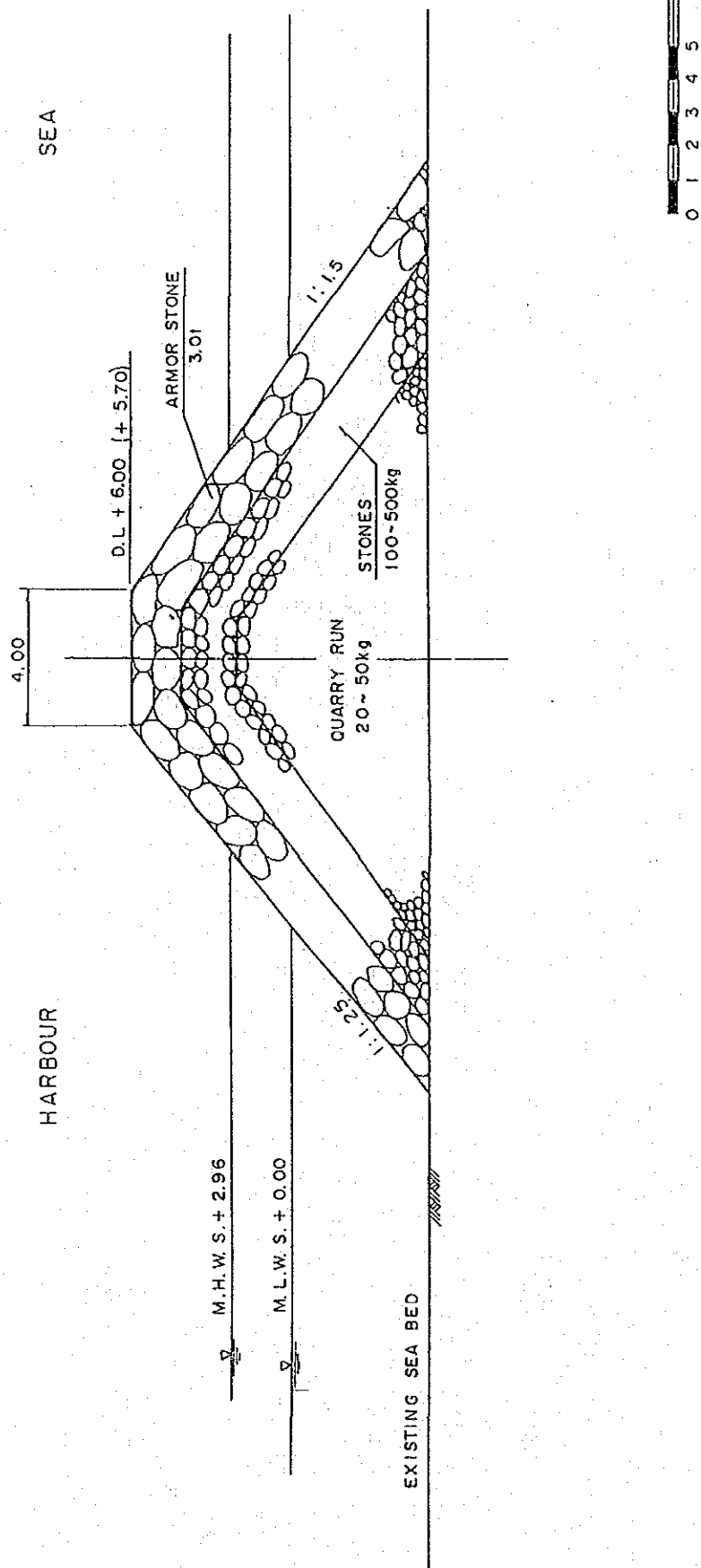
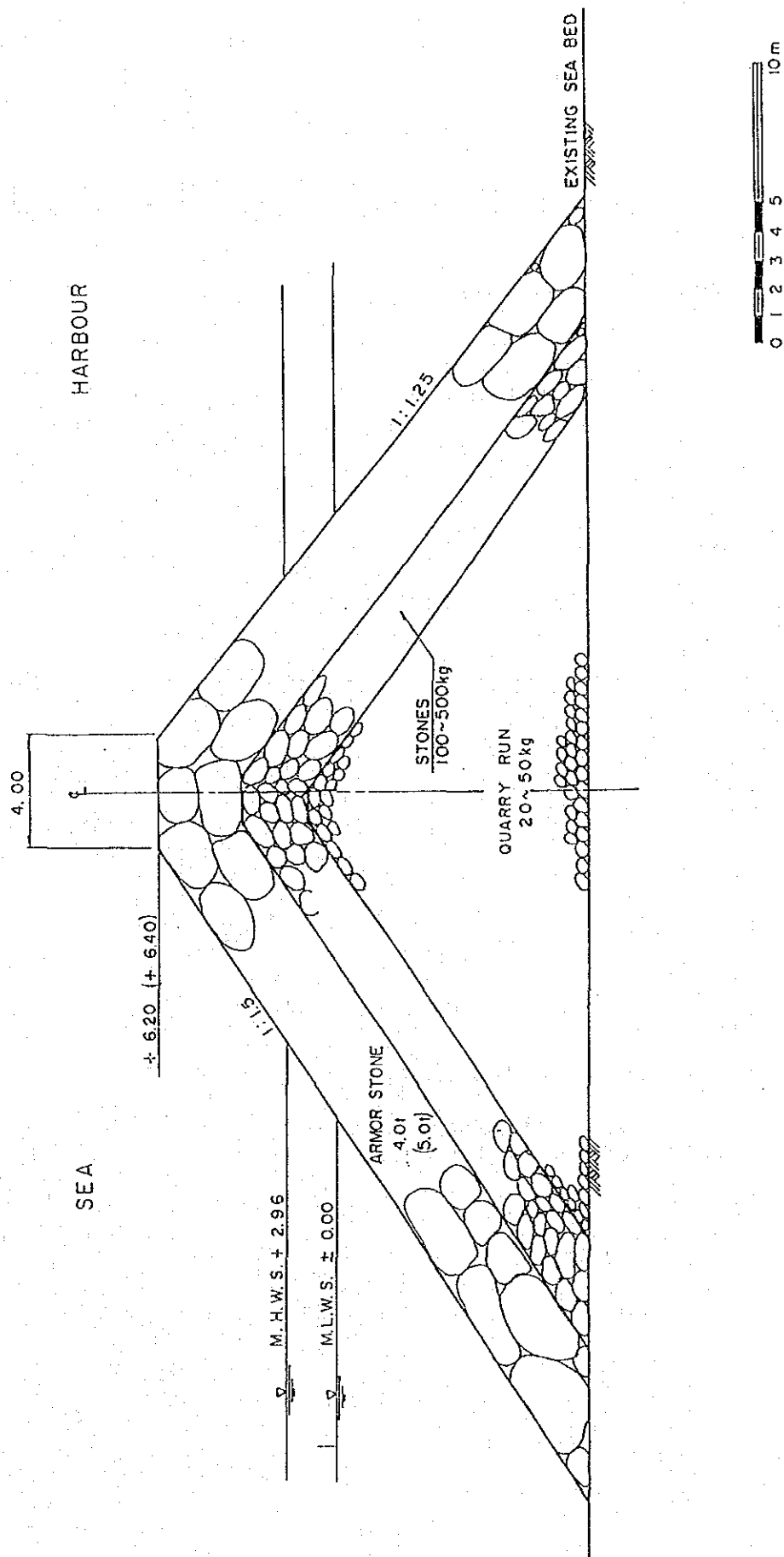


Fig.3-7(2) Typical Cross Section of Breakwater(2)
PUERTO LOPEZ (SAN MATEO)



3.5 Cost Estimate

(1) Main Facilities

The construction costs of the main facilities for master plans initialized Manta, Puerto Lopez, San Mateo and Machalilla are as follows;

(Exchange rate is assumed: 910 S/. per US\$)

(Unit: Million Yen)

	Basic facility	Land reclamation including temporary revetments	Total
1) Manta	3,114	419	3,533
2) Puerto Lopez	2,254	84	2,338
3) San Mateo	2,714	155	2,869
4) Machalilla	1,943	73	2,016

(2) Functional Facilities

The construction costs of the functional facilities such as ice making, ice storage, etc., are estimated as follows;

- 1) Manta 553 (Million Yen)
- 2) Puerto Lopez 345 (Million Yen)
- 3) San Mateo 440 (Million Yen)
- 4) Machalilla 341 (Million Yen)

(3) Total Costs of Preliminary Estimate

Total costs of preliminary estimate including main and functional facilities are as followings;

- 1) Manta 4,086 (Million Yen)
- 2) Puerto Lopez 2,683 (Million Yen)
- 3) San Mateo 3,309 (Million Yen)
- 4) Machalilla 2,357 (Million Yen)

CHAPTER 4 FORMULATION OF THE PRIORITY PLAN

4.1 Selection of the Priority Site

A priority site of which the completion is scheduled for 1995 was selected among the possible sites listed in the Master Plans and feasibility study for the priority site was conducted.

(1) Basic Principles in Determining Priority Site

Selection of the priority site is based on the following basic principles:

- 1) Considering the current problems of the artisanal fishery, the planned fishing port should be constructed urgently. The target year for the completion of the projects is set as 1995.
- 2) It is necessary to take account of the current situation of the artisanal fishery activities and to select a site that make the use of the existing infrastructures possible, so that the planned fishing port can immediately play the role of a center for the growth of the artisanal fishery.
- 3) The planned fishing port should facilitate the small scale fishing boats as many as possible.
- 4) The planned fishing port should also be designed to serve the middle scale fishing boats in order to maximize the investment efficiency.
- 5) The planned fishing port should contribute to the promotion of the fishery in neighboring fishing villages through the distribution of the fish catches and the establishment of the fish markets.

(2) Determination of the Priority Site

The priority site is determined as follows:

- 1) Manta is selected among the proposed master plans as a site covering the northern part of the study area. Manta is the center for commerce and one of the consumer markets. Located between Jaramijo and San Mateo, Manta can facilitate also as a base for the middle fishing boats operating in these three areas.
- 2) Pto.Lopez is selected among the proposed master plans as a site covering the southern part of the study area. Since Pto.Lopez is connected with consumer markets via Machalilla and Pto.Cayo, these three areas can make a common market by united efforts. Pto.Lopez can serve also as a base for middle fishing boats of Pto.Lopez and Machalilla. Pto.Lopez has a high fishing port potential, as shown in the following Table.

- 3) The characteristics of the two sites have been discussed and reviewed by between Japan and Ecuador sides. In 1991, Manta started various public works, such as the flood control mainly intended for La Poza (existing fishing port area), the countermeasures against the sedimentation, the river works for the environmental improvement, the construction of by-pass roads for easing traffic congestion in the coastal areas, and expansion of drinking water supply, in addition to projects concerning existing infrastructures. Therefore, it was agreed that the Manta fishing port should be given a higher priority as a major project affecting the regional development.

4.2 Site Selection and the Premise of Priority Plan

(1) Site Selection

Manta was selected for the site for the Priority Plan aiming the construction at the target year 1995 and the Priority Plan was formulated. The planned site was selected evaluating the fishing port development potential and the emergent needs for the fishing port construction.

(2) Planned Fishing Boats

Planned Number of fishing boats

Small Fishing Boats:

(unit:boats)

Year	Manta
1990	341
1995	341

* As like the Master Plans, in the Priority Plan, the number of the small fishing boats is planned as the same level as the present.

Middle Fishing Boats:

(unit:boats)

Year	Manta
1990	12
1995	25
Purse seiner	11
Long liner	14

* Smaller than 40 GT.

(3) Planned Landing Volume

Planned landing volume is set as follows.

Planned Landing Volume (1995)	
Descriptions	Manta
Annual landing	tons /year
Small fishing boat1)	8,200
Middle fishing boat Purse seiner....2)	4,620
Long liner.....3)	490
Daily landing	tons/year
1) + 3)	31.0
2)	16.5

Remarks: 1) Demersal fish, large pelagic fish
2) Small pelagic fish
3) Large pelagic fish

(4) Distribution of the Fish

Considering the present situation of the fish distribution at Manta, the distribution of landed catch in the planned facilities is planned as following diagram;

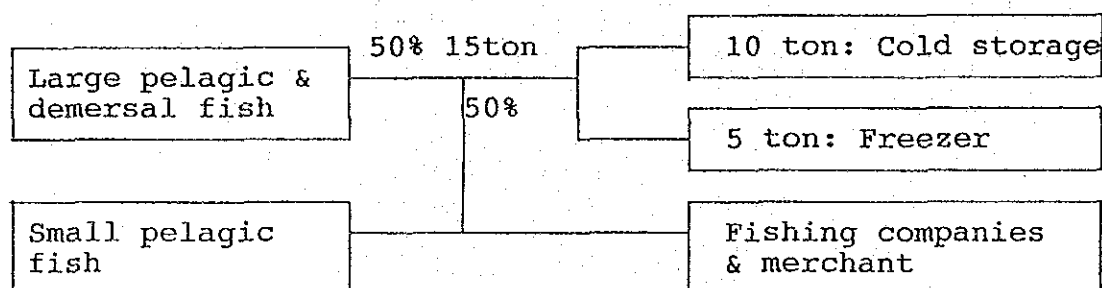


Fig.4-1 Allocation of Fish Catches by Planned Facilities

4.3 Fishing Port Layout Plan

(1) Layout Plan of Main Facilities

There are two alternatives available in the fishing port area, they were compared so as to decide the better option:

Alternative 1: Locating the facilities outside La Poza
(A-1)--Fig. 4-2

Alternative 2: Locating the facilities inside La Poza
(A-2)--Fig. 4-3

Comparison of the two methods is as follows:

1) Calmness

Both alternatives are sheltered by the existing brekwater, and the aiming calmness (90% under 0.3m) can be maintained. But, at the stormy condition, although seldom, alternative(2) is more safety for the small boats.

2) Sand Drift

Throughout the year, the water flow in the direction of prevailing waves (northwest) bifurcates towards west and east about 2km to the west of the fishing port area. The sedimentation discharges from the Manta River as a whole fluctuates widely, and the area in front of the river mouth is one of the areas vulnerable to sedimentation. Actual sedimentation of around 3,000 cub.m per year, however, does not pose a major problem. In this regard, therefore, there seems to be no difference between Alternative 1 and Alternative 2.

3) Sedimentation Discharges

Likely causes of sedimentation in Manta fishing port area include sand drift and sedimentation discharges of rivers. Judging from the annual sand drift of about 3,000 cub.m per year and the sedimentation discharges of 46,000 cub.m, the sedimentation discharges are considered to greatly affect to the shoaling of the fishing port.

In view of this, a flow regime model simulating sedimentation in the fishing port area during the period between 1982 and 1983 was developed. In this flow regime model, flow regime for a peak flood discharge of 280 cub.m, which corresponds to a 50-year flood, was calculated. Then, based on the result of calculation, topographical changes were simulated using Einstein-Brown's formula.

In the study, three cases were considered: present site, Case A-1 (Alternative 1 with an end-of-jetty depth of -2.5m) and Case B-1 (Alternative 2 with an end-of-jetty depth of -2.5m). Results of calculation (stream line vectors and topographic

changes) are shown in Fig. 4-4(1), (2), (3).

Stream line vectors indicate that the present state and Case A-1 have similar flow regimes in roughly corresponding areas, while in Case B-1 the influence of flow regime extends beyond the end of the jetty.

As a result, it was concluded that there is no direct inflow of sediment into the fishing port.

In Case B-1, sediments are deposited beyond the end of the jetty, and unlike in Case A-1, sediments could flow into the fishing port.

There could be inflows of sediment into the fishing port due to littoral drift after floods even in Case A-1. Therefore, influences will be made ignorantly small by setting the end-of-jetty depth at 3.0m, allowing for a safety margin.

4) Site Conditions of Fishing Port

Alternative 1 has the following merits:

- It makes future expansion possible.
- Lots of land for the fishing port and fishery-related facilities can be acquired more easily. On the other hand, Alternative 2 has the following problems:
- A plan for Construction of a coastal road in the rear (plan for improvement of Malecon Jaime Chaves St.) reduces the possibility of future expansion of the fishing port.
- It is difficult to acquire land for fishery-related facilities.
- Since the water area is closed, sea water quality in the harbor might be contaminated by effluence from fishing port facilities.
- There is a plan for constructing a recreation zone (yacht harbor, etc.) in this area.

5) Construction Cost

Alternative 2 permits the best use of existing structures in the fishing port area, but the required extension of the jetty is longer than in Alternative 1. As a result, the estimated construction costs are 16.4 million US\$ for Alternative-1 and 20.0 million US\$ for Alternative-2.

As a result of the above comparisons, it is concluded that Alternative-1 is better.

(2) Main Port Facilities

Main port facilities for Manta are summarized as follows.

Main Port Facilities (unit:m)		
Fishing Facilities		Manta
Boat	Breakwater	~
	Training	430
	Jetty	
Small-Scale	Landing	50
	Outfitting & Idling	400
Middle Scale	Landing	90
	Outfitting & Idling	70

Following table summarizes the functional facilities for the Priority Plan.

Scale Outlines of the Planned Functional Facilities
(1995)

Descriptions	Manta
Cold storage(0°C)	30 tons (net capacity)
(-30°C)	100 tons (net capacity)
Blast Freezer	2 Mt/8hr
Ice making plant	10 Mt/day x 2 units
Ice storage	30 tons (0 Centigrade)
	30 tons (insulated)
Fish handling space	Fish selection, preliminary processing, etc.
Fishing gear repairing space	1000 sq.m
Warehouse	Storage for fishing gear
Workshop	Maintenance for outboard engines
Fuel oil tank:	
Gasoline	150 Kltrs
Diesel oil	100 Kltrs
Freshwater tank	12 Kltrs
Administration Bld.	
Parking space	For around 40 vehicles

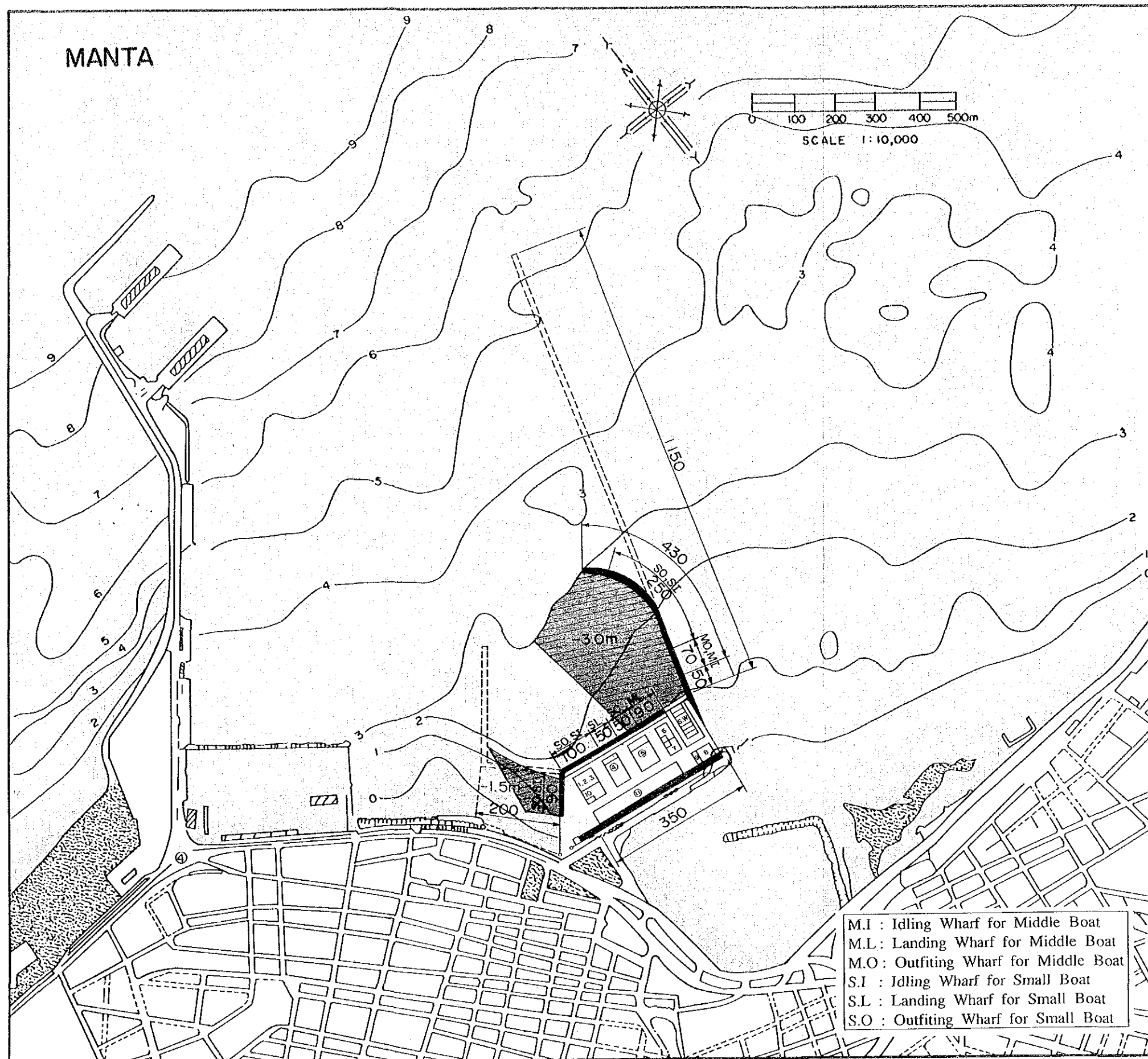


Fig.4-2 Short-Term Development Plan Alternative-1 for Manta

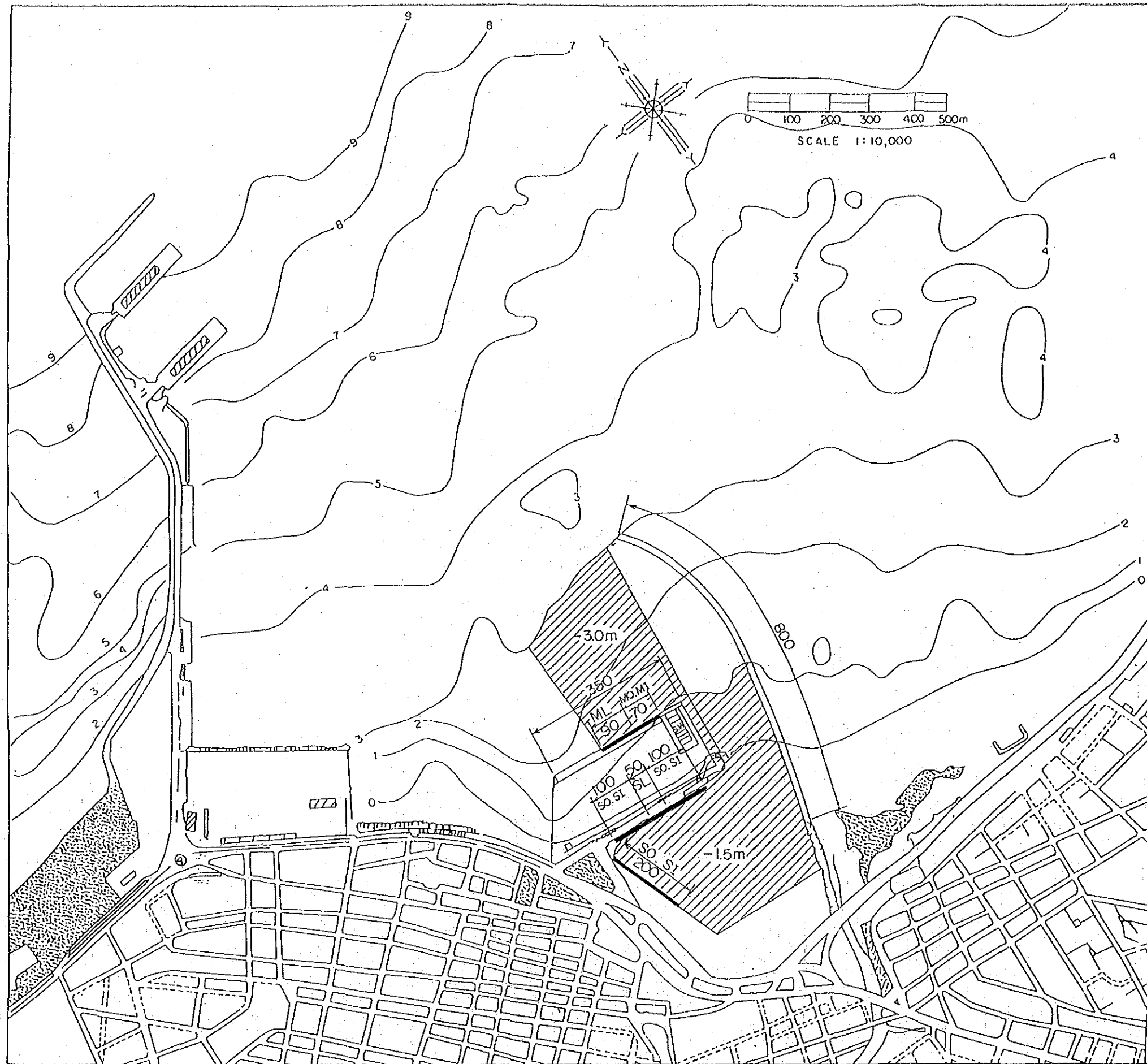


Fig.4-3 Short-Term Development Plan Alternative-2 for Manta

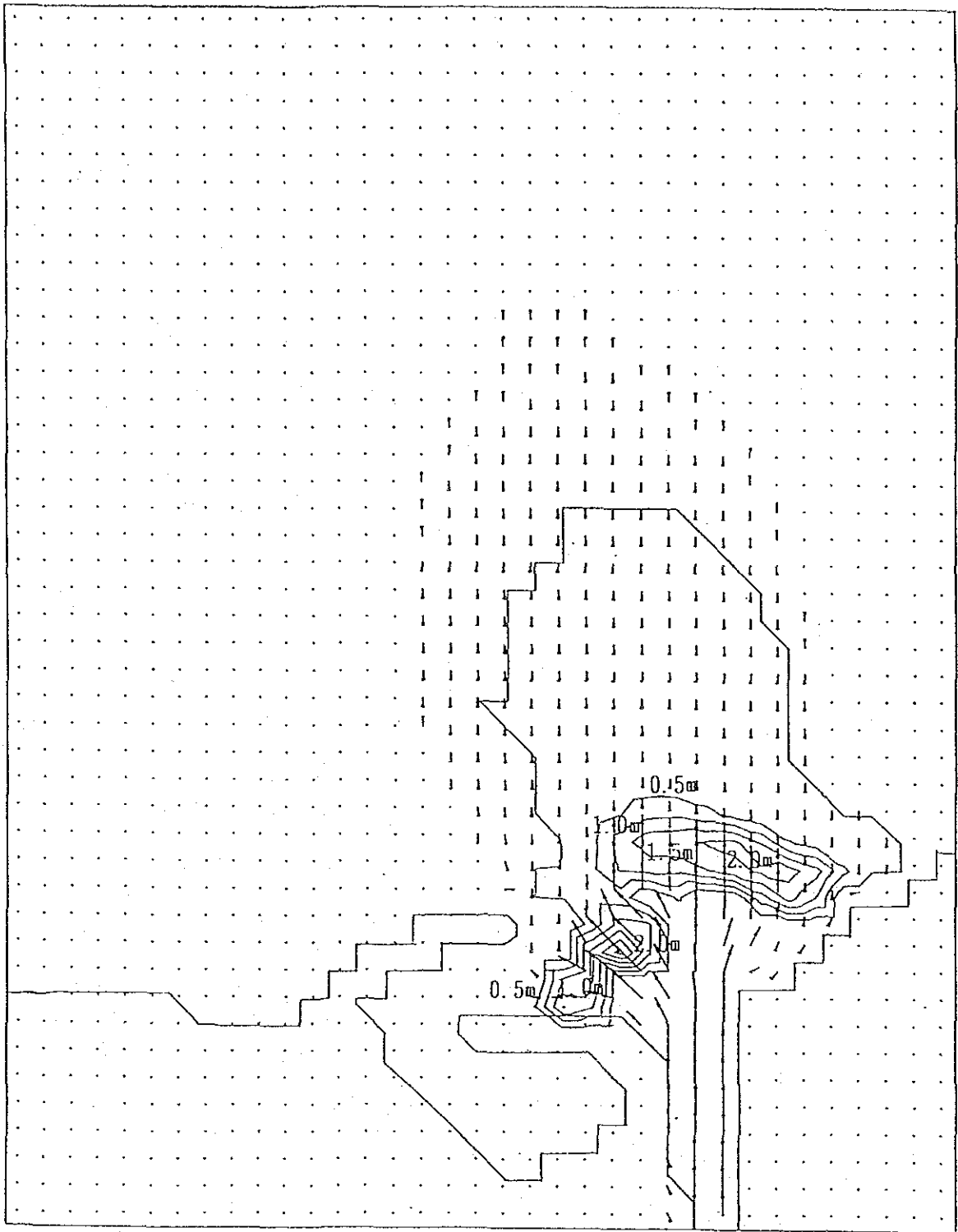


Fig.4-4(1) Seabed Topography Change

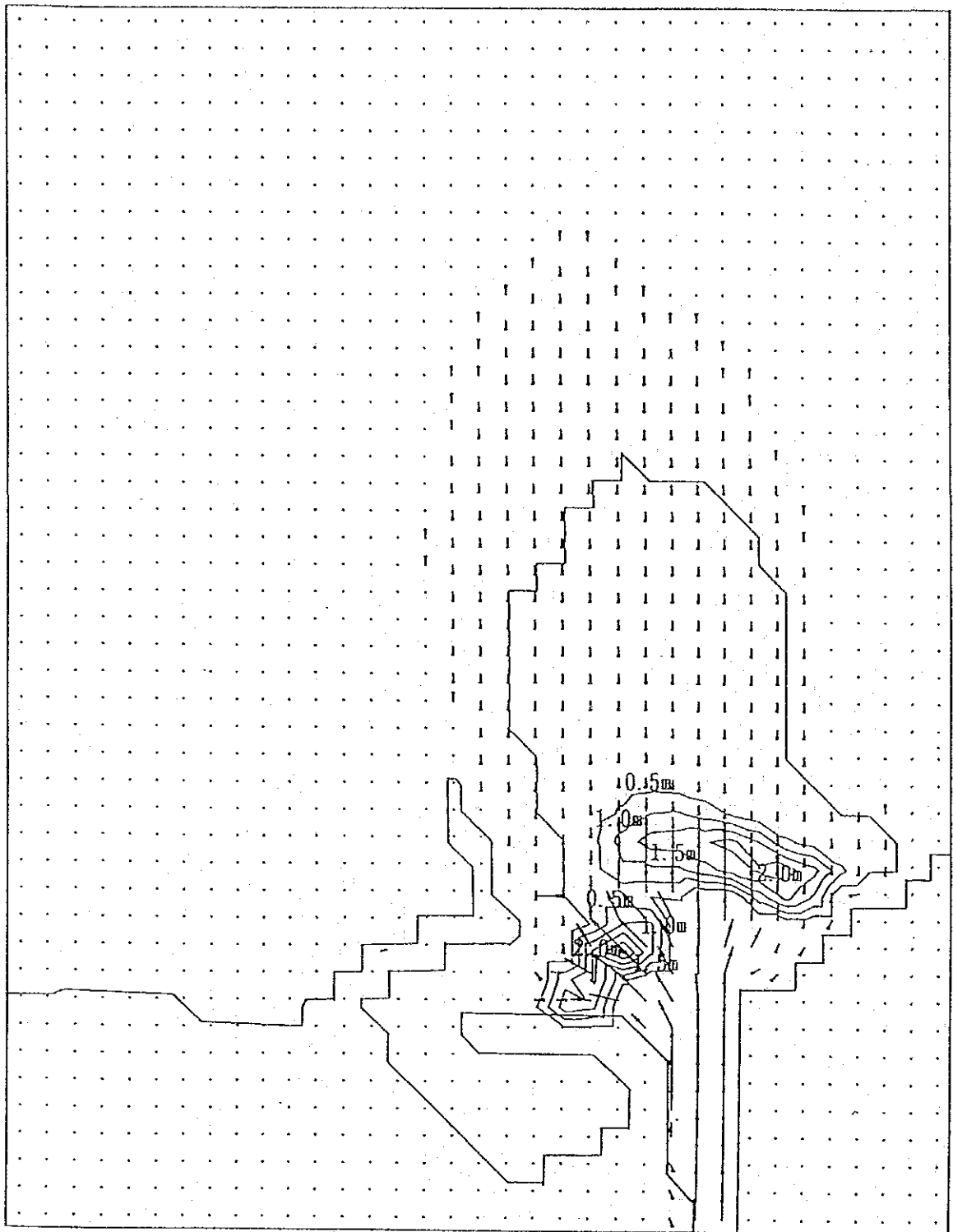


Fig.4-4(2) Seabed Topography Change

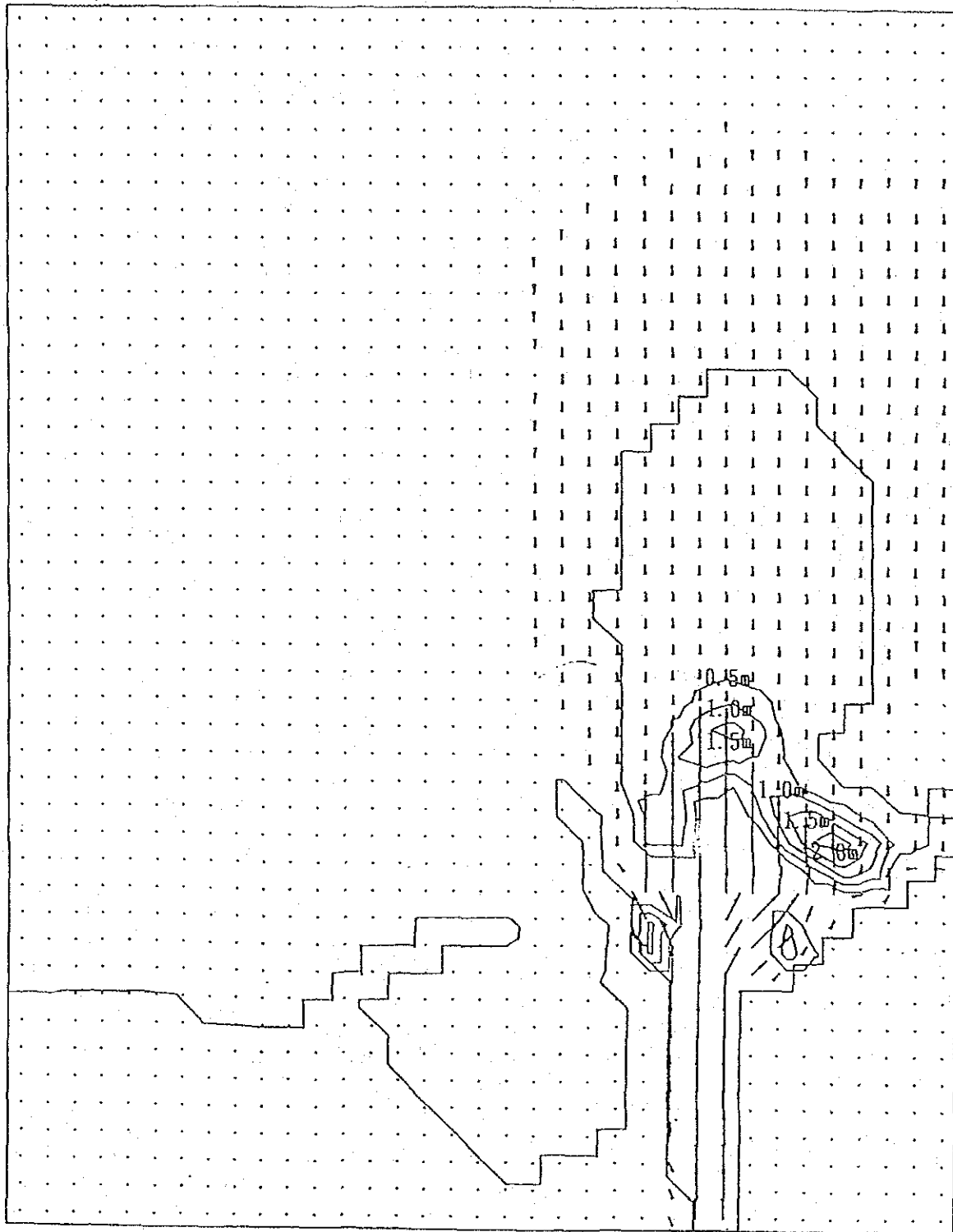


Fig.4-4(3) Seabed Topography Change

4.4 Main Facilities Design

(1) Design of open-type quay with vertical piles (Manta)

(i) Design Conditions

- Purpose: outfitting for middle boats
- Length of quaywall: 18m
- Tide level: MHWS +2.96 (D.L.)
: MLWS +0.00 (D.L.)
- Planned depth: -3.0m (D.L.)
- Crest level: +3.50m
- Width of apron: 10.0m 3%
- Dimensions of the fishing boat: 40GT Draft 2.20m
- Bearing layer of base: Sand, N value is 5.

(ii) Principal dimension of the structure

Designed typical cross section is shown in Fig. 4-5

(2) Design of slope structure for fish landing (Manta)

(i) Design Conditions

- Purpose: landing fish catches for small boats
- Length of quaywall: 50m
- Crest level: 3.5m (D.L.)
- Slope of slipway: 1/8
- Thickness of cobble foundation: 30cm
- Thickness of pavement: 20cm
- Thickness of concrete block: 30cm
(under water)

(ii) Principal dimension of the structure

Designed typical cross section is shown in Fig. 4-6.

(3) Design of training jetty (Manta)

(i) Design Conditions

- Tide level : MHWS +2.96 (D.L.)
: MLWS +0.00 (D.L.)
- Planned depth : -3.0m (D.L.)
- Design wave height : 2.2m
- Bearing layer of base: Sand, N value is 5.
- Crest level : +4.30m
- Side slope of mound: 1:1.25

(ii) Designed typical cross section is shown in Fig. 4-7.

Fig.4-6(1) Typical Cross Section of Slope Type Quay
for Fish Landing of Small Boat

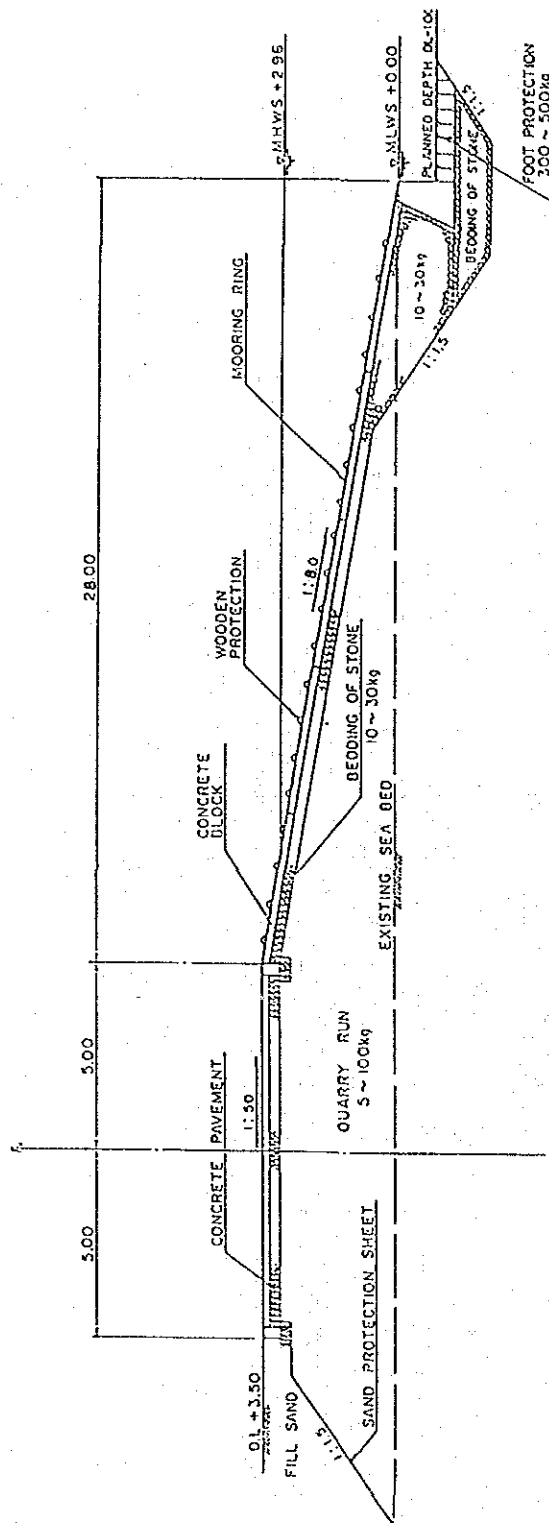


Fig.4-6(2) Side View of slope Type Quay

